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What is this?
About the Grantville Gazette

Written by Grantville Gazette Staff

The *Grantville Gazette* originated as a by-product of the ongoing and very active discussions which take place concerning the 1632 universe Eric Flint created in the novels *1632, 1633* and *1634: The Galileo Affair* (the latter two books co-authored by David Weber and Andrew Dennis, respectively). This discussion is centered in three of the conferences in Baen's Bar, the discussion area of Baen Books' web site. The conferences are entitled "1632 Slush," "1632 Slush Comments" and "1632 Tech Manual." They have been in operation for almost seven years now, during which time nearly two hundred thousand posts have been made by hundreds of participants.

Soon enough, the discussion began generating so-called "fanfic," stories written in the setting by fans of the series. A number of those were good enough to be published professionally. And, indeed, a number of them were—as part of the anthology *Ring of Fire* , which was published by Baen Books in January, 2004. (*Ring of Fire* also includes stories written by established authors such as Eric Flint himself, as well as David Weber, Mercedes Lackey, Dave Freer, K.D. Wentworth and S.L. Viehl.)

The decision to publish the *Ring of Fire* anthology triggered the writing of still more fanfic, even after submissions to the anthology were closed. *Ring of Fire* has been selling quite well since it came out, and a second anthology similar to it is scheduled to be published late in 2007. It will also contain stories written by new writers, as well as professionals. But, in the meantime . . . the fanfic kept getting written, and people kept nudging Eric—well, pestering Eric—to give them feedback on their stories.

Hence . . . the *Grantville Gazette.* Once he realized how many stories were being written—a number of them of publishable quality—he raised with Jim Baen the idea of producing an online magazine which would pay for fiction and nonfiction articles set in the 1632 universe and would be sold through Baen Books' Webscriptions service. Jim was willing to try it, to see what happened.

As it turned out, the first issue of the electronic magazine sold well enough to make continuing the magazine a financially self-sustaining operation. Since then, nine more volumes have been electronically published through the Baen Webscriptions site. As well, *Grantville Gazette, Volume One* was published in paperback in November of 2004. That has since been followed by hardcover editions of *Grantville Gazette*, Volumes Two and Three.

Then, two big steps:

First: The magazine had been paying semi-pro rates for the electronic edition, increasing to pro rates upon transition to paper, but one of Eric's goals had long been to increase payments to the authors. *Grantville Gazette*, Volume Eleven is the first volume to pay the authors professional rates.

Second: This on-line version you're reading. The site here at http://www.grantvillegazette.com is the electronic version of an ARC, an advance readers copy where you can read the issues as we assemble them. There are stories posted here which won't be coming out in the magazine for more than a year.

How will it work out? Will we be able to continue at this rate? Well, we don't know. That's up to the readers. But we'll be here, continuing the saga, the soap opera, the drama and the comedy just as long as people are willing to read them.

—The *Grantville Gazette* Staff

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The Anaconda Project, Episode Two

Written by Eric Flint

Chapter 2

"You look tired, Melissa," said Judith Roth sympathetically. She gestured to a luxurious divan in the great salon of the Roth mansion. "Please, have a seat."

Melissa Mailey went over to the divan, hobbling a little from the effects of the ten-day journey from Grantville, and plopped herself down. Her companion James Nichols remained standing, after giving the couch no more than a quick glance. Instead, his hands on his hips, he swiveled slowly and considered the entire room.

Then, whistled admiringly. "Well, you've certainly come up in the world, folks."

Judith smiled. Her husband Morris looked somewhat embarrassed. "Hey, look," he said, "it wasn't really my idea."

"That's it," scoffed his wife. "Blame the woman."

The defensive expression on Morris' face deepened. "I didn't mean it that way. It's just . . ."

The gesture that accompanied the last two words was about as feeble as the words themselves.

"The situation," he concluded lamely.

Nichols grinned at him. "Jeez, Morris, relax. I understand the realities. What with you being not only one of the King of Bohemia's closest advisers but also what amounts to the informal secular prince of Prague's Jewry. Half the Jews in eastern Europe, actually, from what Balthazar Abrabanel told us."

Looking a bit less exhausted, Melissa finally took the time to appraise the room herself. And some more time, appraising Morris' very fancy-looking seventeenth-century apparel.

Then, she whistled herself.

"*Et tu, Brutus?*" Morris grumbled.

"Quit complaining," Melissa said. "That *is* why you asked us to come here, isn't it? With 'Urgent!' and 'Desp'rate Need!' oozing from every line of your letter."

"Asked *you*," qualified Nichols. "Me, he just wanted to come here to give some advice to his fledgling medical faculty at his fancy new university. *I'm* just a country doctor."

"From Chicago," Melissa jeered. "South side, to boot—which has about as much open land as Manhattan."

James grinned again. "Oh, you'd be surprised how much open land there is in Chicago's south side. Vacant lots, I'll grant you. Nary a crop to be seen anywhere except the stuff handed out by drug dealers, none of which was actually grown there. My point remains. *I'm* here in Prague as a modest medical adviser. *I'm* not the one who just landed a prestigious position at Jena University as their new—and only—'professor of political science.' *I'm* not the one Morris asked to come here to explain to him how to haul eastern Europe kicking and screaming into the modern world, which is one hell of neat trick seeing as how that half of the continent didn't manage to do it in our old timeline."

"They got there eventually," Judith pointed out mildly.

Melissa's expression got very severe. "Yup, sure did. In most places, because Stalin forced them to, after World War II."

James looked surprised. "Since when did you become a Stalin fan?"

"Not hardly," said Melissa. "He was a monster. But I'm not blind to historical realities."

She leaned forward a little. "Poland's the center of the problem—and the opportunities—here just as it was in the world we came from. A brilliant nation, in lots of ways, but one that was completely crippled

by three factors."

Now she began counting off on fingers that looked far too elegant for a former sixties radical. "First, they were dominated by the szlachta, a huge class of noblemen that, for my money, ranks as the sorriest and most worthless aristocracy in the historical record. They paralyzed Poland politically for centuries with their petty self-interest, greed and pretensions. In the real world, their so-called 'Golden Freedom'—which some people even have the nerve to claim was a form of democracy which it only was in the same sense that South African apartheid was 'democratic' provided you belonged to the master race—"

James and Morris were frowning, trying to follow the convoluted presentation, but Melissa continued blithely onward. "—simply made them patsies for every nation surrounding them. All a Russian tsar or Prussian king or Austrian emperor had to do was keep a few szlachta on the payroll to guarantee that their absolute right of individual veto meant that Poland couldn't do anything effective politically. Secondly, and largely as a result, Poland was locked into a form of serfdom that was every bit as bad as anything that ever existed in western Europe in medieval times. In the sixteenth century—less than a hundred years ago, in the here and now—Poland was one of the centers of the Renaissance. Two centuries later, it was one of the few countries in Europe that managed to wind up poorer and with fewer and smaller cities that it had when it entered the so-called 'early modern era.' And with its industries in decline, to boot. That's because the nobility, especially the great magnates, locked the whole nation's fortunes to the Vistula grain trade. They believed in 'King Grain' just as vehemently as the slaveowners in the American south believed in 'King Cotton'—or those stupid rich bastards in Argentina believed in 'King Beef.'"

Now, Judith was looking a little cross-eyed. "How does Argentina figure into this?"

Melissa flashed her a smile. "History's a comparative science, insofar as it's a 'science' at all. It's like a lot of biological study, or even some aspects of astronomy. You can hardly do 'controlled experiments' on history, anymore than you can on the evolution of dinosaurs and trilobites—or stars on the main sequence. Right? So, what you do instead is study the material by comparing it with similar phenomena."

She shrugged. "Of course, that's a lot easier to do with astronomy and even biology than it is with history. Stars are simple things, compared to human societies, and there are trillions of them to compare to each other and against a vastly longer time frame. Still, the principle's the same."

Again, she flashed that quick smile. "So, that's what Poland and the antebellum South and Argentina have in common. In all three cases, societies that started out with lots and lots of potential got crippled by the greed of their elite, and their fixation on a single crop. Most people don't realize it—Americans, anyway—because they think of Argentina as a 'third world' country. But in the late nineteenth century, it *wasn't*. Measured by almost any important social or economic indices, Argentina was more advanced than most countries in southern Europe. Then, especially during World War I when the price of beef went through the roof, Argentina's upper crust locked the country into monoculture—just like the Poles did with grain in this century and the American slaveowners would do with cotton in the nineteenth. The specifics varied a lot, naturally, but they all resulted in stagnation—and a political structure where an elite of not more than ten percent of the population lorded it over everybody else."

She leaned back in the couch. "So that's it. In our timeline, Poland was hamstrung for centuries, and since it's the center of gravity in eastern Europe it more or less pulled half the continent down with it. Not without lots of help from the Austrian Hapsburgs and the Hohenzollerns in Prussia, of course, who were no prizes themselves."

Morris had never stopped frowning. "I'd think Russia was more in the way of eastern Europe's 'center of gravity.'"

"Actually, no. Not yet, I should say. There's a misconception among Americans, mostly because of the Cold War, that Russia was always the aggressor against Poland. But here in the early seventeenth century—and for at least two centuries earlier—it's actually the Poles and Lithuanians who've been seizing their neighbors' lands. Besides, it's something of a moot point anyway. I don't see where there's much you or me or anyone could do in October of 1634 to start turning around that mess called 'Russia.'"

Morris grimaced. "Well, thank God for small favors. I've got enough to deal with as it is. Especially since you seem bound and determined to plop Poland into my lap too, right after Wallenstein and Pappenheim dropped everything south of there."

"Sorry, Morris, but there's no way around it. In the long run, nothing you accomplish here or in the Ruthenian lands will be stable if you—or somebody—doesn't transform Poland. Poland and Lithuania, I should say."

Morris finally took a seat himself, looking very tired. "Talk about the labors of Hercules," he muttered.

Melissa started to say something, but Judith interrupted. "You said there were three factors. What's the third one?"

"Huh? Oh. It's implicit in what I just said. Their protestations of always being the victim of history notwithstanding, the fact is that in this time period it's usually the Poles who are aggressing against their neighbors. So, on top of their existing problems, they added the third one that so-called 'Poland' was never coterminous with where Poles actually lived—until Stalin came along. To get back to the monster I started with."

Again, she started counting off her fingers. "First, he destroyed the szlachta. They'd officially been abolished after World War II, but they still had a lot of power. He destroyed them literally, in some cases. A big percentage of the fifteen thousand Polish officers he had massacred in Katyn Forest were noblemen. Mostly, though, he simply destroyed them as a class by expropriating their property. Secondly, he ended serfdom. Brutally, of course, the way he did everything. And stupidly too, in the long run. But, say whatever else you will about his forced collectivization of agriculture, one of the products was the elimination of serfdom. And, finally, for the first time in centuries, he made Poland's boundaries coincide with the actual lands of the Poles. The Poland we knew in the post-World War II period was something like ninety-seven percent ethnically homogenous, which it had certainly never been prior to that. That's the reason that after the collapse of the Soviet Union, nobody actually proposed to change any of the national boundaries Stalin created. Not Poland's, anyway."

Morris wiped his face. "Wonderful. Stalin as my role model."

"Oh, cut it out, Morris," said Melissa impatiently. "I was simply pointing to *what* Stalin did, not how he did it. Creating a modern Poland—forestalling its decline, I should say, which has only started—can be done by other means, too. It certainly should be. But the prerequisite is that you stop thinking of 'role models' in the first place."

"Meaning . . . ?"

"Forget Hercules and his labors. Meaning no offense, Morris Roth, but you bear as much resemblance to Hercules—or Stalin—as I do to the man in the moon."

"Just what I tried to explain to Wallenstein and Pappenheim!"

"So quit thinking in those terms altogether. The one thing eastern Europe does *not* need is another damn overlord. Instead, approach the problem like a political organizer. *You* don't really do anything. You just organize other people to do it."

"Like who? And to do what?" He looked a bit sullen, and more than a bit like a twelve-year-old.

"Stop pouting, Morris," said his wife. "I can figure that much out, and so can you."

She started emulating Melissa's finger-counting. "First, get some people who know something about military affairs, which you don't. Whatever else, you'll need a real army, and you can't call on Pappenheim. He's tied up facing the Austrians to the south and the Saxons to the north, which is the reason Wallenstein handed you the assignment in the first place. Failing anything else, hire somebody. You're rich enough, these days. Europe's got plenty of mercenary officers, many of whom are quite good and some of whom are even loyal to their employer."

Another finger got wiggled. "Second, the Jewish so-called problem runs all through the area. That, you can handle directly insofar as politics goes. But you really need to get a lot of rabbis on your side to handle the rest of it."

She gave him a cool smile. "You do know some rabbis, right? I'd recommend starting with Mordecai Levi and Isaac Gans. And Jason, for that matter, and his fellow students."

She went back to finger-counting. "Third, get the Brethren involved. Fourth—whatever else you do—make sure Red Sybolt's involved."

The thumb got wiggled now. "Fifth—maybe this should actually be first—establish contact with some Polish radicals."

She gave Melissa a querying glance. "I assume there are some in the here and now, yes?"

Melissa made a face. "Hell, my knowledge of Polish history is only general, it doesn't run to details like *that.* But . . . I'd say there pretty much have to be. Poland produced almost as many radicals and revolutionaries over the centuries as it did grain and layabout noblemen. For that matter, the nobility itself produced a fair number of them. Remember Count Casimir Pulaski, in the American revolution?"

James looked startled. "Is *that* who Pulaski Boulevard in Chicago is named after?"

"Doctors," scoffed Melissa. "Talk about a self-absorbed class of people. Yes, dear, that is who one of your home town's main streets is named after. But don't get a swelled head about it. There must be a thousand Pulaski streets or avenues or boulevards in the United States, in just about as many towns."

She looked back at Judith. "So, at a guess, I'd say you're right. Keep going, girl, you're doing fine."

Judith switched hands and started counting the fingers of the right. "Sixth—"

"How the hell am I supposed to find Polish revolutionaries?" demanded Morris. "I'm a damn *jeweler.* Fine, my family came from Krakow. That's ancient history."

"Stop whining, husband. We're *in* ancient history." As deftly as you could ask for, Judith switch her hands back and wiggled the ring finger of the left. "Red Sybolt, remember? He's been a labor agitator for years. By now, if he hasn't run across some wild-eyed Polish rebels, I'll be surprised. Plant Red in a desert island in the middle of the Pacific, and he'd somehow manage to rouse a rabble."

Morris chuckled. "Well, that's true. Of course, first I'd have to track him down. He hasn't been in Prague for months."

"That's a manageable problem. Somebody will know where he is. Moving right along"—she switched hands again and wiggled a forefinger—"you need to get Uriel Abrabanel—remember him? he works for you already—to start investigating the chances of cutting a deal with the Austrians. Now that that bigoted bastard Ferdinand II died, we're dealing with a new emperor in Vienna. And his son's a lot more capable than his father, by all accounts."

"Certainly is," said Melissa. "He's not narrow-minded, the way his father was—and his sister Maria Anna just turned half of Europe upside down thinking for herself." She gave James a smile that bordered on being lascivious. "I was in such a hurry to get back to my squeeze after we got out of England that I didn't stick around in Holland long enough for the wedding between Maria Anna and Don Fernando. But I got plenty of details from Rebecca, while I was there. The sister is smart as a whip—and she thinks very highly of her brother the new Austrian emperor. So does her sidekick who pretends to be a feeble

old lady, Doña Mencia, and let me tell you that no moss ever grew on that woman's brain."

Morris scratched his jaw. "'More capable' could be bad as well as good, y'know. Still, it's worth looking into. In fact, if I know Uriel, he's already started." He eyed his wife skeptically. "And how many more rabbits are you going to pull out of your fingers for me?"

She took a deep breath. "One. See if you can make an accommodation with the Cossacks. You'd have to find a suitable emissary, of course."

Morris' eyes widened. "*Cossacks?* For God's sake, Judith! They're the same murderous bastards who led the Chmielnicki Pogrom—which is named after their leader—in the first place! Not to mention such minor accomplishments as the pogroms at Kiev and Kishinev." His face grew hard. "Or the massacres carried out in the Ukraine during the Russian civil war by the counter-revolutionary armies, half of which were made up of Cossacks or their hangers-on. The stinking swine murdered something like a hundred thousand Jews before the Red Army put a stop to it. Fuck the Cossacks. Every one of them can rot in hell, as far as I'm concerned."

"I'm with Morris," said Nichols stoutly.

"Stick to doctoring," sniffed Melissa. "See if you can come up with a cure for excess testosterone, while you're at it." To Morris she said: "You're being childish, to be blunt. How is dealing with Cossacks in the here and now any different from what Mike Stearns has been doing dealing with Germans? Compared to what they did to Jews in the Holocaust, the Cossacks are nothing."

"Well, yeah, but . . ."

"But *what?* Since when did you start believing in racial destiny, Morris? Nazi Germany was the product of centuries of history. Change the history, like Mike is doing, and you eliminate them before they even appear. So why can't you do the same with the Cossacks?"

"Because they're nothing but a bunch of—"

"Mounted hooligans? Thugs? For Pete's sake, Morris, in this day and age—early seventeenth century, remember?—the 'Cossacks' are barely even 'Cossacks' yet. They're just getting started. A lot of them are former serfs, in fact, who ran away from their masters. We're at least a century away from the time they started serving the Russian tsars as their mailed fist. This is the best time I can think of to stop that in its tracks, too."

Morris looked mulish. Melissa looked exasperated. "Dammit, you *asked.* At my age, I'd hardly have come racing to Prague on horseback of my own volition."

"You *rode* all the way?" asked Judith.

James grinned. "She rode on a horse for exactly one day. After that, she put her foot down and insisted we hire a carriage. One of those litter-type carriages, of course, not a wheeled one. Going over the mountains on a wheeled vehicle is best left to mad dogs and Englishmen."

It was Melissa's turn to look defensive. "I spent my youth waving a placard at demonstrations. I did *not* attend the kind of ladies' finishing school where Mary Simpson learned to ride."

"How's she doing, by the way?" asked Morris.

"Given her recent hair-raising adventures, quite well. It helped a lot, of course, that when she got back to Magdeburg her son was waiting for her along with her husband. It was quite a family reunion, after their long estrangement. I know, because I was there."

Judith peered at her. "*You* were there? I thought you detested the Simpsons. Well, except Tom."

"I did, sure, when John Simpson ran that godawful campaign against Mike three years ago." Melissa waved her hand airily. "But three years is ancient history, as fast as things have been changing since the Ring of Fire. I think quite well of them, these days."

She pointed an accusatory finger at Morris. "And there's a lesson for you. If I can make friends with Mary Simpson, why can't you do it with Cossacks?"

He threw up his hands. "They're barbarians, for the love of God!"

"Again, so what? Yes, they're not far removed from barbarism. What do you expect, from a society being forged out of runaway serfs and bandits on the borderlands? Nobody is *simply* one thing or another, Morris. It's always more complicated. To go back to Mary Simpson, she's still haughty as all hell—can be, anyway—and I don't think she'll ever really be able to see the world except through her own very upper crust perspective. But that's not all there is to the woman, not by a long shot. The trick is finding a way—which is exactly what Mike did—to match her and her husband properly to the right circumstances. Bring out their best, instead of their worst. So do the same with the Cossacks."

"They don't *have* a 'best side,' that I can see," Morris groused.

"Oh, that's silly," said his wife. "Of course they do, even if it's only courage. If they hadn't been tough bastards, the tsars couldn't have used them in the first place."

A young servant entered the salon. "Dinner is ready, Lady Judith."

Judith rose. "Thank you, Rifka. Come along, folks. You must be starving by now."

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To be continued in *Grantville Gazette*, Volume 14, available from Webscriptions on Nov 1, 2007

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Protected Species

Written by Garrett W. Vance

Summer of 1634

"All right everyone, hold real still!" The small group of third graders froze, looks of excitement on their faces. *What great kids!* There was movement in the tall reeds along the edges of the narrow inlet; once a West Virginia hollow, now an arm of a tree lined lake formed by a Thuringian stream colliding with a Ring of Fire hillside appearing in its path. It was harder to see 'the rim' of the ring these days, time had meshed and melded the North American and European ecologies along its border. From out of the native water grass that had found a home in the formerly West Virginian soil appeared a mother duck and ten brown downed ducklings, much to everyone's delight.

"That's a 'Wood Duck'!" Pam told the gathered students of the summer nature program she was putting on in conjunction with the middle school. "It's one of the species that came through the Ring of Fire. This new lake has created a perfect habitat for it. I'll bet her nest is in those pine trees over there." Pam pointed to the pines that lined the lake's edge in what had once been a Thuringian stream valley. The ghostly silver tops of less fortunate trees below them poked out of the surface along the wooded shore; they had drowned when the lake formed but their protruding upper branches and sunken trunks provided excellent homes for fish and water insects as well as protective cover for shorebirds. Pam's practiced eyes found a European kingfisher perched on a dead branch waiting for a fat minnow to target. The kingfishers were shy but maybe the kids would be able to get a glimpse later if they stayed quiet—right now there were ducklings in front of them. There was no point in trying to drag their attention away just yet; baby ducks are a hard act to follow!

"The male of this species was considered to be one of up-time America's most beautiful birds. There are no other ducks like it in Europe, fossil studies told us that it originated in North America and its closest relative is the Mandarin duck of China. I'm really glad they came along with us. If we're lucky we will see this group's poppa before we end the day." The kids oohed and aahed appreciatively. Their accompanying schoolteacher asked the kids to open their sketch books to record their sighting as the family of wood ducks paddled around in the nearby shallows. Pam wandered over to where Gerbald stood careful watch farther up the hollow's steep side. Despite his usual impassive expression Pam could see wrinkles of pleasure had formed around his bright blue eyes. Gerbald was such a softy under that stony exterior, the retired soldier was immensely enjoying playing bodyguard for the children.

The summer nature program was proving to be a resounding success; everyone involved was having a lot of fun, even stoic Gerbald. Pam felt proud of the program that had been her brainchild. Her interest in birds had grown to include the entire ecology that they were a part of, she had spent long hours in the National Library devouring all the material she could find; she was a well trained researcher and had rapidly absorbed a vast amount of information. She was also making progress on her pet project, writing and illustrating her *Birds of the USE -A Field Guide*. It was fun to think that she would be the default 'John J Audubon' of this universe, something that would have been impossible to imagine in her old life. She smiled up into the blue skies of seventeenth-century

Germany, a place that was finally feeling like home.

* * *

The next day, Pam and Gerbald led a group of lively sixth graders up the now well worn trail to the lake. She enjoyed their cheerful banter as they lollygagged along, even though the noise was probably scaring off all the birds within a mile radius. Pam marveled at the adaptability of children, the mixed group of up-time and down-time Americans were yakking away in an untidy mishmash of English and German. Pam's German had progressed to where she could catch most it but apparently an arcane slang vocabulary was already developing, indecipherable to the hopelessly un-hip ears of an adult.

As she walked through the sun dappled woods listening to the babble around her, Pam reminisced on a long ago dinner party at the home of a work colleague from Morgantown who had spent many years working in Japan and had returned with a Japanese wife. At the table the two of them spoke in perfectly normal English. Of course, his very charming wife barely had an accent; but, when they were alone together in the kitchen bringing out more wine or another course, Pam overheard them both switch to a nearly incomprehensible mix of their respective languages. " *Atsui yo,* use the oven mitts, *neh!*" Pam didn't want to embarrass them, but couldn't help but ask them about it; her hosts just laughed. "Forgive our 'Japan-glish', we can't help it!" They explained that some words just "sounded better" in one or the other languages and so when trying to get an idea across they chose freely from both vocabularies. Listening to her junior birdwatchers Pam was sure she was hearing the sound of the future of their hybrid nation. Up-time Americans were going to have to get bilingual fast or they wouldn't be able to understand what their own kids were talking about!

Pam shushed the exuberant group as they arrived at the inlet. "All right everyone, it's time to be quiet and see which birds are here with us today. Yesterday there was a mother wood duck with her ducklings and they were darn cute!" The kids quieted down more quickly than she would expect. *An excellent German influence on our up-time kids—when it's time to be quiet they do it, no argument!* Pam was not one who flinched at applying some strictness in a child's upbringing, and rather admired the Germans for their expertise on the subject. She hoped her own Walt didn't resent her too much and she was awfully proud of how he had turned out. *I wasn't the easiest mother to have, I know . . . I liked things my way and was damned picky! But maybe the discipline I taught him is making things easier for him as a young adult in this age. I hope so, anyway.*

The kid's school teacher at Fluharty Middle School, Stacey Antoni, a very pleasant lady who had lost a husband to the Ring of Fire, had gathered them by the shore in a semblance of order, ready for Pam to get started. Gerbald had taken his usual watchful place on the hill side, their safety was in good hands. Pam began her introduction.

"This lake is an excellent example of the adaptation and mixture between North American and European ecologies along the Ring of Fire's rim. These reeds are a native German species that find they like the richness of West Virginia's soil much to their liking. The reeds are providing excellent habitat for a North American duck species, the wood duck, which we will hopefully—" Pam stopped her lecture when she noticed she had completely lost the attention of several schoolgirls nearest the water's edge.

"Oh, look! The *liebchen,* they are so *cute*!"

Baby ducks. Pam smiled ruefully. *There is no competing with baby ducks.*

"—see today. Well everyone, it appears that we have met our American ducks. The mother wood duck has grown accustomed to our visits and is no longer very shy. They like to stay in shallow water where they can find a lot of small insects to eat—"

"Ms. Miller!" A sweetly gawky-looking boy whose weight hadn't caught up with his latest growth spurt interrupted her. "Ms. Miller, where is the mother duck?"

Pam stepped closer to the still waters. The ducklings were huddled together beside a clump of marsh grass. They were strangely quiet and weren't engaged in their usual search for food. Pam scanned the shore for the wood duck hen; she was nowhere to be seen.

"That's odd." Pam looked back at the silent ducklings. There were only eight of them—the day before there had been ten.

Pam saw Gerbald, who seemed to possess an uncanny sixth sense when it came to trouble, was already coming down the hillside toward the group; a flash of blue as well trained eyes scanned the terrain from the shade of his monstrous hat's floppy brim.

Pam turned back to her group of students. "Well kids, it is a bit unusual for a mother duck to leave her babies unattended, but not unheard of. She may just be out looking for food and thought they would be safe here. Now is a good chance for you to get out your sketchbooks and get a picture drawn of them while they are sitting still." Pam flashed a quick concerned look to their teacher who returned a subtle nod. *Message received, good teachers have an instinct for trouble.* The teacher quickly went about getting the notebooks deployed and the students distracted with work. Pam walked casually but quickly to Gerbald who had moved quietly along the shore toward the inlet's mouth, his gaze alternating between the muddy ground and the vicinity.

"Gerbald, the mother duck and some of her ducklings are missing. I have a bad feeling about it. . . . Maybe a fox?"

"Pam, I am looking for tracks. If they are here I will find." They didn't discuss the subject much but Pam knew that Gerbald had extensive hunting experience. As a former professional soldier there was no doubt a good many of his meals had come from the region's many forests. Gerbald was a very savvy woodsman. Born and raised in West Virginia, Pam was no stranger to the hunter's art. She had even brought down a buck herself on a hunting trip with her uncles and cousins back in her teens. She hadn't burst into

tears as so many do, she had established too tough an exterior for that, especially in front of her boy cousins; but she hadn't relished the experience one bit either, and felt some regret at the sight of the death she had made. She accepted her family's praise, ate the venison, enjoyed the taste; but once was enough. Hunting was all right and a fact of life—within reason.

"Not . . . a fox." Gerbald said quietly as he peered into the rushes. Gently he extracted a duck's pinion feather from a clump of stalks; her heart sinking Pam saw that it was a female wood duck's. Gerbald used it to point at the damp ground.

"There—a boot print in the mud. There—more feathers. The bird, it struggled. Here—this is where they tied the snare; you see the marks." Pam nodded solemnly at the dead branch, some of the rotting bark had peeled away when the twine was untied. She felt a great surge of emotion building in her, a potent mix of grief and rage. No time for it, she could get upset later but not now, not in front of the kids.

"Which way did they go, Gerbald?" Her voice was even and hard as an iron rail.

"Up the hill, but the tracks are not clear. I am not sure how many, maybe two or more. This was only some hours ago." Pam peered up at the steep formerly West Virginian hill, into the shadows beneath sugar maples, beech and yellow birch trees. She nodded slowly.

"All right. They're for later." Squaring her shoulders Pam marched back to the young teenagers. They stopped their talk, sensing that something was wrong from her face's stony set.

Mrs. Antoni looked very worried. "Pam? Is everything okay?"

"No, I'm afraid its not." Pam considered for a moment softening the story but decided against it. *They're old enough, they should be told.* "The mother wood duck is dead. She has been killed by hunters. Human hunters." A distressed murmur went through the group. Pam looked at the huddled mass of ducklings in the shallows. There was no escaping what came next, as much as she hated to remove a wild thing from its habitat she had no choice. It was unlikely that the two missing ducklings were taken by the hunters, they had probably fallen victim to a crow or some other opportunist—a baby duck alone would make an easy snack for a variety of creatures.

"What we have here now is an endangered species. These may be the *only* transplanted wood ducks in the whole Ring of Fire. I'd like very much to save them and I need your help."

A murmur of excitement went through the group—"Of course we will help!" It was unanimous. Pam smiled a little at their youthful good will. *These are good kids. I'm glad I am here, doing these things.* Pam rarely thought of her life before the Ring of Fire anymore. After her divorce she had disappeared into a glass bottle world comprised of her tiny house and secluded back garden. Seeing herself standing in front of a bunch of people, even if they were mostly kids, and being the one in charge, the one who knew what to do—she never would have expected this . . . or how much she *liked* it.

"All right. Here is the plan. Now that they have no mother we need to catch them and take care of them until they are older. Boys, I'd like to ask you to take off your shirts and give them to the girls." This couldn't help but produce a few giggles. Pam had to have a chuckle herself, despite the tragic nature of the situation. "Well, we aren't going to do it the other way!" Everyone snickered now and Mrs. Antoni gave her an alarmed look. "Girls, you are going to be the catchers, I think you'll be gentler than the boys, *ja*?" One of the girls in the group, and it sounded like a down-timer accent muttered "Duh!" *Yes, we are also having a marvelous influence on this century's youth!*

"You boys are going to roll up your pant legs and wade out into the lake from over there." She pointed a few meters down the shoreline toward the main lake where they wouldn't disturb the ducklings too soon. "Be careful, it drops off pretty sharp about six yards out. I want you to slowly make a half-circle around the ducklings so they can't swim away in any direction—if they try to go past you I need you to grab them with your hands! They are very fragile so you must be careful; it's easy to injure them.

"Girls, you are going to make the other half of the circle along the shore. Crouch low and have the boy's shirts ready. When I give the signal the boys are going to start making noise and will move towards the shore. That's going to drive the ducklings up onto the grass where you can drop the shirts over them. Once you have a duckling caught under your shirt hold it there and I'll come get it to put in my bag here." Pam quickly emptied the contents of her rucksack onto the ground, she could fit most of it in her coat pockets for the trip back, and it would make a nice safe container for their fuzzy little captives. "Does everyone understand? Stacey and Gerbald, you stay back a ways—if the girls miss any then it's up to you to grab them." The teacher gave her a determined nod and Gerbald had developed an exceedingly wry smile.

"Yes, ma'am," he drawled in his best West Virginian; obviously he had been practicing.

Marshaling her troops in a loud stage whisper Pam directed the boys out into the water. *Good Lord, I hope no one drowns on my watch!* They moved surprisingly quietly, lanky young teen herons stalking through the reeds. The cluster of ducklings had begun to peep softly, looking around nervously, their instincts told them something was up. Pam got the girls crouched in their circle, shirts spread wide between their hands, ready to make the catch. *'Operation Duck-lift' is a go!* The excitement of the rescue operation had lifted Pam's spirits quite a bit. She might as well enjoy the fun now and ask questions later about why this had happened and what *she* was going to do about it.

"Boys—move in! Slowly!" The waders had formed a wide ring and now carefully closed it. Soon they were all within an arm's reach of each other. *Ready . . . steady . . .*

"Do it!" The boys began to move rapidly into shore whooping merrily. As hoped for the ducklings lost their nerve and broke from cover; they made a plaintive peeping plunge for the grassy shore. *Perfect!* "Here they come, girls!" To their credit the girls remained calm and quiet, waiting for the madly fleeing ducklings to get within reach—and down went the shirts! Six of the girls had a duckling thrashing about under cotton T's and homespun linen shirts, which were now being cut in up-time style as was, not too surprisingly, the burgeoning fashion amongst Grantville's kids. Pam, distracted by the action almost missed the duckling that ran between Mrs. Antoni's legs and was headed straight for her. *Plop!* Down went Pam's rucksack over it.

One more had broken the shirt line and was weaving madly toward the hillside. Gerbald, with a delicate flick of the wrist, tossed his ridiculous floppy hat on it. He rarely took the misshapen thing off, only when his wife Dore threatened to render grievous harm at the dinner table, so Pam considered it a generous gesture of solidarity on her bodyguard's part. Figuring that Gerbald could suffer the dread German summer sun on his head for a few minutes, Pam scooped her own catch deeper into the rucksack. She then proceeded to gently pry struggling ducklings out from under the shirts. Soon she had six loudly protesting balls of fuzz. When she retrieved the one under Gerbald's hat they exchanged a quick grin. *Yeah, that* was *fun!* The students were laughing and hooting now as the boys tried to regain their shirts from the girls, who were engaged in a merry game of keep-away with the bare shouldered boys. Mrs. Antoni just shook her head and let them have at it. She walked over to Pam and Gerbald. Pam smiled warmly at her.

"Thanks for letting me use the kids as a wildlife rescue team, Stacey."

"No problem, it was good for them. At first the Grantville kids and the new kids were really shy with each other, it was to be expected. But now I'm at the point where I forget which is which—they're all just kids now, American kids. They have really become a tight knit group."

"Can you understand that mixed up slang of theirs?"

"Good heavens no, I never expected *that*! In class they must communicate *correctly* in one language or the other depending on what's required for the lesson. Out of class there is no stopping them, and the funny thing is I catch myself doing it sometimes, too!" They all shared a chuckle. Pam was shortly reminded of her responsibility by the gently squirming weight of her rucksack.

"We need to round these guys up and head back for Grantville pronto. I've got to get these ducklings out of this bag and into temporary quarters." Mrs. Antoni proceeded to bark orders and within a relatively short time blushing boys were reunited with their grass-stained shirts and the students were assembled. Pam gave them a brief thank you speech congratulating them on their helpfulness after which they began the trip back to town brimming with pride and tuckered out from all the hullabaloo.

As they were leaving the inlet Gerbald lingered behind a long moment, gazing up the hillside. Anything that distressed his dear employer and 'little sister' Pam would have Gerbald to contend with. In case anyone may be watching *and he thought he knew who might be*. He made a show of touching the hilt of his *katzbalger,* a lethal shortsword designed for wreaking havoc in the close quarters of unwieldy pike formations.

"It is still sharp." he announced to the shadowy trees, turned martially on his boot heel and marched after the group.

* * *

By the time Pam and Gerbald had been relieved of their charges and said their goodbyes it was getting near dinner time. They walked to Pam's house where Gerbald helped her extricate a dirty sea-green kiddy pool from its place leaning against the side yard's overgrown fence. Pam had thought she might use it as a refreshing spot to lounge on summer afternoons back up-time; she'd used it exactly twice. She found the extra pounds she'd put on during the divorce and the *more* extra pounds she'd put on *after* had pretty much wiped out all desire for getting into a bathing suit, much less venturing outside in one. Once the leaves and dust were knocked out of the thing they dragged it into the living room where it filled most of the floor space. Pam sacrificed a cardboard box, cutting one end of it off and turning it upside down over a folded fluffy hand towel within the kiddy pool's confines to form a cozy *faux* nest. Next she added a wide, shallow glass baking dish with water for them to drink and bathe in. Throughout this part of the process Gerbald stood holding the bag of softly hooting little creatures well away from his body with a long suffering look.

"What's the matter Gerbald?" Pam asked slyly.

"Nothing, of course." He smiled unconvincingly.

"Hey, you are awfully good with those little fellows Gerbald, so gentle . . . maybe *you* would like to keep them until they are old enough to go out on their own! I bet Dore would *love* them!" Pam grinned like a coyote.

"Wass? Nein!" Lapsing into German was rare for Gerbald who rather prided himself on his English mastery. He moved purposefully toward the temporary enclosure, thrusting the rucksack toward Pam, who backed away, making him follow her in a circle around the kiddie pool.

"Pam! Take your baby ducks now, *bitte*!" Pam shook with mirth at her friend's discomfiture.

"So much for being a macho man with a sensitive side, Gerbald!" Pam set the rucksack down on the plastic pool floor, giving a gentle shake to dislodge the small refugees. They ran around willy nilly for a minute, but once they found the water they calmed

down, engaged in the very messy process of splashing all its contents out of the bowl onto the pool's floor. They were still peeping, but at a much less frantic pitch.

Gerbald peered down his nose at them, a glimpse of narrowed eyes beneath his voluminous hat's drooping brim. "Do they always make such noise? This *pee-pee-pee-pee-pee-pee-ing* of theirs?"

"Oh, I should think not. Once they settle down they'll probably go right to sleep, they must be exhausted. Now, you're sure you wouldn't like to have some pets for a while? I think it would be good for you, taking care of something so small and cutsie-ootsy-wootsy!"

Gerbald grimaced at the thought. "I do not do 'cute,'" he announced firmly. Pam laughed at his use of the up-time turn of phrase. Determining that his duties had ended, Gerbald flew out the door so fast his shadow almost got left behind in the living room.

"See you tomorrow!" He called back from the safety of the road, which he had sprinted all the way down to.

"Coward!" Pam waved.

Out of sight down the road Gerbald slowed to a thoughtful pace. He had said nothing to Pam about his suspicions regarding the morning's events. It would not do to worry her further and it was something he had rather not tell her about in any case. He would see to the matter tomorrow . . .

* * *

As she ate her dinner Pam listened to the ducklings; *pee-pee-pee-pee-pee-pee!* "Poor little things, I know you miss your momma. I'm going to make sure you grow up into big wild ducks, I promise." *pee-pee-pee-pee-pee-pee!*

Working on the drafts of her growing field guide Pam felt sorry for the orphans behind her. *pee-pee-pee-pee-pee-pee!* "I am going to find out who did this and put a stop to it my little friends, don't you worry. I don't care if they make it a law or not, nobody is going to kill up-time birds if I can help it. I'll sic Gerbald on 'em all right, that will fix their wagons." *pee-pee-pee-pee-pee-pee!* Shortly she gave up trying to get any work done and headed for the bathroom. *pee-pee-pee-pee-pee-pee!*

After a quick shower and tooth brushing Pam tiptoed through the room. They had grown quieter. She switched off the table lamp. *pee-pee-pee-pee-pee-pee!* With a grimace she turned it back on. *pee-pee-pee-pee-pee-pee!* "Okey dokey, goodnight now! I'll leave the light on." She said tenderly to them. *I'm talking to ducks now.* Softly she closed the bedroom door. Even closed she could still here an only slightly muffled *pee-pee-pee-pee-pee-pee! Poor little guys.*

"They'll settle down after a while." Pam crawled into bed, well worn out after the crazy afternoon. *pee-pee-pee-pee-pee-pee!* She turned on the bedside reading lamp to enjoy a mystery novel she'd borrowed. She had finally gotten past the point where reading any up-time fiction had filled her with homesickness and despair at never seeing the twentieth century again. Now this was home and she could enjoy a good up-time read with just a tinge of nostalgia. *pee-pee-pee-pee-pee-pee!* It was hard to concentrate with the endless chorus going on next door. After she had read the same sentence five times in a row she gave up, flopped the book down on the bed stand, turned off the light and scrunched down under the covers. *pee-pee-pee-pee-pee-pee!* "Poor . . . little . . . things . . ." *pee-pee-pee-pee-pee-pee!*

"Maybe I should turn their light off now." Pam crawled out of bed and crept into the living room. Eight pairs of glossy black eyes peered nervously at her from within the box's shelter. *pee-pee-pee-pee-pee-pee!* "Shhhh, you guys go to sleep now!" *pee-pee-pee-pee-pee-pee!* Pam blinked tiredly at them, then went back to her bedroom, shutting the door firmly behind her. It was already eleven she saw as she got back in bed; she felt unnaturally heavy, drooping with exhaustion.

pee-pee-pee-pee-pee-pee!

Midnight.

pee-pee-pee-pee-pee-pee!

One in the morning.

pee-pee-pee-pee-pee-pee!

Two in the morning.

"You don't know just what an endangered species you are becoming, little ducks . . ." A muffled voice emanated from beneath the pillow.

pee-pee-pee-pee-pee-pee!

* * *

It was early Saturday morning so Pam was considering sleeping in. The problem was, now that the ducklings were finally quiet she was growing worried about them. Around seven she got up to have a look. She found them all in a cozy bunch sleeping on the soft towel. *You guys had a hard day yesterday . . . hopefully today will be a better one.*

She walked into the kitchen to get the morning coffee going. If she ever met any Turks she would probably hug them, tears of joy streaming down her face. The reintroduction of coffee to seventeenth-century Grantville had been a tremendous comfort to her as it was to most other up-time Americans. *Turkish coffee, yum!* Moving quietly Pam sat down at her window-side table. The bird feeder

had its morning crowd; bluethroats, towhees, pirols, titmice, and her treasured cardinals, the usual mix of native German and transplanted up-time birds. She watched the brilliant red cardinals with keen pleasure.

"The American redbird," she reminded herself looking at the noble form of the cardinals. "That's a better name for you in this day and age." In the guide book she was creating she had listed the name 'cardinal' as an "archaic" up-time appellation (best not to think too hard on that), in the New United States the startlingly bright plumaged bird was now widely known among down-timers as the *Amerikanische rotvogel*.

Watching her breakfast guests tearing into the sunflower seeds grown on her front yard plantation Pam let out a sudden gasp. *Good lord! What do I feed the ducklings? They must be half starved!* Pam grabbed her paltry collection of American field guides, pushing aside the old familiar regret that she had not bought more bird books before the Ring of Fire came. *File that under 'Lost Chances and Failed Romances,' Pammy old girl.* She would do what she could with what she had—a skill set that had acquired much honing of late. There wasn't much in the books regarding feeding, and nothing specific on ducklings. She knew wood ducks were mainly herbivorous; they were considered a perching duck but shared some traits with dabblers like the mallards. Thinking hard, Pam distinctly recalled seeing the ducklings when they were still up at the lake going after small insects as well as pondweeds; all baby birds needed high quantities of protein.

On her way out the kitchen door she turned off the stove, the coffee would have to wait. She grabbed a small trowel and a pail as she headed for the sunflower field. Most of her wide, sloping front yard was devoted to sunflowers, they provided excellent bird feed and besides—they were just damn pretty. She stuck the trowel into the dark, dew-moist earth between the rows.

"Bingo!" Her first scoop yielded two wriggling pink earthworms. "Breakfast is served!" Once she had five of the unfortunate invertebrates in her pail she washed them briefly in the wall spigot. Back in the house she placed one on the cutting board, proceeding to chop it into very small pieces. Briefly a voice in her head, her own mother's traveling across the space-time continuum, admonished her. *"That's disgusting—you eat off that, too you know!"* Pam grinned as she realized she could care less. She heaped the minced earthworm into a shallow bowl filled with water. She noticed that some of the pieces were still moving. *All the better.*

Her downy house guests had awoken and were now peeping softly, poking their heads out of the box's shelter, the ringed markings around their eyes giving them a charmingly mischievous look. Pam gently placed the bowl on the kiddy pool's bottom, then stepped

back to watch quietly. The ducklings peered shyly at the new object at first but once they caught the scent all shyness evaporated. *Feeding frenzy!* Pam marveled. Very hungry ducklings tore into the earthworm soup with relish. "So, you guys were hungry. Is that why you kept me up half the night?" *I hope this is the right stuff for you . . .*

Pam knew it was time that she got some help with this. She needed someone who knew something about raising fowl. She hauled out the Grantville phone book, found the name and dialed the number. *He's a farmer—he'll be up early.*

"Hello, Willie Ray? This is Pam Miller. I wonder if maybe you could help me out . . ."

* * *

Pam felt awful as she gently placed the frightened ducklings back into her rucksack—it was still the safest way she could think of to transport them. Soon she was headed down the sunny morning road whistling *Zippity Doo Dah* to a chorus of muffled peeps.

Willie Ray Hudson's place was well-known to every Grantviller. She found Willie Ray still nursing a cup of coffee on his wide front porch. As it turned out the friendly old farmer had spent the prior evening long and late at the Thuringen Gardens public house and he now rather resembled a tree full of owls blinking at the bright morning sun as if it were an unexpected calamity. Pam took his offer of "A cup of Joe." She hadn't gotten around to hers this morning and Willie Ray obviously needed some time to rally. He gave Pam a sheepish grin.

"This coffee is doing the trick, Pam. I'll be up an at 'em pretty quick. A fellow my age putting down that strong German beer like it's Sunday picnic lemonade, I should know better. Made a damn fool of myself. I think I ended up back here courtesy of a wheelbarrow!" He grinned, his jaw a field of gray stubble growing on darkly tanned furrows of weathered wrinkles.

"I know how you feel, Willie Ray. I got into some of that moonshine the boys are making these days a while back. My hired man's wife had to put me to bed like a baby, thank heavens for Gerbald and Dore! I was a mess, I felt like I'd been kicked in the head by a mule the next afternoon when I came to." They shared a laugh at their respective misadventures in the realms of the spirits. Something about Willie Ray and his farm made Pam feel comfortably rustic. She had spent plenty of time here and in places like this in her youth.

"Now, what you got in that old travellin' bag, Miss Pam? By the sound of it I'll bet it's not canned beans and frankfurters. Must be those orphans."

"They're wild wood duck ducklings, Willie Ray. Have you ever seen the ducks with the long crest coming off the back of their heads? The real pretty ones."

"I know what wood ducks are; seen a lot of birds here on the farm over the years, usually going after my patch of corn. Just what happened?"

"Their mother was killed by a trapper up along the rim. Probably a hungry down-timer shacked up in the German pine woods north of town. Gerbald and I are going to go see if we can find who it was later today. I was ready to kill them yesterday but now I think I'm going to try to reason with them, get them to hunt somewhere else outside the Ring." Pam's brow furrowed. She really hadn't a clue how to deal with the situation but she knew she had to do *something.*

"Well, being reasonable is always a good place to start. Come on, Pam. Let's show these little peeps their new home." Willie Ray stood up slowly. He stayed in great shape working his farm but the years had taken their toll; he wasn't a young man any longer.

The cloud passed from Pam's face. "Really? You do have a place for them?"

"Sure I do. What's a farm without a duck pond? It's out back of the barn, remember?" It had been quite a few years since she had

visited Willie Ray. She felt guilty for a moment but the genial farmer wasn't the type to fuss over that kind of thing. Folks were welcome to drop by the farm when it suited them. Pam followed Willie Ray around the side of the house and down the bare path through the grass to the barn. They walked through the large outbuilding, a couple of cows giving Willie Ray a scolding *moo* for being late with their milking.

"I hear ya, girls. Dang it, where are those hired men of mine?"

"Were they with you last night?" Pam asked with feigned innocence. Willie Ray flashed her a rueful grin.

"Why, I do believe they were. Come to think of it last I seen they were singing drinking songs while propping each other up. Figure I'll see 'em around noon then. My own damn fault, I was buying the rounds."

Heading out the back of the barn they arrived at the duck pond. It was fairly spacious, a good twelve yards wide and fifteen long. One end had been left natural, full of cattails and lily pads. The end nearest the barn had a muddy beach crisscrossed with the tracks of various fowl, a gnarled willow tree providing shade. The entire area was surrounded with a sturdy looking chickenwire fence, dug well into the ground, something to keep the chickens in and the weasels out. The enclosure also included a roomy bird yard and several coops and pens, all occupied by an untidy population of clucking, quacking, honking and gobbling critters. A very large red rooster gave Pam the evil eye, an intruder in his domain. It advanced menacingly a few steps but Willie Ray shooed him off with a raised boot. The rooster held its head high in the air, stalking off with greatly injured pride.

"Never mind Pete, he's more bark than bite. But I seen him give a weasel the spur once, cut the varmint's throat wide open! He earns his keep. Now, let's find Matilda." They walked over to the water's edge where a motley collection of drakes and hens milled about, made up of assorted domestic ducks, semi wild mallard ducks and those that were clearly a mix containing varying degrees of both. They walked right into the middle of the congregation, the ducks only acknowledging their presence by stepping casually out of their path.

"Matilda! Tilda, Tilda!" Willie Ray called, followed by a sharp whistle. From the shore a very large and obviously well fed hen waddled toward them. She was a mutt all right; she had the markings of a mallard hen but instead of brown and white they were in shades of dark and light gray. Her beak and feet were a very un-mallard shade of blue. Pam had never seen a goofier looking bird and had to smile outright.

"This here is Matilda, mother to the world. She's a good old gal; poor thing's eggs haven't hatched for a few years. She has adopted everything from goose goslings to a Labrador retriever puppy—good thing they're swimmers! Damn dog still thinks he's a duck. She ought to be right pleased to have some ducklings again. Here Pam, let me have that bag."

Pam handed him her peeping cargo a little reluctantly, but the old leathery hands were as gentle as a cloud. He bent over with a small grunt to hold the rucksack open on the ground, lying on its side. Matilda hurried over to look inside, waddling so fast she almost took a nose dive. Pam laughed aloud.

"Watch this, Pam." Willie Ray grinned up at her.

Matilda stuck her head right into the bag. A gentle grunting quack could be heard. Suddenly the ducklings poured out of the bag to form a huddle around Matilda's big blue feet. Matilda put her head down in amongst them so they could all get a good dose of each other's scent. Then she looked up at Willie Ray and gave a quack that was surely filled with pleasure and pride. *"Thanks for bringing them to me; I'll take it from here!"* Spreading her wings gently she herded them over to the water. The ducklings followed along eagerly and were shortly feasting on duckweed, a happy and hungry line paddling behind their new surrogate mother. Pam could sense the waves of relief coming from their tiny bodies. Some people didn't think animals felt emotions the way humans do, but she had always strongly disagreed with that notion. She felt her eyes moistening with joy. *Oh hell, now I'm going to cry.*

Willie Ray watched the scene with serene pleasure. He took a look inside the rucksack to make sure all the ducks had been released. Satisfied, he handed it back to Pam.

"Well, that's better. Those little guys were sure scared shitless."

Pam nodded. "Yeah, they probably were." She sniffled happily.

"Darn right! Just look in your bag!"

* * *

Pam still had a few more hours to wait for Gerbald to finish his day time job. Willie Ray invited her to have another cup of coffee so they returned to the front porch. Sitting there watching the grass grow and the farm dogs playing Pam could almost forget about the Ring of Fire. This was still "home" after all, a chunk of the West Virginia she had grown up in. She had traveled a little up-time, been to New York and down to Florida, made it to Montreal, Canada, but unlike so many young people in the hills itching to escape their rural beginnings, Pam had been happy going to college nearby, then taking a job only twenty miles from home. It was a good place, and it was still good, even beneath the skies of history book Europe.

"Pam, I've heard about what you are doing with the school. That nature program is a fine idea. Kids should feel connected to the land and get to know the wild things around them. I think you're doing a real good thing."

"Thanks, Willie Ray. I'm glad to hear you say so. Sometimes I wonder if I've gotten a little nuts about it."

"Well, it's a good kind of nuts if it is. Say, bring those kids out here some time, you can visit your baby ducks and show the kids all them birds that are eating up my corn patch. There are these little blue ones that are real hungry buggers, never saw them before."

"Those are bluethroats! *Blaukehlchen*. They're one of the native German birds that have taken a liking to Grantville and my sunflower seeds in particular. And bringing the kids out here would be great! I really appreciate you helping me out today."

"Pleasure's mine. Another thing, I read your proposals on protected species and a national bird. I want you to know I support both of them. I'm going to do what I can to get them passed, especially the protected species part. I figure any critters which came through that thing with us deserve to live as much as we do, and I'm not the only one who thinks so."

Pam slumped back in her chair. It had been a year since she had sent that proposal in and she hadn't tried to follow up on it. Apparently it still existed in governmental limbo. "That is really good to hear. I thought for sure everyone would just think I'm a dingbat, worrying about birds when we're still trying to figure out how we're going to just survive in this time."

"Well Pam, you know we are starting an industrial revolution here. I'm hoping we do it with a lot more compassion for both people *and* nature than happened in the old history. Might as well start now teaching folks to value nature and protect it. Seems like we have a second chance at that."

"Willie Ray, I would never have guessed you were an environmentalist."

"Now, don't start calling names! You'll tarnish my reputation as a red neck hillbilly! I'm a farmer and so I understand that we need to live in balance with nature. I've been joking about those birds getting into my corn; well, they eat some, but I still have plenty left. The thing is, those birds are also eating insects, and insects do a lot more damage to a crop than birds do. It's a good balance. I want to keep those birds around. There's nothing like seeing a flock of red birds in the trees, that's somethin' well worth protecting. My mother was quite fond of them; she used to feed them sometimes, called them 'red birds' instead of 'cardinals' too, a lot of folks did. Anyway, I'm not sure if they're going to make it as a national bird, although they were a fine choice as West Virginia's state bird, and I'd hate to see them all made into hats before they had a chance to build their numbers here."

"A lot of new Americans are already mostly sold on protecting red birds thanks to my friends spreading the word. Right now I'm mostly worried about the up-time game birds, like the ducks. I'm hoping that at least the original Grantvillers will stop hunting them, but I know it's hard to tell folks not to shoot something they like the taste of."

"Well, I think I can help with that. I know more than a few members of the UMWA, including the Prime Minister." He grinned widely "Whoever thought a hick like me would keep such fine company? Anyway, I'll see if I can get them boys squared away on the issue. Law or not, if the UMWA is behind it it's as good as law in these parts." He paused for a moment. "You know, I'm not sure some of them would know a wood duck from a snow goose—if it's a bird with webbed feet they'll shoot it. Do you think you could show them some pictures or something? That wild bunch of gun nuts could use a dose of nature program themselves."

Pam stopped her coffee cup in mid sip. *Pictures* . . . "Willie Ray, you are a *genius*!" She jumped up, startling Willie Ray which caused him to stand up as well. "That's the best idea ever, I'm going to get right to work on it! I'll see you soon, thanks Willie Ray!" Pam bestowed an enthusiastic hug which almost knocked the old farmer over and then went down the porch stairs two at a time. Willie Ray leaned on the rail watching her run up the drive. "You're the best, Willie Ray. A real genius!" she called back as she reached the road.

"Well, that's good to hear Pam, but do tell me just why I'm a 'genius' sometime. Ain't never been called *that* before!"

* * *

Pam hurried down the asphalt road to Fluharty Middle School. She had already walked at least three miles today and would walk many more before the day was done. She allowed herself a small sense of satisfaction, back up-time she would not have been able to sustain such a pace. If the Ring of Fire had not brought an unexpected end to things as they were she wondered how long she would have continued her bonbon eating binges of self pity. Now she could barely imagine an alternative future up-time for herself; this was her life, right now, in sixteen hundred and thirty four. It didn't matter to her how they got here, act of god or the devil himself; she was here and making things happen. It felt like a second chance.

At the school Pam sought out Mrs. Antoni. She explained her idea and asked if the students could be brought to the task. Mrs. Antoni shared Pam's excitement.

"That's a wonderful idea, Pam! This will be an excellent learning opportunity, a good dose of civic action. Why not start now since you're here? I have them this next period and my lesson plan can wait for a good cause."

The sixth graders listened to Pam eagerly, after all she was the nice lady who broke them out of the stuffy old classroom ("School in *summer*? It's not fair!") to go on fun nature walks ("Our hero!"). Anything Ms. Miller needed she would get. As Pam explained the project Mrs. Antoni was readying the butcher paper and poster paints.

"In your notebooks you've drawn a lot of pictures of the birds you've seen. First we are going to make a list of all the American birds from your notes. Next we will assign each student, or group of students, one of those birds to make a poster for. We need a painted picture of the bird and text in both English and German asking people to please protect this species. The more posters you can make, the better!"

Soon the room was a buzzing beehive of activity. There were some pretty good artists in the group; Pam was pleasantly surprised at the quality of the paintings as she walked from table to table. A menagerie of tempera birds was taking shape; a common loon seen down by the power plant, a cedar waxwing found just down the drive from the school, a red head duck spotted on Plum Run, a summer tanager sighted on a fence post beside a farmer's field. The American birds had survived the trip intact and their numbers were increasing. Pam had not dared hope for so many species; it was another example of the resiliency of nature.

A painted slogan above a fair rendering of a Baltimore oriole caught her eye, big bold red and white striped letters with a blue outline: "Don't shoot! I'm an American!" Pam laughed. *That will do!*

"That's great!" Pam cheered them on. "You guys are doing great! I have to get going but I want to thank you all for the help!" Pam left to a chorus of cheers and encouragement from her nature program students. *The future birdwatchers of America , and maybe more. The seeds have been planted and a crop of nature lovers is growing.*

* * *

As she went up the long sunflower-lined walk to her front door Pam felt that something was amiss. The door was open and she could hear the sound of bustling activity inside. The lawn chair that Gerbald would have waited for her in on the narrow concrete porch stood empty.

"Gerbald? Dore?" She called through the door.

"I am here but you will not find that foolish man!' Dore's voice rang out harshly. *Uh-oh.* Pam entered to find Dore dismantling the temporary duck shelter, her hands moving with a harsh precision that spoke of a towering rage.

"Where is Gerbald, Dore?"

"Gerbald? You mean The Great Soldier? Why he is out hunting of course, hunting for blood." The towel the ducklings had slept on flew into the laundry hamper with hurricane force.

"What do you mean? What's going on, Dore?" The older woman paused in her frenetic cleaning. Her face was red and her eyes puffy; she was full of anger but there was also something of fear written across her broad face. She blew a hot puff of air from her button nose, her shoulders slumped as if letting go of some heavy load.

"The men who killed your wooden duck." Dore's English had greatly improved but still had some idiosyncrasies Pam often found too amusing to correct right away. "Gerbald knows them."

"What? How?" Pam moved closer, stunned at this revelation.

"They were soldiers with Gerbald. He knew them by the way they made trap, it was Gerbald who taught them that. They are bad men." A gray, worried expression swept the red from her face. "Pam, Gerbald is not like them, you do understand? He was a soldier, but he never did the bad things, the things to women and children. He hated the men who did those evils. He spoke against them. It became trouble for him."

"Is that why he left that army? I knew it was something like that. What happened?"

"Dear Pam, it is not my story to tell you. Gerbald will when he is ready. But now those old troubles have found us here." Tears were building in Dore's eyes, her wrath had run its course and left a tired woman afraid for her husband. Pam gave her a fierce hug. Dore hugged back, nearly hard enough to break Pam's ribs. No words were needed. After a minute Pam released herself from Dore's powerful washerwoman arms.

"How long ago did he leave, Dore?"

"An hour. He had the look that comes before battle. He said that you that you must stay here with me."

"I'll stop him. I can catch him." Oblique terror came to Dore's hazel eyes.

"No! You must not go Pam, it is dangerous! Gerbald is a strong man, a good soldier. You must let him do as he will."

Pam stood undecided. Dore was probably right, Gerbald could take care of himself. But what if something went wrong? She had come to love the man like a brother, he was without a doubt her closest friend in the world, and when it came down to it, other than Dore, he was her only close friend.

"Goddamnit, that stubborn billy goat! I'm putting a stop to this." Pam grabbed a gnarled oak walking stick from the corner of the room, it had been her grandmother's. It was hard as a rock and the only thing she had resembling a weapon; carrying it would make her at least feel somewhat safer. It wasn't going to come to that anyway, not if she could help it.

"Pam, no, you are crazy! They will kill you, those bad men, or worse, I know . . . Don't do this, please!" Dore moved her solid frame between Pam and the door. Pam felt sorry for her friend but she had made up her mind.

"Dore, don't be afraid for me, please. I'll stay hidden if I can't catch him first, and if he's hurt I'll bring help. They won't see me unless I want them to. Let me go, please." Pam met Dore's fretful look with a cool, confident gaze. There would be no changing her mind. Dore relented, crumpling into a shape much frailer than Pam ever could have expected of the seemingly indomitable woman.

"*Ja*, I know. You have a soldier's courage in you my Pam. Go then, find Gerbald. Damn fools the both of you. I will clean up this barnyard you have made of your house." With a curt gesture of her chin Dore turned to advance menacingly on the soiled kiddy pool. Pam hurried down the walk, not saying good-bye.

* * *

She ran up the road as fast as she could. If she could only catch him before he left the inlet. She exited the road to head up the trail, moving fast on the well packed earth. She kept her breathing as regular as possible, she was in the greatest shape of her life but sustaining an all out run was taking its toll; she was no track star. *Fast enough, I'm fast enough. He's hunting men and will go slow,*

he'll never think that I would dare come after him. Doubt threatened her as she huffed along. *Should I really be doing this? What if we both end up getting killed? This isn't a game Pam, these people are killers.* The walking stick she carried before her in sweating hands suddenly seemed an ineffectual and foolish hope—what good would it be against trained soldiers? She almost dropped it beside the trail but held onto it anyway, it was all the protection she had if something went wrong. *Stop thinking, it isn't helping. Just catch him.*

The inlet was quiet, the dark water calm. Gerbald was not to be found. *Damnit!* Pam went to the spot where they had found the bird snare. To the left the inlet opened onto the wider lake. To the right the sliced West Virginian hillside made a flat edge along the water's edge. There was a new looking boot print on the muddy shore headed toward the hill and Pam remembered Gerbald saying they had gone in that direction. *Up we go.*

Keeping well away from the unstable edge Pam followed what she thought might be the possibility of a trail. A scuff mark here, a bent branch here—she began to feel like a genuine Davy Crocket. A sincere regret that she had disdained the ownership of a firearm as an adult filled her, she had been such a promising shot as a youngster. A Winchester rifle would have provided a wealth of comfort at the moment. She used Grandma's walking stick to impatiently bash a clump of scratchy brush out of her way. *Quiet now Pam, you are going to let the birds know you're here.* An image came to her of murderous looking cartoon birds: crows, vultures and evil-eyed eagles sharpening wicked battle axes with feathered hands; nearby a fire with a big Pam-sized cook pot bubbled. *Birdwatching. A nice safe hobby. Too bad they don't have gator wrestling in these parts, I could use the relaxing change of pace.*

Pam came to the corner of the lake, a jumbled landscape where the hardwood forested West Virginia hilltop abruptly adjoined a pine covered German ridge. The trail seemed to continue to the hard left along the ridge top past the rim, there were signs of recent skids on the still mostly bare soil of a steep two meter tall elevation mismatch. Pam slid down it into Thuringia proper. The ghost of a trail continued roughly northwards away from Grantville into brooding pines. Pam felt a momentary thrill of fear. *Okay, I've never been here before and I've left home territory. There are killers and rapists out there, and I'm looking for someone who is looking for them. I must be crazy and I better be careful.*

Pam walked slowly through the Thuringian forest, listening for the sound of movement or voices. She stayed low and wary, not wanting to be seen or heard. There was no more rushing to stop Gerbald, this was now. . . . What, a rescue? Hardly! She certainly wasn't the cavalry coming. *Why didn't I call the police, tell them what's going on?* It had never occurred to her to do so. *Too late now.* Doubt threatened to turn her back; she fought it, willing it away. *This is something I have to do for Gerbald and Dore.* That was reason enough for the risk.

The ridge curved sharply away east, the lake forming another inlet below her. Pam stopped to think. *How am I ever going to find seasoned woodsmen who don't want to be found?* A breeze wandered through the pine branches, it felt good. Voices came with it; the voices of men . . . angry men. Pam froze. After listening very carefully Pam thought she knew which way they were coming from. She slowly made her way in that direction. *At least they're upwind of me, I'll take that break.*

She soon found herself crouched under a bush watching three men arguing loudly in German. Realizing one of them was Gerbald her heart leapt. She forced herself to stay in hiding instead of rushing to his side, instinctively sensing that would not be a good move. There were two exceptionally scroungy-looking characters standing in front of a dilapidated shelter. Two earthen walls were covered by an incongruously bright side of aluminum sheeting, obviously filched from the outskirts of Grantville. Objects hung from a length of twine across the shack's opening; dead birds and small animals. Pam's heart wrenched as she recognized a Baltimore oriole and a redhead duck drake next to a fox pup. A fury began to kindle within her. There were many other items lying about the decrepit shack; a child's bicycle, a coil of rusty chain, a gas can. These men were thieves at the least.

The shouting had resumed. Gerbald was gesturing angrily at the stolen goods and the hung carcasses. She could only catch about half of his rapid fire German, it wasn't the Thuringian dialect and she guessed that every other word was an exotic blaspheme or bloodcurdling curse. The two dirty men glowered at him, she saw that one lightly held the heft of a sizable axe and the other had a long knife stuck in his ragged belt. The murderous crow and vulture. They were unmoved by Gerbald's fiery lecture but not willing to challenge him either. She had never seen Gerbald like this. He was furious, his voice a thundering avalanche of icy shards and unstoppable boulders. Although his stance seemed relaxed Pam knew he was coiled to pounce, one hand eagerly gripping the hilt of his prized *katzbalger* shortsword. *This is what Gerbald looks like when he's going to war.*

The harangue continued. It occurred to Pam from watching the demeanor of the two ruffians that they had experienced Gerbald's rage before. *These were once* his *men! He must have commanded them back when they were all soldiers!* Pam nodded slowly at her revelation. *I wonder who's in command of them now?*

A hard, heavy boot placed itself firmly on Pam's bottom where she squatted. With a mighty upward shove it sent her sprawling face first out onto the scrabbly ground in the hut's clearing, in full view of Gerbald and his former command.

"Well, we have guests I see!" a sneering voice announced in false friendly tones from behind her. The man's German was slow and clearly spoken, undoubtedly for her benefit since she was clearly dressed as an up-timer and would be unlikely to understand anything but the simplest language. Pam kept enough wit about her to hang on to her walking stick as she rolled quickly to the side.

She regained her feet in a ready crouch, backing carefully away from the man who had kicked her. The evil eyed eagle had arrived. Gerbald quickly hid his look of unhappy surprise at Pam's presence, but the unpleasant newcomer had seen it well enough. He continued in taunting tones.

"So, Gerbald, you have found yourself a woman amongst these American witchfolk. You are doing well, she is a fine improvement over that old potato you used to keep. That old sack wasn't even good for birthing! Tell me, I have wondered what these Grantville she-devils must be like, I have heard they think themselves the equal of any man. When you have your way with her does she howl like a wild creature? Has she taught you some new sins?" Pam gazed at him with a mixture of disgust and disbelief

Gerbald's face went radish red with wrath. He snarled. "She is a sister to me, Kurt, so stop your filth. Your mouth is a pit full of shit and rotten puss. One more word and I'll shut it for good." Gerbald was advancing toward this Kurt creature, the two men he had been haranguing forgotten. Pam feared the look in Gerbald's eyes nearly as much as she feared the three evil men. She noticed, much to her terror, that the first two had readied their weapons and were quietly in step a few yards behind Gerbald. The leader of their flock had returned and now they were emboldened. Gerbald was outnumbered three to one. *Well, I'm here, too . . .*

"Oh, your s*ister*! Well in that case, I must surely taste such delight for myself!" Kurt gave a sharp nod to his two cronies who now rushed at Gerbald. Gerbald, no fool, knew they were coming from behind but Kurt was already lunging toward Pam, one hand reaching to grab her, the other pulling a shortsword from its scabbard. Pam knew he would go for Kurt at all cost to prevent the man from touching her, ignoring the approaching threat. *Men. Some tacticians they are.* A rage had been building in Pam as well, enough to match Gerbald's—maybe more. She had to prevent Kurt from taking her hostage so that Gerbald wouldn't end up with an axe in his back thanks to his heroic foolishness. She took a step back, planted both feet, gripped the walking stick like a baseball bat and let fly the mightiest swing of her life, shouting in German:

"TASTE THIS!"

KE-RAK!!!

The length of hard oak shot above Kurt's grasping talon, colliding solidly with his jaw. The jaw gave way to the walking stick, bone breaking with an awful splintering sound, teeth spilling out like rice thrown at a wedding. A gush of blood followed as his head snapped sideways at the blow. He went down in seeming slow motion, an inhuman sob emerging from his throat. Gerbald stopped in his tracks stunned at the unexpected sight. Pam shouted at him in English. "Behind you!" *Idiot!*

With Pam no longer in immediate and distracting danger Gerbald's years of battlefield experience kicked in. It occurred to Pam that he had never fought directly for a loved one before, and the concept had distracted him from his usual combat savvy. *Well, that is kind of sweet.* With a practiced move Gerbald's *katzbalger* found the poorly guarded gut of the knife wielding enemy to his left, his thrust leaving a spreading circle of red on the man's wool tunic. With a low moan the man fell forward on his face. The other attacker swung his axe at Gerbald's head. Gerbald side-stepped that blow but tripped against the fallen form of his first target. This gave the axe wielder another shot, he connected a cruel cut into Gerbald's lower left thigh. This caused Gerbald to grunt with pain but it didn't stop him. His short sword was a silver blur as the man was pulling his axe from Gerbald's flesh. The *katzbalger's* razor sharp tip darted into the man's throat and twisted. Pam found the look of surprise on the man's face more shocking then the streams of bright blood coursing down his front. *That's death. That's what death looks like.* Lifeless hands released the axe, the man fell backwards with a gurgling cry.

Despite his pain Gerbald spun around, sword raised, crimson and thirsting for more. He stepped heavily toward the spot that Kurt had gone down thanks to Pam's at bat. Kurt wasn't there. Pam saw him slipping into the bushes, one hand holding shut his broken jaw. Gerbald started to lurch after him, laying a trail of his own blood next to that which Kurt had left. Pam's wits returned reluctantly, trying not to look at the two gored corpses slumped at their feet.

"Gerbald!" she shouted. "Stop!" It was a command. She pointed grandma's walking stick at him like a general's rod. Gerbald took another uneven step, awkwardly trying to hold the blood seeping from his thigh in with his free hand. He wasn't having much luck and knew it. Slowly he turned back to Pam as the despicable Kurt made his escape, fleeing whimpering into the brush.

"Yes, ma'am?" in that infuriatingly accurate hillbilly drawl he had made such a point of mastering. Pam shook her head in relief, horror, exhaustion, joy. It was really all a bit much for a summer afternoon.

"Hold still right there and let me wrap that wound. War's over." Gerbald nodded resigned assent, there was no way he would catch his enemy in rough terrain with such a wound hampering him. He wiped his gory shortsword nonchalantly on the pair of Levi's jeans he had come to favor. Later he wouldn't be happy about that tear in them. Pam handed him Grandma's walking stick which he used to take the weight off his injured leg.

"A handy thing." he remarked, idly stroking the smooth wood. "Very effective."

"No kidding. I can't believe I did that. Good lord, what would Grandma say!?" Gerbald handed her a length of linen bandage from one of the many useful pockets within his sage colored wool soldier's coat. It didn't matter how hot it got, he rarely took the thing off. Pam wrapped the bandage as tightly as she could around the wound; the blood slowed but didn't stop. "Can you walk?"

"I can, at least for now. A *valkyrie* from the old stories guides me to my spot at the table of heroes." She took his other arm and did

her best to help support him. She couldn't help but look again at the two dead men as they passed by. A sudden realization shocked her.

"Gerbald! These men! I've seen them before!"

"Where, Pam? When?"

"In the woods along the rim a couple of years ago, not too far from here. These were the three men I saw who scared me when I was out birdwatching alone. I hid from them. It happened the day before I met you! They were *why* I hired you!"

Gerbald nodded. "It is good they did not see you then. Also, hiring me was a very good idea." Wry Gerbald charm despite the severity of the situation.

"Yes, I'd agree, most days . . . Boy are you in trouble. Do you want to tell me about it before Dore gets hold of you?"

"Not really. I knew them. They were under my command for a time. I felt a responsibility. I thought they were near but so far they had contented themselves with thievery. Eventually the rapes or murders would start as their fear of Grantville left them. It is all a bad story, we've had enough blood for today. Another time I'll tell you, please?"

"All right soldier, but I'll hold you to it. What about the bodies?"

"I am not a religious man, Pam. I'd as soon leave them for the carrion crows, they deserve no better. I suppose we should alert the Grantville authorities, especially since Kurt is still out there . . . Do you think I will be in trouble for this?" his eyes looked questioningly at her.

"As far as I'm concerned they got what they deserved. I'll tell them you were defending me; you aren't going to be in any trouble. Besides, it's kind of like the wild west these days, anyway."

"Yippee!" he cheered faintly. *Why did the Germans love cowboy movies so?* Gerbald's face turned serious again.

"Pam, this is important: That man, Kurt. It was brave what you did, who would have guessed our gentle bird lover contains such fury? He has hurt many women, it was good to see him get some measure of justice at your hands." Gerbald paused, making sure to catch her eyes with his. "It would have been much better if I had been able to kill him. Please understand, a wounded beast is more dangerous still. He will want revenge, in time he will come looking. You must be careful. I will always watch over you but he will try to find a time when I am not there, he is a coward but still very dangerous. Do you understand me?"

"Yes, Gerbald."

"When I heal I will begin looking for him if the Grantville police don't find him first. I will finish today's work before he can make more harm."

Pam nodded, accepting this unsavory necessity. "All right, Gerbald, I get it. But be careful, you're just way too much fun to have around."

"Yes, today was fun, don't you think? A real ass-kicking good time, a right fine shivaree!"

"Don't push your luck, Ivanhoe."

* * *

They were fortunate to find a ride when they hit the pavement, a mineworker with an official truck hauling something that was apparently valuable under a canvas tarp. It was a good thing, too, as the injured Gerbald was putting more of his weight on Pam as he grew weaker, and she was about done for herself. The driver was a down-timer and didn't ask many questions. He drove them directly to the hospital where Gerbald grinned at being pushed along in a wheelchair to the surgery.

Doc Nichols gave them both an appraising look as he cleaned and stitched the deep cut.

"And you about knocked this thug's head off with your grandma's walking stick you say?"

"Yeah, he was making a grab for me so I let him have it. Broke his jaw for sure. Gerbald killed the other two while defending me." There was pride in Pam's voice. The doctor's eyebrows were raised high as he slowly shook his head.

"Ms. Miller, you sure don't look like the type, but *wow*! Remind me to stay on your good side!" They shared a grin, the fact that the esteemed doctor had been an inner city brawler in his youth had become well known. "Crazy times, crazy times." he mumbled as he stitched. While he finished Pam borrowed the phone to make the call to the Grantville police. They'd come out to the house later to hear their full reports.

With Gerbald patched up and with strict orders to take it easy for a few days they were given a ride in a hospital car back to Pam's house. As the two of them limped up the walk Dore stood in the doorway, fixing them both with a fearsome scowl. Pam noticed her rucksack had been washed and was hung to dry on the clothes tree. *The woman is a saint.* The tirade began when they arrived at the porch.

"Well, well, the great heroes return. And in how many pieces? They nearly cut off that leg I see, it is a shame they did not aim a little higher and to the center! And you, foolish young woman, you look like a fox after the hunt, you have run yourself half to death, and are filthy! All for this buffoon of a man, this old soldier who does not know when to let the proper authorities do the work while he should be staying home looking after the helpless women folk in his charge!"

Pam almost lost it when she heard that one. *Dore? Helpless?* Pam recalled that not an hour ago she had taken down a professional soldier with her grandma's walking stick. *No, not so helpless are we!* Dore's pitch went up as she shifted her scolding into high gear. Pam took a moment to appreciate that Dore's command of English had improved greatly over the year.

"How dare you go off like that knowing that dear Pam would follow you? She is new to these times and doesn't know the dangers. You are an idiot, a blockhead, a dimwit, an oaf!" Running out of English expletives she launched into a barrage of German and possibly Italian ones. The woman was shaking with anger but Pam knew that it was her way of showing how much she cared.

Gerbald nodded, reconciled to his fate. "Yes my dove. You are right in all things, as always. Is there perhaps dinner? Let's eat before the coppers get here." Using the oak walking stick he made his way onto the porch, ducking past Dore's raised fist. Pam followed, receiving a brief, hard squeeze on the arm from Dore. Pam smiled at the older woman, her very dear friend who had spent some very worried hours waiting for them. Gerbald had gone into the kitchen to sit at the table. Pam saw that no sign of duckling presence remained in her living room, everything was where it should be and sparkling with post Dore cleanliness. As she entered the kitchen Dore bellowed at Gerbald:

"And take off that DAMNED FOOL HAT!"

Ahhh, home. Pam sighed happily.

* * *

A few days later Pam and Gerbald walked at a gentle pace over to Willie Ray's farm. Gerbald still limped and had taken quite a shine to grandma's walking stick upon which he had bequeathed the title "Headbanger." When he wasn't using it for support he sometimes playfully reenacted Pam's lethal swing. As they strolled Pam saw that nearly every fence post, power pole, and unmovable structure sported a brightly painted bird and beseeching phrases like *"Protect me!", "Give us a chance!", "Let us live, too!"* in both German and English. It looked like every kid in Grantville had made a poster, maybe twenty. The entire town was wrapped in the things. Willie Ray's open front gate boasted the Baltimore oriole proclaiming *"Don't shoot! I'm an American!"* Pam laughed with pleasure as they headed to the farmhouse.

Mrs. Antoni and her sixth graders were there as planned. Pam thanked them all again for the wonderful job on the posters and for all the work they had done plastering the town.

"Do you think there are enough, Ms. Miller? Do you think people will do as we asked?" the students asked her.

"I can't really say for sure kids, but I do know we've made a good start. You should all be proud of what you've accomplished. Our birds are worth saving and you have sure let people know it!"

Willie Ray came around the side of the house, fresh shaven and brimming with easy country graciousness. "Hey everyone, let's go have a look at that old duck pond."

As they entered the barnyard fowl's enclosure Willie Ray stood back, letting the kids wander among the tame flocks. He caught Pam and Gerbald's eye, then led them over to the pond's edge. Pam saw Matilda and her adopted children serenely feeding in the shallows under the willow tree. The ducklings had grown already, how could it happen so fast?

"They look good, Willie Ray. Thank you so much for giving them a home and looking after them for me!"

"Well, it's a pleasure. I'm not the only one who has taken an interest in our little fellows, though. Look up in that tree."

Pam put her hand on her forehead to make shade from the afternoon glare. She and Gerbald scanned the tree, four sharp eyes, birdwatcher eyes. They found it perched in the lower branches, an unusual type of bird to see in a tree, a peculiar trait of this species. An emerald sheened head enhanced by striking white markings was held erect above a russet breast with highlights of rich purple and spotted by bright specks of white. The dramatic swoops of white on its face framed ruby eyes which now regarded its observers

with interest. A sleek pointed crest with a jaunty white streak was combed back from the top of its bill, falling stylishly down its neck. The bill was marked with flame orange and black, coming to a point sharper than most ducks. It looked more like a fancifully carved and painted imagining of a duck than a real animal. It was in fact a male wood duck, a spectacularly plumed drake and quite probably the father of the ducklings below.

Pam gasped with delight while Gerbald looked on appreciatively, pleased to see that its presence made Pam happy. Willie Ray grinned so widely as to nearly split his head open.

"He's been here a couple days, Pam. He mostly stays in the tree and keeps an eye on things. I figure those little fellows are well looked after."

"I'd say they are. It's a good feeling . . ." She looked to Gerbald who allowed himself a satisfied smile in the shade of his ridiculous hat. ". . . being a protected species."

* * *

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A Tinker's Progress

Written by Terry Howard

Jack Jones made his way into the sleepy little town of Elstow, about a mile south of Bedford in Bedfordshire, home to perhaps five hundred souls—give or take half a hundred. There was a notable stone cross in the center of town where he stopped to survey for a tinker's shop. "A bloody tinker!" he muttered. "I'm carrying mail for a tinker? What next, a milk maid? A bar wench? At least he's one of the better sort with a forge and a settled station." In a bit, when it was not obvious where he should go, he headed to the parish house next to the church of Saints Mary and Helen and approached to knock on the door. By chance the vicar himself answered.

Jack asked, in a slow voice, watching his word choice carefully to be better understood, knowing that his accent was often something of a bother, "Good marrow, good sir. Could you be directing me to the shop of one Thomas the son of Thomas, a tinker?"

"And you are?" the vicar asked.

"Jack Jones, dispatch rider, at your service. I'm up from London with a letter for Goodman Thomas, the tinker."

"A letter you say?" The vicar looked skeptical. "And just whom in London would be writing a letter to Thomas?"

"It was given me by the office of one Isaac Abrabanel just east of Temple Bar."

"Don't tell me Thomas has gone and borrowed money from a London Jew that he can't pay back?" The vicar let out a deep sigh. "That man will end in debtor's prison and his wife will be asking for charity. I knew it. I told her father not to let Margaret marry beneath herself. This is what comes of marrying for love."

"I wouldn't know anything about that, Vicar. I just have a letter to be delivered. Could you please tell me where I can find him?"

"Go to the cross. Face east. Take the middle of the three streets. When it forks, go left and the shop will be on your right. There is a shingle of a mended pot hanging over the door." The vicar started to close the door.

"One more question, of your grace, please. Would you know if Thomas has his letters or do I need to take a reader with me?"

"No, he does not. But his wife, poor woman, does." And with that the vicar did indeed close the door.

* * *

Jack led his horse through the town. When he entered the front door of the tinker's shop he was promptly addressed.

"What can I do for you?"

"Are you Thomas the Tinker?"

"No. Thomas is my brother. We share the shop. What can we do for you?"

"Does Thomas have a son named John? The lad would be not yet seven years of age."

"That's right. What is this about?"

"Could I have a few words with his wife, Margaret?"

"You could . . . if I have a mind to call her from the kitchen, which I am not about to do until you tell me what this is all about!" By this time the tinker had put down his tools and stood up from the bench, quietly picking up the heaviest of his hammers.

Jack decided he'd better answer quickly. "I have a letter for your brother. I suppose it will be all right if I give it to his wife, seeing as Thomas hasn't his letters and she will have to be the one reading it, anyway."

"A letter, you say?"

Jack lifted the flap on the pouch over his shoulder and brought forth a folded parchment, sewn with a string, set with wax and sealed with a stamp.

"Maggie?" the tinker called out.

"Yes?" The answer came from the back of the house.

"Can you come out to the shop, please?"

Margaret pushed open the door that separated the shop from the living area. She was drying her hands on her apron as she did.

"This fellow says he has a letter for your husband."

"How very odd," she replied. "Are you sure?"

"The letter is for one Thomas, the son of Thomas, a tinker in Elstow, who has a son named John," Jack said.

"That would indeed be my Thomas. But why, in the name of all that is holy, would anyone be sending Thomas a letter?"

"Goodwife, could you tell me your father's family name?"

"What an odd thing to ask."

"True enough. I've never been instructed to asked the likes of it before but—" Jack put the letter back in the shoulder pouch and lifted a small bag of coins. He tossed it up and down in his hand, causing it to clink with the distinct sound of large silver coins. "I was told to ask and if I didn't get the right answer, the letter and the money are to go back to London."

The tinker promptly answered. "Bentley. The family name is Bentley."

Jack set the bag down and dug a stoppered inkwell out of his shoulder pouch along with a quill and a bit of paper. "Goodwife, would you please assure yourself that the seal on the coin bag is unbroken and then sign a receipt?"

"What is the money for? What is all this about?"

"Now, how would the likes of Jack Jones be knowing that?"

"Perhaps I had better read the letter before I sign anything."

Jack shrugged and handed her the missive.

* * *

As she read it, her lips moving silently as if in prayer, her face became increasingly contorted by puzzlement. The tinker's face held ever more curiosity until it erupted like a spit melon seed. "Well? What does it say?"

"The money is to pay Thomas' expenses to go to London to discuss a business matter with one Isaac

Abrabanel. Thomas is to see him three doors east of Temple Bar."

"A London Jew? What business does Thomas have with the likes of that?"

"You would know better than I, as tight lipped as the two of you are about money matters."

"You and Rose don't need to be worrying about how much is on hand and what is coming in."

"No. We're just supposed to figure out how to feed the lot of us when there isn't anything left to buy food with."

"Times are hard, woman. Thomas and I are doing the best we can. If you are so all fired concerned, we could save the cost of sending John to get his lettering."

"For sure, and then he could go through his life at the mercy of who ever it is that is reading to him. If he doesn't go now, he'll not go later when he's old enough to be of some use."

Jack was growing more and more uncomfortable. These were family matters that should not be discussed in front of a stranger.

The tinker opened his mouth and shut it. Jack suspected that he wanted to say "it never hurt me any," as many men would have. But Jack could well imagine many disputes—had even had some himself—that would not have happened if people had written the agreement down to begin with. It was a common enough problem in life.

Jack cleared his throat, "Gentle folk, if you could, I need a signed receipt. Then I can be getting on my way."

"What can you tell us about this?" the tinker demanded.

"I'm naught but a dispatch rider. I just need you to sign the bloody paper."

"Well, I'm nothing but a tinker and I don't give a damn what you need. She isn't signing anything until you tell us all you know."

Jack reached for the money but the tinker was faster. He held the bag out of reach. "All I know is what I've told you already."

"Well, tell us about this Abrabanel man."

"I never set eyes on him. I talked to a clerk in the front room of a fancy office with a big brass handle on the front door and an even bigger glass window. Now, either sign the bloody paper or give me the money and the letter to take back to London!"

"Sign it," the tinker told his sister-in-law.

* * *

Later that day Thomas came back from making the rounds. He walked through the door and before he could put the new lot of pots to be mended down he was hit by a question. "Brother, what business do you have in London?"

"What are you talking about?"

"Why does a man in London, and a Jew at that, want to see you in his office at 'your earliest convenience'?"

"Have you lost your head?" Thomas asked. "You know I don't know any Jew in London or anywhere else."

"Margaret, bring that letter out here and read it to your husband."

"Letter? What letter?" Thomas was puzzled.

"The one that came from London today while you were out. The one that came with more money than we've had at one time in years. Enough for you to take a coach to London and dine in fancy inns along the way."

* * *

Margaret pushed open the door. The total puzzlement on her husband's face told her all she needed to know. He obviously didn't know one iota more about what was going on than she did. She held up the letter for him to see, then she began to read it aloud.

Thomas listened to the end without saying a word. "So all I've got to do for this money is go down to London and talk to this man?"

"I read you the letter, Thomas. You can ferret out the meaning as easily as I can."

"I know, but it doesn't make any sense. What does he want with me? They've got tinkers aplenty in London."

"Well, brother, I guess you'll just have to go down there and find out."

"You say there's enough money to take a coach?"

"Don't go getting any fancy ideas, brother of mine. There *was* enough. After I pay off what we owe the tin man—and pay for the next round up front to get the discount we never have been able to afford—then there's enough left to take care of you, there and back. As long as you start out with a cheese and a loaf and don't dally along the way."

* * *

Margaret met her husband at the door with a satchel holding a small cheese about the size of a good cabbage, and two loaves of bread about the same size. "The cheese should see you there and back. You can buy more bread before you leave London." Two loaves, two days walk, fresh enough, but there was no point in Thomas eating stale bread when it could be had for a fair price. She gave him a peck on the cheek.

"Margaret, please. What will the neighbors think?"

"Thomas, the day I can't send my husband off to London with a kiss because the neighbors are Puritans is the day we will move to Rome. I still think you should have hired a horse, or taken the coach."

"No. My brother is right. The money is better spent. I'd walk twice that for a lot less. Besides, I probably couldn't stay on a horse anyway, then it would run off and how would we ever pay for it? I've got my walking stick. I'll see you in five days."

"Thomas, when you get there call yourself a brasier instead of a tinker. It sounds better."

With these words of advice from his wife, Thomas set off for Temple Bar in London, wondering each step of the way what it was all about.

* * *

While munching the last of his bread in the last of the daylight Thomas found Temple Bar. He asked where he could find the office of Isaac Abrabanel, thinking to locate where he would go in the morning.

"It's right there. That's his shingle hanging over his door, just three down. The one that reads Isaac Abrabanel, Importer. Didn't you look, or can't you read?"

Thomas suspected that the fellow he asked couldn't read either, but wasn't about to admit that to some bumpkin just in from the country. To his surprise, the window spilled lamplight out onto the street. A glance through the glass made it clear that people were about.

"Well, the sooner begun, the sooner it's finished." Thomas pushed the door open and walked in.

* * *

The clerk summed up the man in front of him with a glance. "It's after hours. Come back tomorrow."

"Is this the office of Isaac Abrabanel?"

"Yes. We open at eight in the morning."

"He wants to see me."

"I'm sure he does! Tomorrow."

"Tell him Thomas Bunyan was here, then. I'll be back tomorrow."

"Thomas Bunyan? The tinker from Elstow?"

"I prefer to think of myself as a brasier."

As Thomas turned to leave, the clerk realized he had just made a big mistake. "Please, wait a moment, sir. Let me check with Mr. Abrabanel. I know he is anxious to speak with you."

The clerk came back in short order. On the one hand, he was vindicated. His boss would see the ragged scarecrow tomorrow. He was in a conference at the moment and it would run late. On the other hand, he was unhappy. Yes, he could lock up and leave, but he was to buy the dusty countryman a good dinner and settle him into a decent lodging. And he was to see the fellow back to the office in the morning. It wasn't the way he'd intended to spend his evening.

"Mister Abrabanel is tied up right now. He will see you in the morning. Join me for dinner and then—"

The tinker brushed at his shirt. "I've eaten."

"Are you sure? There is a very nice dining establishment just around the corner."

"I'm sure."

Avram, the clerk, was annoyed again. There went the paid for dinner he was looking forward to, even if it meant being seen with a tinker. "Well, then. Let me get you settled into your lodging for the night."

* * *

Thomas took one look at the hired room. It was, without question, the finest room he had ever even seen and he would be spending tonight here. There was a huge bed, a fireplace laid but unlit on an August night. The wash stand, sink and pitcher, along with an actual bath tub were absolute luxuries. "I can't afford this."

"Oh, but it's at our expense."

"You're sure?"

"Of course." The clerk hesitated a moment. "Dinner is at our expense also . . . if you would care to change your mind?"

* * *

Later, Thomas, smiling, stuffed and bathed, settled into bed with the knowledge that his laundered clothes would be returned in the morning. "A fellow could get used to this if he wasn't careful."

* * *

"Master Bunyan, it is good to meet you. Please be seated. How was the coach ride down from Elstow?"

"I walked."

"Oh, I see. Your wife and young John, they are in good health?"

"Yes."

"Well, Thomas . . . do you mind if I call you Thomas?"

"Most do."

"Yes, well . . . Thomas, I have been instructed to pay all of your expenses if you will relocate your family to the town of Grantville in the Germanies."

"Grantville?"

"You've heard of it, I'm sure."

"Yes. I've heard of the city from the future . . . and I've heard of the sea monsters that dwell in the lakes of Scotland. You might as well pay my way to the New World so I can move into one of the Spanish cities of gold and start making golden pots and kettles."

"I assure you, Grantville is real. I have a cousin there. He wrote me concerning you and your family. You are wanted in Grantville. All expenses are to be paid. A complete shop will be provided and there will be more than enough work—at a sufficient rate of pay to more than provide a good living for your family and a good education for your son."

"Why?"

"What?"

"Why? They have tinkers in Germany. Why does someone want me?"

"Well as you have heard, Grantville is from the future." Isaac held up a hand to forestall Thomas' objection. "I assure you it is true. So, while you may have lived a very ordinary life up till now, it would seem that you will do something extraordinary in the future and someone wants that to happen in Grantville."

"What?"

"I have no idea. Perhaps you will invent something or create some notable works. Perhaps it is young John who is to do something of note, or a child yet to be born? I wasn't informed and I don't know. What I do know is that you are wanted there and I am to see to it that you get there if you are willing to go."

Thomas' mind raced. The bag of coins in his brother's keeping, the room and the meal last night, the bath and the clean clothes, the fancy office. Someone was willing to spend money like Thomas had never had and never dreamed of having. Still . . . "There is a war in Germany."

"Yes, but not in Grantville. It will be quite safe, I assure you."

"This is beyond belief!"

"Yes, I imagine it is. But it is quite true. Master Bunyan . . . Thomas . . . there is a ship leaving in six days. I would like it very much if you and your family were to be on it."

Thomas sat in silence.

"You will want to discuss this with your wife." Isaac brought a small bag of coins out of his desk drawer. It had been prepared for just this point in the conversation. He let it drop several inches, in a spot Thomas could reach. It made the sound that only comes when gold meets gold. "Take a coach home. Think about the offer, and then bring your family back to London by coach. At least, let your wife sit in on the discussion." Isaac had laid the bait. Now it was time to set the hook. "I am authorized to tell you that money for a return trip will be on deposit with us until you use it or it is released to your heirs at the time of your death."

* * *

Secure in the belief that the Abrabanels would be successful, and looking to the patent and copyright laws

in the books he'd read, an attorney in an office in Grantville was quietly preparing a brief to claim the royalties for *Pilgrim's Progress* for young John Bunyan. True, John hadn't written it or any of his other works yet. But he was undeniably the author. It was a fine point. A very fine point of law. He would have to argue it in court, of course. But he thought he had quite a good case.

Elsewhere in Grantville, an old Free and Approved Mason was wondering what John Bunyan's output would be when he had received a first class education. The expense to find out was well worth it.

* * *

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Nothing's Ever Simple

Written by Virginia DeMarce

Grantville, December 1633

"That's probably about the best we can do." Roberta Sutter looked at the stacks of paper on the table in front of her with considerable dissatisfaction.

"We've interviewed everyone in town," Sandra Prickett said. "We've made them look for family Bibles and scrapbooks and newspaper clippings and birth certificates and applications for delayed birth certificates and applications for Social Security cards and . . . Anyway, quite a few people got annoyed and said things, like, 'Don't you realize there's a war on?'"

"We've gotten a lot that we didn't have before," Mary Jo Blackwell added her bit to the Genealogy Club council meeting. Mary Jo was always spoiling someone else's desire to have a good fight. She was a nuisance that way, sometimes.

Marian Butcher nodded. "Some surprises, too, like how Rose Howell's descendants knew that some of Cyrene's great-grandkids lived here in town and that they were related, but Cyrene's had forgotten all about it."

Miriam Miller looked at Jenny Maddox. "I guess the point is—does the Bureau of Vital Statistics want us to stop the blitz? Have we done enough for the records you need?"

"More than enough, probably. We're going to put copies of everything in the public library. Marietta's fine with that. People can come look up their family trees if they're interested. Down-timers as well as up-timers."

Roberta frowned again. "The down-time stuff is still mainly oral history. It's not properly documented. When the wars stop, maybe we can write to the parishes where people told us they were born and married and get copies of their baptisms and weddings for our files."

"With your approach to genealogy, there will never be an end to it."

Roberta looked at Jenny, honestly surprised. "Of course not. Everyone who's ever been born has two parents, and lots of them have aunts and uncles, brothers and sisters, nieces and nephews. And cousins. Even Jesus had cousins. The historian Josephus wrote that Roman officials interviewed them, about thirty years after the crucifixion. Oral history *is* an important part of the process, even though it isn't sufficient in itself." Her voice was starting to perk up again.

Sandra Prickett sighed.

February 1634

"I hate to say it, Melvin, but I think they're losing their enthusiasm."

Melvin Sutter chewed his sausage. Personally, he had sort of hoped, after they adopted a couple of

children after the Ring of Fire and Roberta got a full-time job, that she would lose some of hers. Not that he had anything against family trees. But their house didn't have just plain family trees. It even had family trees that Roberta had cross-stitched, framed, and put up on the walls. There was one hanging right over his head, here in the breakfast nook.

"I started to explain how we could supplement the oral history we collected for the new immigrants. I need documentation for our own children. I've already written to Gotha for Albrecht and Margaretha and to Kitzingen for Martin. Now if I could just find someone who remembers exactly where Verena was baptized, since she doesn't seem to be related to any other of the Elsisheimers who have immigrated to Grantville—not that I'm sure they're telling me the truth. They're a bit evasive, especially Magdalena Albert. She's Kunz Polheimer's wife—her first husband was an Elsisheimer, though she didn't have any children by him. If it's because Verena was born out of wedlock and her mother Maria was actually a relative somehow, then . . ."

Melvin, a veteran of such speculations, tuned it all out and continued chewing.

Until he heard the dire words, ". . . and I'm not going to put it off any longer. I'm not going to wait until it's too late."

"Uh. Put what off?"

"Melvin, you haven't been listening."

He didn't even try to defend himself.

"I know we don't have any natural children, but Marilyn has Matt and it's likely he'll marry and have children one of these days. So I really need to finish the Hooper side of the family. Before the Ring of Fire, I took it as far as the church records from Schwarzach that had been microfilmed by the Mormons would let me, but they only started in 1612. If I go to Schwarzach now, before it's too late, I can interview living ancestors. I'm sure with what they remember, I can add a couple more generations to the family tree. Huber, it was, in Germany, before the Germanna immigrants Americanized the spelling. I hope that my ancestor Georg Huber is still the mayor of Schwarzach."

"I hate to say this, but we've got four adopted children, now. Their mother can't just go haring off someplace to do genealogy."

"They're not babies. Albrecht's sixteen; Martin's fifteen. Margaretha's eleven. Even Verena's five, not a baby any more. Marilyn will help you. I'm sure she will, especially now that Matt's off in Magdeburg. It's her family tree too, after all. You can manage on your own this coming summer."

"Marilyn just got married again last fall. Baxter Harris may not want for her to be babysitting a batch of kids all next summer."

"Since she married Baxter, she's Trissie's stepmother, and Trissie's the perfect age to baby-sit Verena and Margaretha, plus she's in the same class at school with Albrecht." Roberta patted Melvin's cheek. "Don't worry. It will all work out fine."

Melvin shook his head. "It won't be that simple. Things never are."

July 1634

Roberta sat quietly.

Roberta quiet was Roberta dangerous.

"Just where is this Schwarzach place, anyway? Why don't you write them?"

"After the Benedictine imperial abbey there was secularized in 1803, it became part of the Grand Duchy of Baden. That was the German state of Baden-Wuerttemberg in our day. I did write to the mayor, last year. And to the Catholic church, but I haven't gotten an answer. So I need to go."

"By my count, there's close to a hundred seventy-five years of politics between now and 1803. Where is it now?"

"Um. In Swabia."

"Horn has a Swedish army in Swabia."

Roberta tilted her head. "Not in the part of Swabia where Schwarzach is."

"Just what part of Swabia is Schwarzach in?"

"It's on the Rhine. And now I have a contact there, so . . ."

"You have a contact there? I thought you said that they hadn't written back."

"Well, Mayor Huber hasn't written back."

"And . . ."

"Uh, you remember that Duke Bernhard of Saxe-Weimar offered Kamala Horton a job? And she took it and shook the dust of Grantville off her feet, so to speak? She and the kids left right after school was out in May."

"Yeah . . ."

"Well, Duke Bernhard has his military headquarters at Schwarzach. That's where Kamala and her kids are. She's going to Besançon this fall, but there's stuff they want her to do in Schwarzach first. They've been given quarters right in the abbey buildings because she's working on military sanitation first. I can stay with her while I'm doing the research, which will save a lot of money in hotel costs . . ."

"Roberta!" This time Melvin practically shrieked. "You'll be walking right into a war zone."

"But not through a war zone. I can go straight over to Frankfurt and then take a boat down the Main and up the Rhine."

"Roberta! It's fucking dangerous!"

She looked at him, honestly bewildered. "Well, that's sort of the point." She patted his cheek again. "If the war is moving that way, I need to get in and copy the records for our family tree now, before things like tax records get destroyed or someone who remembers important information gets killed or dies. Think how many courthouses got burned during the Civil War up-time. It was horrible—just horrible."

* * *

"It's not common to have such a long family tree that's all made up of perfectly ordinary people," Roberta said. "There's not a famous person on it. Just farmers and innkeepers and stonemasons and carpenters. People like that. And their wives. I have all the maiden names back to the Georg Huber who is alive now, in this year 1634. Matt's the thirteenth generation. If I can just talk to this Georg Huber—a lot of the records spell his given name as 'Jerg'—then I'm sure I can add his mother's maiden name and he almost certainly knows the names of his grandparents. All four of them. His father was named 'Jerg' too. I've only been able to determine from the microfilmed church records that the older Jerg died some time between 1629 and 1641. If I'm really lucky and that ancestor is still alive, then he should remember the names of *his* grandparents, too. That would give us fifteen generations to my nephew Matt. At worst, I'll be able to find out Jerg, Sr.'s date of death and enter it on the charts."

Ed Piazza wished that he dared reach up and massage his temples. Roberta Sutter's family tree—to be more precise, Mrs. Sutter's extended disquisition on the topic of her family tree—was giving him a headache. Not only the abstract "problems for the consular service" headache that would result from her intention to go kiting off into Bernhard of Saxe-Weimar's little personal sandbox, but a very real one, here and now, in the front of his brain. This was worse than Count Ludwig Guenther's librarian in full spate on the topic of relationships among the ruling families of the various states and substates of the USE.

"Of course, it's not entirely a male-line pedigree. It was male-line up to my sister Marilyn, but then she married Harry Tisdel, so Matt's a Tisdel. Of course, she'd divorced that bum even before the Ring of Fire and Matt didn't see much of his father. Maybe he'd be willing to change his name to Hooper and carry on the family name." Roberta smiled brightly. "I'll write him in Magdeburg and ask. He's up there training to be a Marine since he graduated from high school this spring. There shouldn't be any legal problems."

Ed pulled his shoulder blades together as inconspicuously as possible, trying to relieve the tension in his neck. Roberta Sutter had been in his office for an hour. Unfortunately, he hadn't primed his secretary to interrupt with an urgent appointment. Maybe the kid liked being a Tisdel. Who knew?

A knock on the door. A wonderful, blessed, knock on the door. It opened. Jamie Lee Swisher's head poked through. "Mr. Piazza, guess what? Mr. Ferrara is here. I just knew that you'd want to see him."

"Yes. Thank you, Jamie. Get him a cup of coffee, will you? I'll finish up here." He prepared for some difficulty in disposing of his current visitor, but Roberta Sutter was already picking up her purse.

Unfortunately, as she went out the door, her parting words were, "I just knew that you would understand how important the project is. I'm meeting Melvin and Henry Dreeson for lunch at Cora's. I'll tell them that you don't have any objections at all."

He did. He could think of a dozen perfectly reasonable objections. He just hadn't been able to get in a word edgewise, which was—unusual for him.

If she had stayed a little longer, he would have told her no. Now, unless he actually chased her down the

corridor, she would be out in public announcing that he had given permission to go to Schwarzach before he could do anything about it. That kind of announcement was hard to retract without ending up with egg on your face.

He looked at Mrs. Sutter's departing rear and reminded himself to be careful, because sometimes you get what you wish for. In this case, an interruption. One more premature than timely.

Anyway, why did Mrs. Sutter think that Matt Tisdel needed to carry on the Hooper surname line if the ancestor was alive right now? Presumably carrying the line on himself. Why couldn't anything ever be simple?

At least, Greg was carrying *two* cups of coffee.

Ed smiled. "Greg," he asked, "do you happen to be interested in genealogy?"

Another hour later, well into the permutations of the Ferrara family tree, which involved the Trapanese family and the second marriage of Greg's mother to one of the Zeppi boys, Ed made a note to himself in regard to an addition to his personal list of "Questions a Sensible Person Never Asks."

Schwarzach on the Rhine, August 1634

Abbot Georgius of the Abbey of Saints Peter and Paul at Schwarzach on the Rhine looked at the papers on his pedestal desk. Then he reached out and felt them again. Maybe for the tenth time since the up-time woman arrived. Perhaps for the twentieth time. Possibly for the hundredth time. So slick, so smooth. He had received descriptions of up-time paper from the librarians of the great *Stift* at Fulda, but this was the first time he had seen it for himself. Much less touched it.

Schwarzach was a Benedictine abbey, an imperial abbey, but not an important one like Fulda. One small town and a few villages, occupying seven square miles. Seven square miles—not seven miles square. Smaller now than it had been in the middle ages—the tribulations of the past couple of centuries had forced the abbey to sell some of its holdings to the margraves of Baden. A few thousand subjects. A ferry across the Rhine at Greffern—the tolls from that, far more than the modest taxes and dues paid in by the village farmers, kept the abbey going in a moderate sort of way. A very moderate sort of way, as evidenced by the fact that there was not a single nobleman among the monks and had not been for generations. Schwarzach did not have sinecures that would support the younger son of an influential

family in the style to which he wished to remain accustomed. The monks of Schwarzach did not have to make any significant effort to fulfill their vows of poverty. They doubled as the parish priests for the villages. Sometimes, in difficult circumstances when no fellow villager would serve, they also doubled as godfathers for the children of the abbey's parishioners.

Or for children who did not belong to the abbey. His mind wandered back, briefly, to the *annus terribilis* of 1622, when the imperial troops had been quartered on the abbey. Sometimes he wondered what had happened to those soldiers and the women to whom the abbey's monks had married them that winter. What was the fate of the children who had been born in a dozen different camps and finally baptized here, on the banks of the Rhine, sometimes three or four years later?

He picked up a piece of the wondrous, slick, smooth, paper.

"Photocopies" the up-time woman called them. "Photocopies" that she had made by a machine from something called "microfilm."

He turned to the other pedestal desk, the one he had borrowed from Father Gallus' cell. On it lay the church registers for Schwarzach and its villages, meticulously maintained—or as meticulously as possible, given the exigencies of the war—in accord with the prescriptions of the Council of Trent. He picked up one of the pieces of paper, turned a few pages of the register, and compared.

It was true. Exactly and precisely true, just as Father Gallus had said. This woman had brought, from the far future, copies of pages from their own church registers. Black, a bright white, and gray, rather than the gentle cream color of the paper in the church books. On the copy from the future, one could see little tears at the edge of some of the pages, broken corners, an occasional stain that didn't yet exist on the originals. But the abbey's own registers, without a doubt.

Father Gallus' own handwriting, plain and straightforward, just like Father Gallus himself. Gallus was a solid man. Plain spoken. Abbot Georgius' right hand in these difficult times.

Here was a page with Father Bonifacius' delicate script. It always surprised correspondents when they first met Bonifacius in person. He was a big man—bigger even than Gallus—who looked like he would destroy anything in his path, but somehow he walked without making a sound. Of all the monks, he was most successful at keeping the Great Silence. Abbot Georgius always chose him if there was detail work to be done.

The woman, Mrs. Sutter, had expected Father Christophorus to be much older. The style of his handwriting, she said, belonged to the middle of the previous century. But Christophorus, barely thirty, was the youngest of them all. Excited by new things, his writing was where he stepped back, at least in form. Not to mention, of course, that his village schoolmaster had been nearly eighty years old. Perhaps Christophorus simply shaped his letters the way he had learned them as a child.

Father Paulus wrote this page. His script, as usual, was clear, but a little cramped. Paulus was a fussy little man, insistent on getting the details right, sometimes at the expense of the big picture. But he was also the man who, wondering about the Latin baptismal record that listed a child's mother as "Regina" when no one in the village called her that, had gone back, year by year, realized that the priest from Lorraine who thought that he was hearing "Königin" and translated it into the Latin "Regina" was misunderstanding "Kunigunde," and had given the young mother her proper name back in the registers. Abbot Georgius smiled briefly at the thought of a village woman named "Queenie."

Father Augustinus, large and florid, but without flourishes. An excitable fellow. Sometimes loud and with just the touch of a fanatic about him. Very sure of his beliefs, but kind for all of that. He had

spearheaded that 1622 campaign to regularize the military marriages and legitimate the children, completely ignoring demands that he first seek permission from the regimental commanders.

Father Anselmus. His handwriting was difficult, but consistent. The up-time woman had remarked that she had found it hard to decipher originally, but once she had become used to it, had no further problems. Anselmus was also difficult, in a way. *He struggles with his faith*, the abbot thought. Anselmus *wants* to believe as a little child, but he can't help questioning.

Father Beda's small, angular, uncomplicated script—as close to a printed page as handwriting would ever come. *A cold man,* Abbot Georgius thought, *though he tries to be a good one*.

Father Geroldus. He always had Father Beda enter clean copies of his scribbled notes, kept on random scraps as he went from village to village, into the permanent register. Geroldus was a natural persuader and organizer. The scrawl of his signature indicated that everyone else should be grateful that he had persuaded Father Beda to write out his documents.

Father Gabriel. Abbot George smiled again at the up-time woman's description. What had she said? "Presuming that he believes in purgatory, I hope he spends a couple of centuries there, writing on the blackboard, getting his cursive improved under a stern taskmaster who will also break him of that obnoxious habit of throwing in non-standard abbreviations at random." It was true. Father Gabriel was creative and sometimes half out of control. His thoughts came too fast for him to keep track of. The other up-time woman, Duke Bernhard of Saxe-Weimar's "nurse," called Gabriel, "an absent minded professor type."

Father Antonius, whose writing was even worse than Gabriel's. The up-time woman had said, "I couldn't even decipher his surname. If anyone ever wants to keep a secret, just have this guy write it down; flocks of cryptographers will perish in despair." Georgius had thought briefly that he might be able to get some money from Duke Bernhard by loaning him a short little red-headed monk with a pot belly and a goatee." Then Frau Sutter had destroyed this hope by adding, "Of course, the recipient won't be able to make heads nor tails of it, either. If possible, I would like to be permitted to work with him, and have him read his entries to me out loud."

And Father Gregorius, the paper consumer. One would think his entries had been written by a lady-in-waiting at the court of Ferdinand II, with the wide margins, the wide spacing between the lines, and all the flourishes on the capital letters. Still, the page was legible, and that was what mattered. Gregorius willingly assumed the tedious responsibilities associated with vestment repair, the mending of liturgical books, the cleaning of stained glass, the thousand minute and unending tasks associated with keeping a centuries-old church building intended for a far larger congregation usable and in a condition that honored God. In return, Abbot Georgius did not begrudge him twice as much paper as anyone else used.

And that was the venerable Benedictine abbey of Schwarzach *anno domini* 1634. An abbot and eleven monks.

Until Bernhard of Saxe-Weimar's *Kloster* arrived and took up quarters in their cloister.

Whatever else might be said about Bernhard of Saxe-Weimar and his advisors, they were scarcely monks. Georgius was grateful that they spent much of their time out campaigning or at the duke's new capital in the Franche Comté. Although, to give them credit, they appeared to be reasonably chaste. They had not defiled the abbey's walls with loose women.

The duke also insisted that his soldiers attend church services, albeit heretical Lutheran ones. His Protestant chaplains made an effort to keep a rein on the blasphemies falling from the soldiers' mouths, although they did little about other obscenities and profanities. Still, Bernhard's men refrained from taking the name of the Lord in vain. At least when the officers and chaplains were present.

Abbot Georgius picked up the sheet of paper again, sliding his thumb over its slick surface.

He was an old man. He had been in office since 1597. Every year became a little more difficult. He, too, like Father Anselmus, longed for the simple faith of a child. But it seemed as if nothing was ever simple. Duke Bernhard had recently gone south to join the troops he had called into the Breisgau. He would have to notify the duke of the woman's arrival. The duke would undoubtedly want to know that the up-time "nurse" had another up-time woman staying with her. One of Jerg Huber's sons-in-law could take a message down to Lörrach. They were reliable men, and close-mouthed. Simon Jerger, Sibilla Huberin's husband—he would do. Simon could take Susanna Huberin's son, young Regenold with him. The boy was fourteen, and didn't get along very well with his stepfather. He was restless. Eva Reinlin had been complaining about his behavior, just the other day. The errand would do him good.

* * *

Lawrence Crawford hated this job. He was twenty-three years old and had been a soldier since he was fifteen. From the age of fifteen, he had fought in the armies of Christian IV of Denmark and Gustavus Adolphus of Sweden. He had fought in the name of young Karl Ludwig, the Elector Palatine, after the death of the Winter King, who was at least properly Calvinist. He had joined Duke Bernhard to fight, even though he, like the Dane and the Swede, was only a Lutheran, which was a poor substitute for the truth of God, if you asked him. Charles I and Laud were very close to being papists, and the Lutherans weren't much better.

Was he fighting? No. Instead, he had been assigned to a *monastery* to act as translator for the up-time "nurse." The woman's German was very poor. She said in excuse that she had spent the four years since the Ring of Fire mainly either at work in a nursing home, which seemed to be some kind of *Spital*, or attending her children's school events. In any case, it was still very poor and almost entirely limited to phrases such as, "When did her symptoms start getting worse? And "Is his temperature coming down?"

The woman's English wasn't much better. At least not from the perspective of a man who had been born in Jordanhill in Glasgow. In Scotland. He and Mistress Horton were divided by a common tongue. Not to mention by the fact that she belonged to some kind of sectarian church. Crawford did not hold with toleration of Independents and other religious radicals. Disciples of Christ—that was what she called her body of dissenters.

And now she had brought another up-time woman to Schwarzach. Whom he was to escort to meet the mayor.

Mistress Sutter's German was better, at least.

* * *

Jerg Huber was nearly sixty-five years old. An old man. Almost as old as Abbot Georgius. He had been mayor of Schwarzach since 1615, and on the town council long before that. The two of them had worked together for half their lives.

It was one thing for a man to have children. He had seven children who had survived. Five had already married and established families of their own. He had nearly two dozen grandchildren already—a blessing from God in these days of war and disease, these latter times of tribulation.

Though he could wish that Hans and young Jerg would get married. Except for Michael's two, all of his grandchildren came through the girls. He had only one grandson named Huber, so far-Michael's four-year-old Jerg.

They were good, steady, sons, though: hard-working and civic-minded, all a reasonable man could ask for. Barring famine and plague, one of them would probably, some day, become mayor of Schwarzach in his stead. Presuming Hans and Jerg got married, that is.

But.

He could not see that it was a divine blessing to have someone suddenly appear in the world who claimed to be his descendant thirteen times removed.

Not all miracles were necessarily blessings. Undoubtedly the fig tree cursed by Our Lord Jesus Christ had come to that conclusion somewhere in the process of being the object of a miraculous action. So he had ignored the letter from this woman, Frau Sutter, when it arrived the previous winter.

Now she was in Schwarzach.

It was hard to avoid a miracle when God wanted you to undergo it. Consider the fate of Jonah. Jerg Huber paused during his morning's work and considered the efforts of Jonah to avoid destiny. The maneuvers of Joseph. The evasions of Elijah.

He had to answer the message from Herr Crawford. He sent his granddaughter up to the abbey to say that he agreed to meet with the up-time woman.

If a miracle wanted you, it would get you.

Although why God thought she really needed to learn his grandfather's name was well beyond his comprehension.

Anyway, it had been Huber. Of course. What had she expected?

* * *

Father Anselmus came with Frau Sutter, most times. Abbot Georgius thought that his faith could benefit from close contact with a modern miracle.

Officially, Abbot Georgius had assigned him to make copies of all the information that Jerg was remembering about earlier times in Schwarzach and the people who had lived there. He said that he would place it in the monastery's archives, next to the church registers. Perhaps, some day, if he had time, he could turn it into a chronicle.

Jerg Huber took exception to Frau Sutter's assertion that his family tree consisted of "perfectly ordinary people." He was, after all, a citizen of Schwarzach. The mayor of Schwarzach. Not some insignificant day laborer or vagrant.

"Well, I meant . . ." She sputtered a little. "Not nobles or anything."

Their conversations continued. One day, the topic was Jerg's maternal great-grandfather's sister's stepdaughter. Whom he had never met. That was the day that Father Anselmus mentioned that the abbey had tax and lease records much older than the church books. Mrs. Sutter gave him a blinding smile.

Jerg Huber gave him a blinding smile, too. Even if Father Anselmus didn't, quite, believe in miracles, he had performed one, at least in Jerg's opinion. Since then, the up-timer hadn't pestered him any more, but rather had buried herself in the muniment room at the monastery, assisted by Father Paulus. From first daylight to the last dim remnants of dusk, according to Herr Crawford, the day he left Schwarzach to escort Mistress Horton to Besançon, she made copies of financial documents and put them in her files.

As Jerg Huber lighted a votive candle in the great church at the Abbey of Saints Peter and Paul, he gave thanks that the world still contained small miracles as well as large ones. Miracles such as the diversion of Frau Sutter to the abbey's archives.

Moreover, he had received, through this woman, the knowledge that his fatherly patience would be rewarded. Eventually, Hans and Jerg would marry—marry well, both of them—and father families. There would be only daughters for Hans, but four sons for Jerg.

If things remained the same in this world as they had unfolded in the one from which Grantville came, of course. A man could only hope.

September 1634

"Send her home," Bernhard of Saxe-Weimar said. Firmly. "By the time we wind things up here and *das Kloster* returns to Schwarzach to start planning next spring's actions, let her be gone. Absent. Removed. No longer present. While I admit that the likelihood that she is an intelligence agent seems to be . . ." His voice trailed off.

"Diminishingly small, on the basis of everything Crawford told us," Friedrich von Kanoffski contributed.

"Minute," Duke Bernhard admitted. "Minuscule. Nevertheless, we have Mistress Horton on her way to our civil headquarters, where she can do the most good now that she has provided directions for our new medical corps and well away from the location where we will be considering our . . . upcoming enterprises. Let the other one depart as well."

"You are assigning Colonel Raudegen to guard Frau Dreeson and Signorina Allegretti," Kanoffski suggested. "I will have the boat stop at Schwarzach. He is surely capable of removing Frau Sutter from the abbey and ensuring that she returns to Grantville."

"If anyone is. He can certainly try," Duke Bernhard rubbed his stomach. "But I remember all too well what it was like when I was a boy and my tutors started talking about the genealogy of the Wettins."

Grantville, October 1634

"Do you realize, Melvin?" Roberta asked. "The colonel would not even tell me his actual name. The one with which he was born. He claimed that he had used his military alias since he was old enough to run away from home and it was good enough for him."

"Ummnn," Melvin said.

"But I kept talking to him, and I got a lot of clues. I'm pretty sure I know what village he was born in, now, but I need a good map of Lower Austria. And his mother was called Barbel. I'm pretty sure that with those clues to go on, I could work out his family tree, with enough time and effort."

"Sounds like more trouble than it's worth, to me. Especially since Raudegen doesn't *want* you to research his family tree. Why don't you just keep working on our kids, now? There's a whole batch of stuff that came in while you were gone, from Kitzingen and places like that. I piled it all in your inbox. It doesn't sound to me that doing research on Raudegen's family would be easy."

"But it would be a challenge, Melvin. A *challenge*." Roberta waved both her hands. "Nothing worthwhile is ever simple. Nothing."

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The Ear of the Beholder

Written by Terry Martin

"No way, man, I thought they were Brits!"

"Way, dude. They were Brits. But their first record was in German." Danny grunted to signify that was settled. "Not only that, but it was recorded in Paris."

"France?"

"Is there any other?"

"Well, not any more there isn't." Carson chuckled. Danny nodded in agreement.

Colby shook his head. "Man, that Rishloo character ain't gonna like that much."

"Jeez, Colby, Rishloo was long gone when—" He was interrupted by an explosive sneeze from the drummer. " *Gesundheit*! Anyway, that guy was long dead before the Beatles came around."

Colby shrugged. "It sounds pretty weird, but if you say so . . ." He turned to the drummer. "Hey, Carson,

you may want to wipe yourself off. You got a massive snoogee running down your shirt from that sneeze." He snorted a laugh as he pointed.

The drummer looked down to see the 'snoogee' oozing down his shirt. His cuff smeared it into the fabric.

"Good enough, dude." Colby snorted again.

"Nice," was all Danny could think to say.

They had all been learning German and so the lyrics were not much of a challenge, but the slow and steady beat was giving Carson fits. "There's no place in this song for me to really show my stuff."

Danny knew 'show my stuff' translated into 'bang on the drums in a mad frenzy.' And that was probably how his parents had agreed to let them practice in their basement—they had already become accustomed to the noise of his showing his stuff. And Colby was having a similar problem playing a steady rhythm.

"Do you guys really want to be musicians or are you so pigheaded you won't play anything but the heavy metal you love? Personally, I don't mind 'down-sizing' the rockness of the tunes so the locals can start to know us better. After that, we could ease them into the heavier stuff. You dig?"

"Yeah, but." Colby gestured helplessly. "C'mon, guys, I mean 'soft rock'? Really! I don't think I could stomach that."

"Know what you mean, dude. Can't stand to even listen to the stuff myself."

Danny threw his hands up in exasperation. Ever since the Ring of Fire had left them stranded in this world of minuets and dirges, the four of them were about the only heavy metal freaks around. Before that they always had friends in Barrackville, the record store in Fairmont, and the occasional concert at WVU in Morgantown.

"Guys, c'mon. What good is being a 'professional' musician if you can't play anywhere? I know Carson would love to strut his stuff and Colby would love to wow the ladies with his licks, especially Carson's sis, Natasha. Which I suspect is the real reason you wanted to join the band."

Colby began a feeble protest, but Danny continued. "The point is, fellas, we're pretty good at what we do and would be no good to anyone in a machine shop, construction crew . . ."

"Or the army," Colby added.

"Or the army. Except maybe with their band—if they had one. But all we really want to do is play music. And if it's that important to you—and I mean music is *all* you feel passionate about . . ."

"Except for maybe my sister." The drummer laughed. Colby glared.

Ben, being the youngest, had let his elders carry the conversation. Now he blurted out his biggest fear. "All the down-timers want to hear is country music, and I know I don't want to play that. Don't even think I can. Just as soon not play music at all if that's all there is."

Danny relaxed a bit and laughed. "Well, I can't say I don't agree with that sentiment. It's at least got to be rock for me, even if we have to play the 'oldies.' Otherwise we'd just be another polka band."

"Yeah." Colby laughed. "And I never learned the accordion."

They all shared in a laugh then, and Danny felt the tension ease. "So, I figure if we can slow the beat down a bit—c'mon, Carson, you can do it!—and let up a bit on the rhythm, I think we can get the audience to like us."

Ben sighed. "Better than last time, I hope." Even Danny winced at the memory. "I thought no one was ever gonna talk to me again."

"Yeah," Carson added, "we didn't make many friends that night."

The silence that descended over the group left each in their own embarrassment. They had fast-talked a gig at the Gardens one night when some group from Jena did not show up. It did not take them long to get their equipment there and set up—each was high on adrenaline and ready to shine.

The first song was "Sugar" by System of a Down. They had changed some of the lyrics to make it presentable to younger people. At the end of the song a waiter had approached and whispered to tone it down, as people were trying to eat.

What? They could not eat with the music playing? So they toned down their second song. Something mellower: Anthrax's "God Save the Queen." Someone pulled the plug before they got thirty seconds into the song. Literally pulled the plug on their equipment.

That was the extent of their professional performances. They never even got to what they considered their 'signature piece,' "Caught Somewhere in Time" by Iron Maiden.

"That song would've really rocked," commented Ben.

"What song are you talking about?" Colby was still depressed remembering that night.

"'Caught Somewhere in Time.' It was, like, so perfect for what's happened to us."

"Know what you mean, man." Danny tried to shake off the mood. "But we gotta pick a new signature song and try it again. We can't give up."

"Okay." Carson twirled his drumsticks. "What say we give this Beatles' song a try?"

* * *

It took every bit of charm Danny had to just get his foot back in the door at the Thuringen Gardens. Their prior engagement was still the stuff of legends and he had to convince them that an audition would be worth their time.

"Okay, fellows. We got one shot to do this." Danny spoke quietly to the band after they had finished setting up the equipment. "Are we ready to wow them?"

Colby nodded. "My ax is tuned and ready to rock—rock quietly, that is."

Carson and Ben nodded their agreement. Danny turned to the crowd of three: the manager and two of the wait staff. "We'd like to start out with an old favorite."

Carson was able to get the simple beat going. Soft, slow, and steady. Danny took the mike and sang, in German.

After three songs, the manager signaled them to stop and tipped back his chair. "Well, boys, I must say. I'm quite impressed with the change in your sound. Do you have enough material to play a couple of sets for an evening?" He leaned forward to set the chair aright. "I mean without resorting to the kind of stuff you played the first time?"

"Yes, sir." Danny replaced the mike in its stand. "We have enough similar material ready to do three or four sets, if you like. Soft rock, middle-of-the-road . . ." He chuckled. "Stuff that will not destroy anyone's digestion or drown out their conversations."

"Very good. I think I can get you in for one night next week—how's Wednesday sound?" He came over and extended a hand. "And we'll see how it goes from there."

Danny shook the hand. "Fantastic! I know you won't be disappointed."

The others also shook the hand and murmured their thanks. Then quietly got to the task of putting everything away.

Walking home with their heavy load on a couple of dollies, they said little. Danny wondered if it was some sense of having sold themselves out or simple elation at a chance to redeem themselves.

Colby voiced his concerns. "Man, after all these weeks of practice, I sure hope they like us."

Carson smirked. "I am sure Natasha already approves."

* * *

Now that it was over, it was all well worth it—all the hard work and practice, practice, practice. Their performance pleased everyone as much as the tryout.

The early Beatles went down well. The up-timers knew the song well enough, even if the lyrics were in German, which pleased the down-timers.

Most the stuff was old Beatles' tunes and the like. Even one Garth Brooks piece that was more rock than country. Still, the high point of the evening was when they played the John Denver classic "Take Me Home, Country Roads." Most the up-timers sang along and quite a few of the down-timers as well.

And they were all smiling when they got to tearing down their equipment.

Carson nudged Colby in the ribs. "I noticed Natasha was pleased with the performance—especially yours."

"Maybe so." Ben laughed. "But he was spending most of his time flirting with Cheyenne Bledsoe."

"Oh? So, what, Colby? You already dumping my sister?"

"Hey, there's nothing wrong with your sister, man. I mean she's nice and all." He shook his head. "But Cheyenne is hot!"

"See fellas? It's like I told you. Being a professional musician will get you noticed. If we had stuck to the metal, no one would be talking with us." Danny paused a moment. "I think the Denver and Brooks songs got the best audience response. Maybe we could add a few more of those. Y'know . . . country and folk?"

Carson shrugged. "Okay by me. At least we're playing."

"Me too. And you know? I was thinking about that beer barrel polka song. I remember it from a movie or something."

Ben stopped and stared at Colby. "Are you kidding? A polka?"

"Well, I mean it could be kinda fun playing one of them."

Danny nodded. "We could check into it."

Three of the members nodded together and continued rolling up cords.

Ben hung his head in disbelief and moaned.

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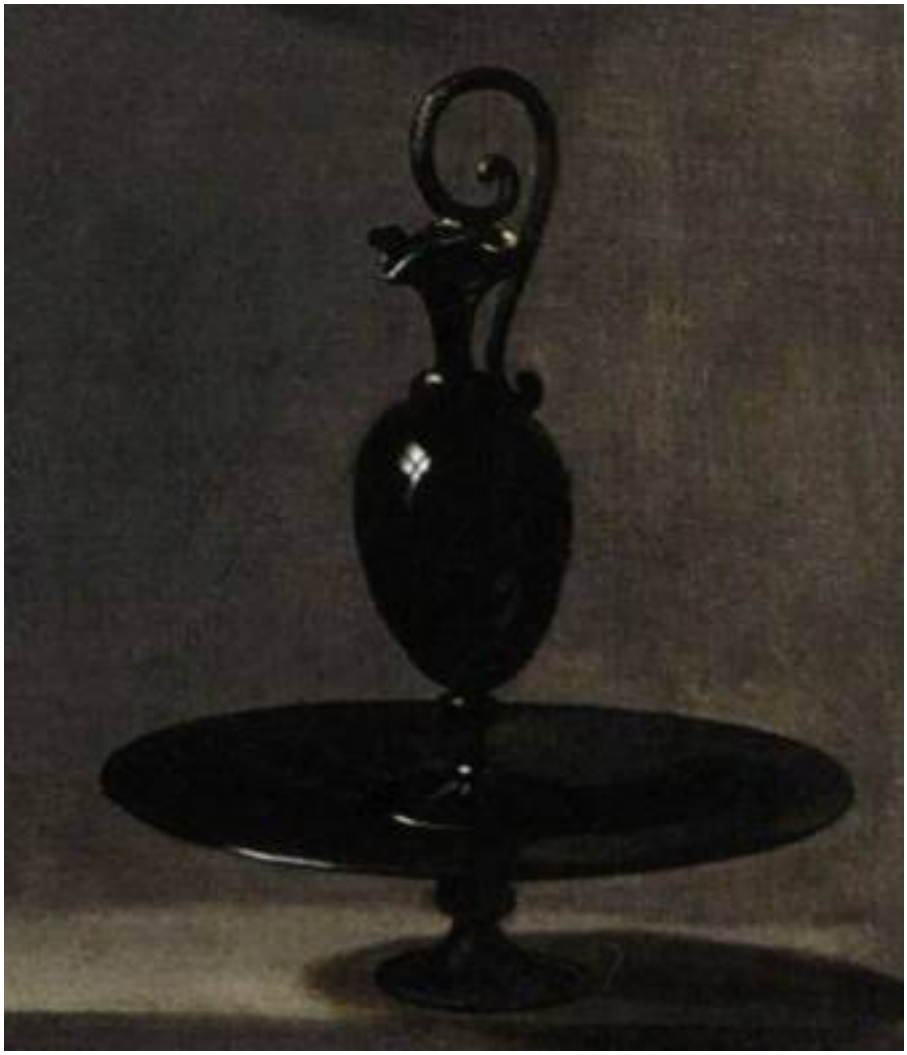
Out of a Job?

Written by Iver P. Cooper

I am no ordinary assassin. As one of the foreign agents of the Most Serene Republic, it is my task to bring our wayward glassmakers back into the fold. I prefer the carrot to the stick, and the stick to the dagger.

But if need demands it, I *am* an assassin. In Normandy, I left one recalcitrant glassmaker with a dagger in his heart. And, lest his colleagues think it a chance street killing, I attached a note to the hilt. It bore but one word: "Traditore." As the French say, " *pour l'encouragement d'autres*." Or perhaps that should be, " *decouragement*"?

How I despise these ingrates. The security of the Venetian Republic rests on its economic power, and that, in turn, on its mastery of certain arts, glassmaking being *primus inter pares*. Yet they dare to pass on our precious secrets, knowing full well what damage it will do to their homeland. And are not the glassworkers the most pampered of craftsmen? Why, regardless of their birth, the masters are permitted to marry the daughters of the nobility.



My bird, Tomasso, had flown the coop again. We had tracked him to London, and a member of the

Ambassador's staff had been sent to offer Tomasso a nice sum of money to return home. He had laughed, assuring our envoy that his noble British patron would pay him more, and that if he had to be confined to an island, he would rather it be England, not Murano. Despite the difference in climate.

The domestic branch of my department had been watching his family, of course, hoping that he might come home for a conjugal visit, and arrested his wife as she tried to slip out of the country to join him. She was imprisoned, and persuaded to write letters begging him to return. We passed those letters on to Tomasso.

They seemed to have some effect on him and he promised that he would come home as soon as he finished a particular job for his nobleman. One, he assured us, that didn't implicate any Venetian secret. Then it was until an outbreak of the plague subsided. Then he had to wait for the roads to clear.

I decided I had heard enough excuses, and set up the arrangements to abduct him. Such are tricky, since you must find the renegade alone, if at all possible, and get him out of the country before he is missed. He must have noticed something, because next thing I knew, he was gone.

I rode the post to Dover—which ate quite a chunk in my expense account, being eighty miles at two and half pence to the mile—but by the time I got to the docks, he was off and away.

Nor did I find him in Calais.

The first new rumor I heard of him was in Paris. I hoped he would settle down there long enough for me to set up a retrieval, but he didn't oblige me. Couldn't find a good enough deal, I suppose.

My pursuit was a blur of long roads and bad food, crisscrossing France, the Netherlands, and Germany. I caught up with him at last in Lauscha, in Thuringia. There, he had settled down to a life of making titanic gilded *waldglas* beer goblets for the feasts of barely literate princelings. What a comedown!

The town was small enough for strangers to be noticed, so I spread some coins about and waited for him to head out. I knew he would do so, eventually; he was in town only to sell his wares and buy supplies. The *walglashutten*, where the glass is actually made, have to be located near a source of wood for the fires, and as soon as they exhaust the local supply, they are moved.

We took him like a coney in a trap. Within a trice, he was disarmed, bound and gagged. At first he thought we were common bandits. Well, that was probably the usual occupation of my hirelings, but he realized quickly enough what I was.

He made gagging sounds.

I cuffed him. "You wish to scream for help? So sorry, I cannot oblige you."

He shook his head vigorously.

"You wish to tell me something?"

He nodded.

"Very well. I will let you speak. In a whisper." I put my knife against his throat, and one of my henchman removed the gag, then stepped back. "Remember. Whisper."

"This is an exercise in futility. There is nothing I know that is of any real value to Venice. Not anymore."

"Do you not know the secret ingredients and proportions of crystallo? Have you not the craft of blowing bubbles of glass, and spinning them out to form a perfect circular pane? Or of swinging it into a sausage, and slitting and unrolling it to make a broadsheet? Are you not also one of the *specchiai*, who know how to make a glass mirror without cracking it with heat?"

"All of that, and more, but I say again, it doesn't matter. Look at the manuscripts in my bags."

"Bide a moment in silence, then," I said, and replaced the gag. I searched his belongings.

What I found there was . . . disturbing. The worst offender was a manuscript, written in English, and entitled "1911 Encyclopedia Brittanica—Glass." It contained both formulae and descriptions of manufacturing techniques. What shocked me the most was its nonchalant statement that the methods could be used to produce single sheets measuring more than twenty-seven feet by thirteen feet. How did

the English make such an advance, and how could our ambassador have been so derelict as to fail to report it?

"Where did this come from?"

"From Grantville."

I had heard of Grantville, of course, who hadn't, but up to this point it had had no obvious connection with my work. I was more concerned with the mundane disappearance of glassworkers than the magical appearance of alleged towns of the future.

"So . . . you have stolen their guild secrets? You offer me their secret craft manual in return for your freedom, and that of your wife's?"

He laughed, but not pleasantly. "I am tempted to say yes, but you would probably think better of the bargain too soon for my wife to be released. That is no secret manual, you can buy it in any bookshop in town. As you can many other articles of the infernal *1911 Encyclopedia*."

"Perhaps it's a scam," I said. "Whoever heard of single sheets the size of a house?"

"Tell you what," said Tomasso. "I will wait with your men. You go into the town of Grantville, and look at their windows for yourself. Then decide if my secret knowledge is so important, anymore, that you must immure me and my wife on the island of Murano for the rest of our lives."

After some thought, I consented to this arrangement. I moved Tomasso off the road to a cave my henchmen knew of. Their knowledge of potential bandit campsites didn't surprise me in the least.

I visited the town of Grantville. Many times since then I have wished that I hadn't, for there I saw that the great days of the Most Serene Republic were past.

"Well?" Tomasso asked, when I returned to our little cave away from home.

"You were right," I admitted. "Even little stores had windows, so clear that a bird could fly into one by mistake; larger than that found in any palace in the world. And mirrors, likewise of fantastic size, and with images so clear that you thought that the legends of doppelgangers must be true."

"Just to be fair, those windows were made by a technique which isn't in that 1911 encyclopedia. Let glass spread on molten tin, under a special kind of air. But before you think that a trade secret, it's in another encyclopedia, and you can buy copies of articles from that one, too."

I didn't know what to say, at first. At last, I sighed. "Very well. For my masters to save face, I will have to offer them something in return for your family's freedom. Give me the 1911 manuscript, and write out a description of that molten tin business. For that, I will endeavor to obtain the release of your wife, and the cancellation of the order against you."

"I suppose I will have to be content with that," said Tomasso.

I ordered my hirelings to release him. They hesitated for a moment, until I assured them that they would be paid just as if we proceeded with our original arrangement.

As Tomasso clambered back onto his mule, he delivered one parting shot.

"So, Mister Secret Agent, I am no longer a master of the glassmaking art. No Venetian is, anymore. I eke out a living now in this little forest village, but it's only a matter of time before the Grantville methods come here. And what happens to me when that happens?

"And I imagine there isn't going to be much of a market anymore for secret agents to retrieve Venetian glassmakers, since they don't know this new technology.

"In short, we're both out of a job."

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The Truth According to Buddha

Written by Terry Howard

"Hey, Jimmy Dick." Bubba sidled up to the bar and waited for Jimmy to order him a beer. It was Thursday and Bubba was broke. "You hear about the horrible way the school treated preacher Wiley's kid?"

"No. What happened?"

"He was up there giving his Indian arrow presentation and they flat kicked him out in street 'cause he said he believed in science."

"Bubba?" Jimmy said, waving two fingers at the bartender, "You'll believe anything, won't you?"

"Whata' ya mean, Jimmy?"

"You heard Will's side of the tale and swallowed it whole. You didn't bother to find out the other side or to even think that there might be one. I bet ya' this is just another huha Wiley's brat is stirring up."

"Well hell, Jimmy. How am I supposed to know what the truth is?"

"Bubba, let me tell you story. I had a dream I had last night. In my dream I heard a voice—

"'Docket number 659,656 being an alleged violation of the protocol compact limiting direct intervention in the affairs of the worlds of men by gods.'

"'Now comes Tyr speaking for the complainant Odin and all others, before the supreme council of all the gods.'"

"Hey, Jimmy? I know who Odin is. He's Thor's sidekick in Super Hero's, but who's Tire?"

"Other way around, Bubba. Thor is Odin's sidekick. Tyr is a god just like Thor, another sidekick of Odin's. Thor was famous for his hammer, Tyr was famous for always telling the truth. He got his hand bitten off by a wolf while he was saving the world."

"You sure about that, Jimmy?"

"Yeah, I'm sure about that. Now can I tell the story?"

"Sure, Jimmy."

"'Well,' Tyr said, 'Most gracious judge, for nearly two thousand years, ever since the Roman Christians brought the Semitic god, Jehovah—'"

"Roman Christians? You mean Catholics, Jimmy?"

Jimmy sighed. "Yeah, Bubba. I mean Catholics. Now can I tell the story?"

"Oh, sure, Jimmy. Sorry."

"'Ever since the Roman Christians brought the Semitic god Jehovah into the lands of the Germans—'"

"Semitic? You mean like in anti-Jewish?"

"Bubba, have I ever told you you're dumber than a box of rocks?" a frustrated Jimmy Dick asked.

"Yeah. But does that mean Semitic means anti-Jewish or not?"

"*Huuuuuh*. Semitic mostly means Jewish. It doesn't mean anti-Jewish unless you say anti-Semitic. You got that?"

"Sure, Jimmy. I was just wondering."

"Now can I tell you this story or not?"

"I'm listening."

"'Ever since the Roman Christians brought the Semitic god, Jehovah, into the lands of the Germans, we have bided our time without having farther disturbed this council once you ruled that the saints were not gods nor were they avatars and therefore what they did in the world could not be considered a violation of the compact of non-interference. We have watched their direct intervention in the world of men, an absolute violation of the compact if it were done by a god, and—save for the complaint that the saints were being prayed to as gods and not just petitioned as venerable ancestors, a claim supported by the accusation of the reformed Christian priests against the Roman Christians—we have said nothing.'"

Ken put two cold bottles down in front of them. Jimmy grabbed them both.

"Hey, I thought you were gonna buy me a beer," Bubba said.

"I thought you were going to listen to a story?"

Bubba started to say something and stopped. He got the message. Jimmy slid the bottle over to his captive audience and continued the tale.

"'We have wept at the abuses fostered on our peoples at the hands of their priests. And though we have often contemplated doing so, we have not bothered this council with that compliant. Nay, we have said nothing.'

"'We have watched in silence while they have destroyed our holy places on every high hill, their believers being stronger than ours, because they had the aid and succor of the saints. And we have said nothing.'

"'We have said nothing while the mother of their god has appeared to every shepherd girl in Europe making and fulfilling promises that are a direct violation of the compact. But we have said nothing, for even the mother of their god is protected as a saint.'"

Bubba started to ask a question. Jimmy looked at the beer and Bubba shut up.

"'We have watched their priests steal our customs and our holidays. We have watched as they changed the names of the high, holy days, perverted the meanings of the observances and the symbols and not given credit where it was due for their origin even though they have nothing to do with the history or customs of the Semitic faith. And we have said nothing.'

"'We have waited in peace for their influence to fade so we could reclaim our territorial rights.'

"'But this is too much. The Semite has moved a village from half the world away and from four hundred years out of time into the middle of Germany. Even if it were the work of a saint, which it is not, any saint that can do that surely must be considered a god and must be under the ban of non-interference.'

"'We submit that this council is obliged to require the Semite to return the town to its proper place and time. We farther feel that it is only fitting, in light of this clear and flagrant violation of the compact, that the Semite's saints be barred from the farther usurpation of the duties of gods and that for a period of at least three hundred years we, the true gods of the Germanies, be allowed to commune directly with our few remaining believers and aid them directly in overcoming this gross invasion. I thank the most gracious judge for hearing our petition.'

"'Now comes the saint Elijah speaking for the defendant Jehovah in each of his three forms.'"

Finally it was more than Bubba could take. He had a question he just could not hold in. "You mean Elijah, like in the bible? I thought you were talking about a made-up Jewish god. I didn't know you meant *God*. This ain't funny, Jimmy."

"Bubba, do you want to drink my beer or not?"

Bubba shut up by sticking the rim of the bottle to his lips and lifting the bottom high.

"'Well,' Elijah said, 'Most gracious judge, once again we are forced to answer the whining snivels of Oden from his grave in Valhalla. My god has abided by the compact that he asked for in the days of the Babylonian exile when his, his and her chosen people asked that he end the oracles of other gods. To do so he, has given up the giving of prophecies and direct appearances and assistance, even to the bother of his becoming a man to teach as a man and to die as a man. It was a wise choice that has stopped much destructive warfare between the gods.'

"'I have checked with my god, and neither he, nor he, nor she had anything in the least to do with the anachronistic appearance of Grantville in the 1600s. It is a clear violation of the compact. We agree. Something should be done. But it was not done by my god.'"

"Tyr, waving the empty stump where his hand was bitten off, called out from the bar, 'Your high priest in Rome and your high priest in Moscow say your god has done this thing!'

"'My good god Tyr,' Elijah responded, 'surely you of all beings know, priests lie!'

"'If your god did not do this then who did?' Tyr demanded.

"'Our best guess is that it was an act of Science.'

"'Shit!' screamed Tyr, 'Science again? Gracious judge, something must be done!'

""Buddha, whose turn it was this eon to sit in the seat of the judge and be chair-deity of the council spoke. 'i AM AFRAID,TYR, THAT science IS NOT SIGNATORY TO THE COMPACT AND DOES NOT RECOGNIZE THE AUTHORITY OF THIS COUNCIL.'"

Bubba had the bottom of his beer bottle between his face and the ceiling until it was dry. He set the empty down on the bar. "What's all that supposed to mean, Jimmy?"

Jimmy sighed. "I think it means we need another couple of beers down here."

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Sailing Upwind

Written by Kevin and Karen Evans

Late September 1633

"Sally, did Mr. Pridmore say where he was going?" Reva leaned toward the young receptionist, to keep the conversation a little more private. Reva worried about Marlon. He hadn't been eating or sleeping well for the last week. Just like he had last September, he'd gotten moody and irritated. And today, instead of finishing work, he just stood up and walked out of his office.

"No, Miz Pridmore. When he didn't see you, he told me to tell you he was feeling poorly, and then got his coat and left."

"Yeah. I guess he's got the flu, just like last year." Reva went back to her station behind the teller window. *No use going after him. I might as well finish work.*

* * *

"You sitting here moping again?" Reva came into the living room to hang her coat in the closet. While lights were on in other parts of the house, he was sitting alone in the dark. "I swear, you're gonna wear me out with your sour moods this time of year."

Marlon grumbled, "Tomorrow is October first. This weekend would be the beginning of the Albuquerque Balloon Fiesta. And I let Hilde down again."

"I know. I heard it all last year. Same old story. You were gonna help him get the money for an airship, and then you weren't there to hand it over. Nothing new. I thought you were over this."

She waited for him to respond, and when he didn't she continued. "I've worked at that bank with you for more than twenty years, and put up with your moods here at home. But you don't have an excuse to sit here and feel sorry for yourself. You don't need to be in here moping like this, Marlon Pridmore. Life goes on."

He glared at her. It was an old argument. "Reva, you just don't understand. I gave them my word and I failed. I've been adjusting, but when it starts to get to fall weather like this rain, it makes me long for the things we used to do. You enjoyed that balloon fiesta as much as I did, and you know it."

"Now, don't pull me into this mess, old man. Yes, I liked going to Albuquerque just fine. But that was then, this is now. We can't go back, and that's that."

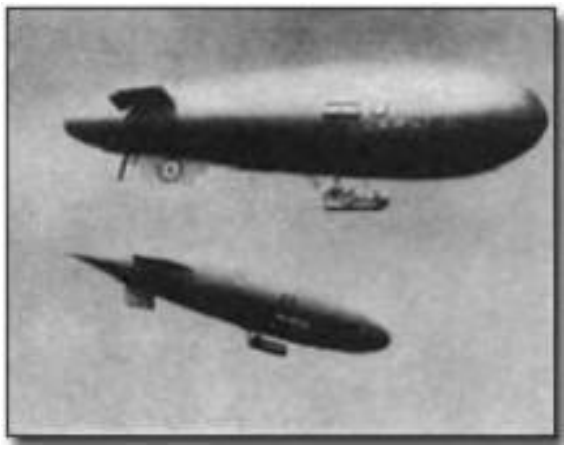
He stood up and started walking toward the kitchen. "I'm going out to the barn. Don't wait up." He walked out the back door, hands shoved into his pockets.

* * *

Marlon sat out in the dark barn, drinking *kirshwasser* in memory of Hilde, mourning the loss of his friend once again. Marlon and Reva had both grown up in Grantville and most of their family still lived in the area. They had never had children, so there were no grandchildren left up-time. Now all that Marlon missed from West Virginia, besides getting a new computer once in a while, was Hilde and balloons.

Hilde and Marlon had planned to get some investors, including a loan from Marlon's bank, and buy the

envelope and basket for a thermal airship. This wasn't just any balloon; it was a hot air blimp that could be steered against the wind. It was going to be their entry in the Gatineau Challenge, a thermal airship race with the prize of half a million dollars.



Reva found him in the barn later that night. She stepped under the single bare light bulb and put her hands on her hips. "Okay, I've had it!"

"You just don't understand! I gave my word I'd be there, and there's no way I can get there now."

"Listen here, Marlon Pridmore. You need to stop this pity party of yours, and go build yourself a balloon. You can do it. There ain't anyone here down-time that knows more about it than you do. But it ain't gonna happen with you out here drinking brandy, and feeling sorry . . . "

Marlon interrupted. "What did you say?"

"I said you need to stop this pity party . . ."

"No. The part about the balloon."

Reva stopped glaring, and laughed. "Swordfish, you're an idiot. What you miss isn't that silly airship project you set up in Leipzig. You miss spending time with balloonists. You miss flying. I just think that if you want a balloon so bad, there isn't anyone around here that knows more about building one than you, now is there?"

Marlon thought for a moment. He'd never considered building his own airship. Up-time, it was much easier and safer to have a professional company sew the envelope out of high tech materials, and just gather the money together to buy it. He took another sip of the brandy, then looked at his glass. He couldn't seem to remember why he was sitting out in this damp barn drinking in the first place.

Reva shook her head, then hurried back into the house. He sat for a moment more, then stood and ambled over to an old dresser at the back of the barn. He had always used it for plans and notes and such. Maybe there was still some of that graph paper in one of the drawers.

* * *

"Herr Pridmore, have you been out here all night?"

"Hmm? Is that you Bernard? What time is it?"

"It is just before dawn, time for me to milk the cows. Can't you hear them calling me?"

"Oh, yes, so I can. Well, don't let me stop you." Marlon was busily drawing diagrams, figuring volume, referring to old ballooning magazines that had been stashed in the bottom drawer of his dresser.

Bernard Brenner, with his wife Agnes and his fifteen year old daughter, Helga, had come to town as refugees in 1631. Bernard had been a distiller of cherry wine before the war destroyed his village. Now the Brenner family was woven in as part of the Pridmore family. By now, Bernard was accustomed to Marlon's

eccentricities, like becoming obsessed with an idea, and forgetting to eat or sleep.

Marlon looked up from the paper. "Bernard, what do you know about cloth? I think I have a new project that you can help me with."

* * *

It was late in the day when Marlon and Bernard came back from the barn. Agnes had peeked at them several times that day, and even taken lunch out when they didn't show any sign of stopping to eat.

"Reva, I think we can do it. Sure, Bernard and I have to do some more research, and it's anyone's guess what it's going to cost, but I think we can get the cloth we need and somehow make it hold hot air.

"Well, I kind of thought there would be a way. I'm sure that you can find someone either here in town or up in Magdeburg that can give you price estimates and such."

"That's what I'm thinking, hon. Look at these here figures, and tell me, do you think we can afford to do this? You know what we have, and what we need to keep going. What do you think?"

Reva sat down at the kitchen table and spread out the papers that Marlon handed her. Together they looked over the figures and diagrams. "Well, Marlon. I guess it depends on what you're willing to give up. You're probably going to have to sell some things. And it isn't going to happen all at once. We're going to have to take some time to raise some money. But I can see us doing this over the next couple of years. That is, if you're willing to give up some of your other toys and projects."

Marlon grinned like a ten-year-old boy who had caught his first fish. He pulled Reva to her feet and swept her into a big hug. "Sweetpea, we can sell whatever you say to get this done."

April, 1635

It took almost two years, but finally it was coming together. The gondola, woven from wicker, was complete, and the last shipment of Indian muslin had been delivered. So this morning, Marlon and Bernard were busily working on their toy. Marlon was in the yard stirring a huge vat of brown smelly stuff.

"What is in that stuff?" asked Bernard.

"This, Bernard, is a modern miracle. It is a conglomeration of lacquer, gum Arabic, turpentine, and resin. It's gonna keep the hot air where it belongs."

"So you say, Herr Pridmore. But how do we get it on the envelope?"

"I'm glad you asked that, Bernard. We're going to soak each and every piece of cloth in this stuff and let it dry. Local weather wizards say we have about a week of clear weather, so we've got to jump on this."

"Oh, I see. Hmm. I think I've something to do in town . . ."

"No, you don't. You're my helper, and this is what you're helping with. Reva already bailed out on me, said she'd rather boil soap. Can you imagine that?"

Bernard looked as though he, too, would rather stir stinking soap over a hot fire than drag fifty foot lengths of cloth through the vat and lay them out to dry. But there was no escape.

"Don't worry. I got more help coming. You remember them boy scouts over at the Methodist church? One of the boys won't let me alone with questions about hot air balloons. The Council has agreed to allow him to work on a hot air balloon merit badge, and named me as the local expert. He and about ten of his friends are headed over to learn how to build a balloon. With all those hands, and youthful enthusiasm, we should be able to get through this today."

The boy scouts arrived in good time, and all set to work with a will. The weather was fine and warm, and while it was uncomfortable standing by the fire, the breeze helped. By the end of the day, the muslin was coated, and drying on every bush and clothes line in sight. Marlon, Bernard, and eleven boy scouts were coated with gummy brown stuff from head to toe.

September, 1635

Ulrich Schwarz frequently felt like he wasn't a good choice for leadership of a scout troop. He had never been a boy scout, and wasn't always comfortable with all the customs of the troop. The boys knew much more about the requirements and the confusing paperwork for these merit badges. He had been methodically working through his first-class qualification, sharing one of the books they had for the group of new scouts.

He liked the idea of Boy Scouts. It really was a good idea to have training for young boys, and the uniforms and mottos were certainly uplifting. But he still didn't feel comfortable as the authority.

"Herr Schwarz, have you ever read Tom Sawyer?" The question brought Ulrich back to reality.

"No, I do not read English so good, yet. Do you like it?"

Fritz Metzger and J. D. Cunningham were bent over a book, trying to read it together. "Yeah. I think it's great," said J.D. He was an up-timer, and seemed inseparable from his friend Fritz. "See, there is this boy named Tom, and he's got a friend called Huck. And they go on adventures, and get into a lot of trouble."

Ulrich wasn't sure how advisable it was to give these boys a book about more trouble. They were well capable of finding their own.

"Boys, it is time to put the book aside. We must start our troop meeting." Ulrich watched as almost twenty boys ranging from ages eleven to fifteen settled into chairs. The meeting was held in a classroom at the Methodist church, and it was the first time that Ulrich had to run the meeting. Between the colds and flu that were going around, he was the only adult available today.

After the opening flag ceremony, and recitation of the motto, Ulrich nodded to Levi Carstairs, the oldest boy. Levi stood and walked to the front, carrying a small pocket notebook.

"Before we get to today's activities, I want to remind you about the Orienteering Hike we've got this weekend. We have permission to set up the course in the hunting preserve of the dukes of Saxe-Weimar on the northeast of town. It's only a couple of miles away. How many of you need this for first class qualifications?"

Only the two youngest raised their hands. Levi nodded, and then looked at Ulrich. "Herr Schwarz is going with the Tenderfoots, so you two make sure you take good care of him. Mrs. Moss wouldn't take it too well if you let her handy-man get lost."

"No, and neither would my platoon sergeant." Ulrich had been sworn into the army when he turned eighteen and was very proud of his rank of Private First Class. If only it was as easy to get a promotion in the scouts.

Levi looked sternly at the boys. "Now for the rest of you. We will meet here at the church on Saturday morning. Remember to be on time!"

* * *

Everything for the balloon was ready. Reva and Agnes had worked hard to get the enormous envelope sewn together. It was a good thing that Reva owned one very good sewing machine, and the other older one she had kept after upgrading.

Bernard and Marlon were in the barn, gathering bits and pieces. Marlon grinned and asked his friend, "Where is Helga today? She was up so early."

"She went with some of the girls from school. I don't know exactly what their plans are, but they have chaperones along. Agnes is with her. That soldier, Ulrich Schwarz, has been showing a little too much interest in her lately, and Agnes decided to put a stop to 'accidental meetings.'"

Marlon straightened from where he was laying out all his brand new instrumentation. "I think I've met that young man. He stays over there with Geneva Moss, doesn't he? I heard he was helping supervise a boy scout troop. Those boys get a mite rambunctious now and again. Ulrich seems to have a steady hand with them, without losing his temper. Good practice for him, I'd say."

"Ah, Marlon. You just don't understand. You don't have a daughter who is approaching womanhood. When I see all the young men in town follow her with their eyes, I just want to knock their heads together."

Marlon smiled, and crouched to the ground. Along with the instruments he had built for the airship, he laid out the hand-held radio that he and Reva had used on chase crews over the years. And Reva insisted that he add in the first-aid kit he had carried in his car for a couple of years.

"Herr Pridmore, those instruments are amazing. Do you think they will work?"

Marlon smiled, and nodded. "Yes, I think they will. I've done all the tests on them that I can think of. Now we just need the field test.

* * *

Saturday morning arrived with clearing skies, which calmed one of Ulrich's fears. He had done maneuvers with the army in the rain, but he really didn't relish the thought of dealing with the boys in that weather.

Levi whistled for quiet, and stood on a stump that was there just for that purpose. "Okay, everybody. This hike today is for Orienteering. I want everyone to remember that as scouts, we leave a site better than we found it. We don't disturb the trees or animals, and only pick up deadwood if we need it. We want the duke to be glad he let us use his preserve again. And make sure that everyone stays with their group. Safety first, you know.

"Now, who has a compass?" Five of them held up their hands. Ulrich did also. "Right. There are seventeen of us here this morning. Let's break up into three- or four-man groups, and share the compasses. And we have a small prize for the first team that finishes the course and returns with the flag. Here are your instructions."

The boys sorted themselves into groups, and Ulrich found himself with Fritz and J.D. Fritz said, "Herr Scoutmeister, I have your compass, and a canteen. J.D. can carry lunch for us, and we will let you be in charge of the instructions. Is that okay?"

"*Ja*. That is good. We can trade later, so J.D. learns to use the compass also."

Levi held up his whistle and shouted to be heard over the tumult. "Everybody ready? On your marks! Get set! *Go*!" He blew a mighty blast on the whistle.

Like racehorses responding to the trumpet, the boys took off at a run. It had begun.

* * *

Marlon and Bernard spread the envelope out flat on the grass. Flattened, the envelope was more than one

hundred fifty feet long, and sixty feet wide, and weighed four hundred fifty pounds. This airship was a monster! It had a gondola that would seat three and mounted two forty-horsepower ducted fan engines (robbed from two defunct dirt bikes). The frame had an inverted "V" tail. Lift was provided from a set of internal burners that blew hot air inside the sealed envelope. The gondola was hung from curtain catenaries.

"Bernard, the difference between this beast and a regular hot air balloon is the engines. If we didn't have them and the vector fans, we would be subject to the whim of the wind."

Bernard nodded as he listened to Marlon, but truly it didn't make much sense to him. He hadn't seen a "regular hot air balloon" to compare to this one. It would just have to wait until they got it up in the air.

* * *

Ulrich shook his head as he tried to make sense of the directions. They had been walking for two hours, and had not found point M, which was the second to last mark on the map before the flag. It had not been as long between any of the other locations, and he was sure that they were lost. It also didn't help that none of them had been here for other scout activities.

"J.D., hand me the map again." Ulrich had already examined it not five minutes before, and this time didn't change anything. They were still lost. He didn't recognize any of the landmarks.

Fritz held up the compass once again. "I think we have come too far north and not far enough east. What should we do?"

"Well, a scout should always be prepared. What did you bring for emergencies?"

"I brought a blanket in my pack, in case it rained again," J.D. said.

Fritz's eyes lit up. "I have some extra crackers and cheese."

"Good. You're both learning to be prepared. If we do not find our way home tonight, someone will come and find us. And I think we have enough to be okay tonight." Ulrich could tell that the boys tried hard to keep fear from their faces. It would not do to act like babies.

Ulrich looked around, and pointed to a hill southwest of them that seemed taller than the others around. "We will go to that hill, climb to the top, and see if we can spot something familiar from there. I think the sun has only two more hours before it sets, and we may have to be out here after dark."

* * *

Getting everything laid out, strapped on the gondola, and prepared for inflation took the men most of the daylight, with a short break for sandwiches and beer.

"Well, look at you two, smug as a cat with a mouse between his paws," said Reva.

"Darlin', I think this thing is really gonna run. You shoulda seen the fire-up on the burners before we set them in the envelope. Bernard just about burned off his left eyebrow." Marlon elbowed the tall, thin German in the ribs, and laughed.

Bernard grinned sheepishly. "One would think that I would remember to keep *mein* head away from it."

"I think you were mistrusting me about whether or not this thing would really burn."

Bernard frowned. "I've never seen something like this. How was I to know?"

Agnes hurried over to examine Bernard. Marlon stretched, and looked at the horizon west of his place. The sun had already passed behind them, and the sky was darkening. He shook his head. "I think it's too late to try this today. Don't want to be fiddling in the dark."

Reva put her hand on her hip, and got that same old belligerent look. "Course not. Just get your tarps and whatnot, and cover it up till morning, and we can go in and have a nice supper."

She walked back into the house, shaking her head, and muttering to herself. Reva didn't always need others around to have a conversation, especially when she was irritated with Marlon.

Her husband grinned at her back, then turned to Helga. "So, girl, you gonna be around in the morning to help with liftoff?"

Helga's eyes glowed. "Yes, I think I will. But it doesn't look like it will fly. It looks like an auto with a very large cloth cover."

"Oh, it'll fly, all right. You just be here at five a.m. and see for yourself."

* * *

Ulrich and the boys neared the top of the ridge. There weren't too many trees, and bare rock jutted from the side of the trail they followed. At the crest, both boys sat on a large boulder to catch their breath. The walk uphill had been a little longer than Ulrich thought it would be.

He looked out over the landscape, and didn't see one thing that he could identify on the map. They were well and truly lost.

"All right. I cannot see a way to go, and it is almost dark. Right here by this rock will be a good place to shelter. J.D., you start gathering some wood. And remember to only pick up dead branches. We don't want to disturb this forest any more than we already have."

* * *

Ulrich and the two boys huddled together under J.D.'s blanket. They were burrowed into dead leaves between the roots of an oak tree.

It had gotten cold. Ulrich slipped out of the blanket to put more wood on the little fire, and then stepped out from under the branches of the tree. The night was very dark. No starlight, or even the moon, was visible

through the clouds. At least it wasn't raining.

He turned at a small rustling sound behind him. "Who is there?" he whispered.

"It's me, Fritz. I've to go."

"Okay. Over there by that hazel bush. Be careful in the dark."

As Fritz scampered off toward the area they had decided was their privy, Ulrich sat back down by the fire. The crackers and cheese they had eaten at dusk now seemed ages away. He was saving Frau Moss' oatmeal cookies for breakfast. Now he wished he had thought to carry more food. They had enough water, but not much else.

"Fritz, where are you? You have been gone so long. Are you all right?"

There was no answer. Ulrich checked the fire, and on J.D., snoring away in the pile of old leaves. Both could be alone for a few minutes. He stood for a moment outside the circle of firelight to let his eyes adjust, and then walked toward the bush.

"Fritz?" Ulrich listened for a moment, and then heard leaves rustling and the soft crack of a twig. It was coming off to his left. "Fritz, are you there? Fritz?"

Still he could hear nothing except rustling leaves. And he couldn't tell if it was Fritz, or a slight wind in the treetops.

Then a terrified scream split the night. It was ahead of him, and a little more to the left. "Fritz, answer me!"

"Ulrich? Can you hear me?"

"Yes, Fritz. Where are you?"

"I . . . I don't know."

"Just keep talking, and I will find you." Ulrich thought that Fritz's voice sounded strained and frightened.

"Ulrich, my leg really hurts. I thought I saw a light over here, but when I came toward it, the ground suddenly disappeared."

Ulrich was inching forward with his hands feeling the dark ground in front of him. "Keep talking, Fritz. I am close. I will help."

"I thought it was a lantern or something through the trees, and I thought I could find someone to help us. I guess it was a witch light, like in Tom Sawyer."

Ulrich felt bare rock, then nothing. He laid down on his belly, and inched forward until his head was hanging out over a chasm. In the darkness, it was difficult to tell how large it was. Fritz had fallen into a sinkhole. "Fritz, where are you hurt?"

"I don't know, Herr Scoutmeister. My arm isn't moving too well, and my leg really hurts." Ulrich could hear suppressed tears in the boy's voice.

"Don't move! I will get a light."

* * *

Marlon rolled out of bed promptly at 4:30 a.m., as he had done every morning at any balloon rally he had attended. Balloonists know that in the hour right at dawn, the air is at it's coolest—which aids in hot-air inflation—and the wind was usually still. He didn't want to inflate this monster in anything more than a one- to two-knot ground breeze.

"I'm going to go start breakfast," Reva said, a bit drowsily.

"Woman, don't bother with food right now. I got too much on my mind for that."

"I got something special planned for you, you old goat. I don't want no backtalk, either. You hear me?" The last was delivered with a stern expression, but the twinkling gray eyes and wry smile let Marlon know she

was teasing him.

He grinned. "Yes, ma'am."

* * *

Bernard and Helga were pulling on coats and work gloves. Marlon pulled his old leather gloves from his back pocket and did the same. "I'm kind of glad we don't have everyone in the neighborhood underfoot when we try to launch today."

Bernard nodded. "*Ja*, it is better to fail without an audience."

"What do you mean, fail? Don't you think we'll get it off the ground?" Marlon turned his grin on Helga. "Maybe I shoulda had you get that young man to help us today. We've still got a lot of work ahead to get this beast off the ground." Marlon's eyes twinkled as he teased her. "What was his name? Oh, yeah, Ulrich. Maybe he could come over and help out. We could use another strong back."

"I think he does not like me now," Helga said. "He said he would call last night when he got back from the hike. But he didn't."

"That's too bad. He'd have been a great help."

Bernard frowned. "I think we can do this without that man."

Marlon laughed out loud. "Well, Bernard, we're gonna have to, I guess."

They proceeded out to the meadow. The morning was crisp and cold, just like the weather guessers said it would be. In the pre-dawn, the wind still hadn't risen and that argued for little or no wind at dawn.

"We need to christen this ship before we launch," Marlon said. "And I think I know what to name her. Helga, go ask Reva for something fizzy to launch this with."

Moments later, she returned carrying a beer bottle, and a strange paper contraption, followed by Reva and Agnes.

Laughing, Marlon took the items. "Looks like Reva anticipated what I'd want again."

They stood in a half-circle around the bow of the ship. Marlon didn't want to break a good bottle or leave glass in the meadow. So he opened the flip lid and said, "I hereby christen thee *Upwind*." He splashed about half the beer on the nose of the gondola, and then they shared sips of the rest of the brew.

"Okay, time to get this show on the road. I need to know wind speeds in the upper levels of atmosphere."

While Reva and Agnes went back to the house, Helga picked up the paper construction she had carried from the kitchen. It was a small handmade balloon with a cup on the bottom that held a candle stub. She held the paper form from a string in the top.

Marlon went into the meadow to get a good clear view. From forty feet away, he shouted, "Light it up." Soon the paper balloon was filled with hot air, trying to escape sky ward. The balloon had a white ribbon hanging from the cup.

"Let her go!" Marlon couldn't keep the excitement out of his voice.

The balloon rose gracefully upward. drifting a little away from town. At about two thousand feet, the candle guttered out. Even the ribbon wasn't visible.

"Almost no wind. It'll be a good flight," Marlon said. "Now be careful when we take up the tarps. The dew has settled, and we don't want the envelope wet. Pick the tarp up, and let the water pour off the side. And for heaven's sake, don't step on the envelope."

Bernard and Helga lifted the tarps and poured the little rivulets of water to the side. Marlon stood for a moment, admiring the ship.

Reva came out of the house with a tray. Agnes followed behind her with a steaming pot of tea and four

cups. "Marlon, before you go too far, it's time to eat."

"Woman, I don't have time for that. We need to get this thing off the ground!"

"Now, none of that, Swordfish." She motioned to Bernard, who took the small TV table from under her elbow and set it up. She set the tray on the table, whisked off the towel, and there, steaming invitingly, was a collection of bundles wrapped in napkins.

"What is it?" Marlon stepped closer, and got a whiff of beans and chili. "My favorite. When did you make breakfast burritos?"

"I put them together this morning. Went over to Monica's yesterday, and we made up a batch of refried beans and some of her *carne adovada*. What do you think I was doing all day, lollygagging?"

* * *

The envelope was inflated, and the engines were running. Helga and Bernard had taken their seats in the gondola, and Marlon was doing final checks.

Reva nodded. "Nothing to worry about, Swordfish. Do everything by the numbers, and you'll be a winner."

Marlon wrapped his arms around his wife and leaned his cheek against the top of her head. "Woman, how could I have ever done anything without you?"

"You couldn't, of course." With that, Reva released Marlon, and then stepped back to the truck next to the bow line.

Marlon grinned and climbed into the gondola. He throttled up and looked to where his wife was waiting, next to the truck.

"Reva!" Marlon chopped his hand down, and she pulled the link. The bow line fell away from the truck. With another pull at full burner, the ground fell away just as the sun broke over the horizon.

Helga let out a long sigh and stared at the ground. "Herr Pridmore, this is marvelous!"

"Yes, it is. I remember my first flight. Today's flight will be special for all of us. Where should we go first?"

Helga shrugged and giggled like a little girl. "Oh, Herr Pridmore. Wherever you take us is fine. I just love the trip."

Leveling off at five hundred feet above ground level, Marlon gave the controls a work-out. He steered the airship to the left, then right, all the time drifting slowly backwards. This was definitely not something you could do in a balloon. He maneuvered the controls up and down, watching as small movements of the pitch wheel easily changed the attitude of the ship.

He looked over his shoulder at Bernard and Helga. "So, what do you think?" He had to shout to make himself heard over the fan and the burners.

Bernard was gripping the back of Marlon's seat so hard that his knuckles were white. Helga, on the other hand, was leaning across the edge of the gondola, and waving down at her mother and Reva. "Hello Mutti, hello Reva! Oh, Poppi, everything looks so small!"

Bernard nodded, and forced himself to look down at his wife, then closed his eyes, and continued holding on. Marlon hid a smile and remembered his first trip above the ground. There were a few moments of terror, but he couldn't even remember what that felt like.

The radio, popped a short shot of static. "This is Sweetpea. Ya having fun?" Reva's voice had the same smile in it that he had heard on other balloon flights. She had gone up a couple of times, but enjoyed the chase crew more.

"Swordfish back at ya. This is great! Did you see me steer it in a circle? I've wanted to do this most of my life. For now, I'm gonna take her out about a mile or so. I'll stay in line of sight and radio range."

"Sounds about right to me. If you have to put it down, I'll run the truck out to find you."

"Roger. Swordfish out."

* * *

Ulrich sat at the top of the sinkhole and tried to comfort Fritz through the coldest part of the early morning. The darkness was easier for Fritz to bear when he knew he wasn't alone. Just before dawn, J.D. woke up alone and cold. Ulrich brought him over by the sinkhole and built another fire. They tossed the blanket down to Fritz, but could do nothing else.

Ulrich was still grateful for small miracles. He was certain that if it had really gotten cold last night, they would all be in very bad shape. Something nagged at the back of his brain, something about emergency situations. He couldn't remember what it might be. First, he decided, he would get the boys warm, attend to Fritz's wounds, and then try to remember.

* * *

Reva was changing into her Sunday best when the phone rang. "Hello?"

"Mrs. Pridmore?"

"Yes. Who is this?"

"Ma'am, this is Matt Prickett, from the police department."

"Oh, yes. I remember. Is there a problem, Officer Prickett?"

"Yes, ma'am, there is. Is Marlon around?"

"Oh, dear. I'm afraid he's out right now. Is there something I can do for you?"

"Well, Mrs. Pridmore, we got us a search and rescue situation here. The boy scouts had an activity yesterday out there at the duke's preserve, and three of the troop didn't come home last night. They searched as well as they could with torches and such most of the night, but didn't find any trace of them. So we need all the volunteers to report to their teams."

"Oh, my goodness. Which boys are they?"

There was a rustling as Officer Prickett turned pages. "I have the names Ulrich Schwarz, Fritz Metzger, and J.D. Cunningham. The first one is the assistant scout leader, and the other two are both eleven year olds."

"I'll go out and find Marlon, and call you back."

"Call the department and the dispatcher will know where we are. Let's just hope that they just got lost, and haven't run into some dangerous individuals."

"Okay, Officer. I'll have Marlon call back soon."

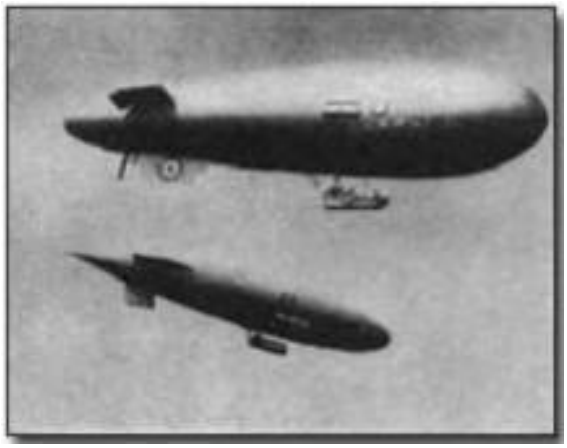
Agnes asked, "Something is wrong? What has happened?"

"I think Helga's sweetheart, Ulrich, is in trouble. We've got to radio Marlon and Bernard."

* * *

Marlon didn't even notice the cold. The burners inside the envelope were keeping a lot of heat close, and it was almost uncomfortably hot when he pulled the burner controls.

Bernard was still clinging to the back of Marlon's seat, and had not quite gotten his eyes open. Helga was reveling in the experience. When she saw Marlon looking, she laughed.



"Oh, Herr Pridmore, this is glorious! This is how I think that angels fly to the heavens."

"Yeah, Helga. I think you got that just about right. Just like an angel." His musings were cut short by a static burst on the radio.

"Marlon, do you read me?"

"You're four by four. Are we late for church or something?"

"Now you quit your teasing and listen to me for a minute. The police department just called. Helga's friend Ulrich is missing. He went out with two eleven-year-old boy scouts yesterday, and they haven't come back. They're putting together a search and rescue, and you need to get back down here and help."

"Don't you think that it would help if the search and rescue team had an eye in the sky? This is the perfect rescue machine."

There was silence from the radio. Marlon knew from long experience that Reva was thinking about what he had said before answering.

"Maybe you're right. I'll find out where they think the boys might be."

* * *

Things were a little more cheerful in the daylight. Ulrich dug out the oatmeal cookies and they divided them for breakfast. Fritz didn't look good. He couldn't speak much, and his leg bent at an odd angle. Ulrich had not climbed down into the hole because the sides were narrow and unstable. Ulrich was afraid crumbling debris would fall on the boy. They could see that Fritz was pale and sweating, though. It was high time to find a way to get him home.

"J.D., you stay here and keep this fire going. Maybe someone will see the smoke and come to help. I will go back to the top of the hill. That reminds me of something." He had finally remembered what had been bothering him. It was from his army training. They told him that three of anything meant emergency, like three gunshots. Or three smoky fires.

At the top of the cliff, he carefully cleared and piled three bonfires. It would not be possible for him to carry Fritz home in his condition. They needed to be found.

Soon, three smoky fires were burning in the open glade. Ulrich went back to the sinkhole. "J.D., look there. Do you see those fires?"

J.D. stood up, and looked at the cliff. "Yeah, I see them."

"Okay. It is your job to take care of them. Don't let them go out, and don't let them get away from you. We don't want a brush fire, just a rescue signal. Keep putting wood on each one. This will help them find us, so they must keep burning and smoking. Can you do that?"

J.D. brightened at being given such a responsibility. "I sure can, Herr Schwarz." He hurried off to watch the

fires.

Ulrich peered over the edge of the hole. Fritz still looked a little grey, and his eyes were not open. This wasn't good. "Fritz, can you hear me?"

The boy groaned and mumbled, but didn't open his eyes. Ulrich got the canteen, tied a cord to it, and lowered it to Fritz. The boy roused a little and sipped from the canteen. He seemed to come more awake, and drank a couple of sips of the water. Ulrich settled down to wait.

* * *

Matt Prickett was just getting ready to assign grid squares to the twenty or thirty men in front of him when another officer stepped up and got his attention.

"Matt, I just got word from the dispatcher that Marlon Pridmore is on his way over and should be here in a minute or two."

"That was quick. Reva must have had a good idea where he was."

The other officer hesitated, and scratched his head. "Yeah, Matt, but you ain't heard the rest of it. The dispatcher said that Reva said to tell you that he's coming over here in a blimp."

"A what?"

"Matt, all I can tell you is what the dispatcher said to me. She said that Reva said that Marlon is coming over here in a blimp.

"I heard a rumor that he was working on a balloon. But I didn't believe it. We'll just have to see what he's got when he gets here."

* * *

With the engines running, it wasn't silent like a hot air balloon would be. Two motorcycle engines put out more noise than Marlon had thought they would. He watched the ground flow away underneath him. He didn't have radar, but he had a stopwatch and estimated they were doing about twenty-six knots. He was concentrating on where the boys might be and making contact with the search and rescue team. He hadn't even considered how the ground troops might react when they caught sight of him. His attention was pulled away from his instruments when he heard shouts from the ground.

Helga was practically standing up in her seat, waving like a maniac. Bernard wasn't. "Helga, sit down this instant, before you fall to your death," he said through clenched teeth.

"Oh Poppi, I'll be all right." A blazing smile lit her dark features, and her hazel eyes gleamed with enjoyment.

Down below, men and boys were running and pointing, and the babble of their voices wafted up to the airship in the eerie way they always do. Marlon spotted Matt Prickett standing in the bed of a pickup with his mouth open.

"Sweetpea, you catching me darlin'?"

"I'm right here. And I'm gonna stay right here till you land."

"Good deal. Okay, tell me where they've been looking for the boys, and where they're gonna go today."

"Gotcha. I'll get back to you in a minute."

Marlon was again glad that the telephones still worked. His radios were not wired quite the same as the others, because they were German, and used slightly different bandwidths. They had their own private channel, but he couldn't contact the team directly.

"Dispatcher says that the scouts searched the eastern side of the preserve last night, and the plan today was to try more to the south," Reva said.

"Sounds good, darlin'. I think we might circle the area and see what we find."

"I'll let the dispatcher know. You take care and don't fall out of that contraption."

"Don't you worry your pretty head about that. I got my seatbelt on. Besides, Bernard is doing enough worrying for the both of us. Helga's having the time of her life, though."

The smile in Reva's voice was clear, even through the static. "I'll just bet she is. Most exciting thing that has happened to her in a blue moon."

* * *

J.D. wiped the smoke out of his eyes after sticking another branch on the middle fire. He felt lonely here away from Ulrich and Fritz. And hungry. Then he heard something.

It was like the chainsaw he had heard a long time ago. He looked at the trees around him, but didn't see anything. And then the day got a little darker, like when a cloud goes over the sun for a moment. J.D. looked up and saw something amazing. It wasn't an airplane, but something entirely different. It reminded him of the Goodyear blimp they used to have at football games when he was little.

"Herr Schwarz! Herr Schwarz, come quick!" J.D. waved his arms over his head to get the assistant scoutmaster's attention. "You have to come and see this. I don't know what it is exactly, but it's coming this way. Hurry!"

* * *

Ulrich dropped the stick he had been using to stir his small fire, and hurried up to the signal fires. J.D. sounded disturbed. It took him a few minutes to reach the boy. And when he did, J.D. stood staring up into the heavens.

Ulrich didn't wonder about that. It was unbelievable, all right. An egg-shaped thing colored in red, black and yellow. Like J.D., Ulrich stood staring with his mouth open. Then he noticed that it was coming toward them.

* * *

"I see something. There to the left," Helga shouted.

Good thing I brought her along, Marlon thought. "You got good eyes, girl. I see it. Three columns of smoke."

Marlon adjusted the yoke, crabbing sideways some. "Helga, I'm gonna come in from downwind, keep a look out." Swinging the tail of the ship as it drifted by the signal, Marlon brought up the throttle as evenly as possible. The airship began to settle. Marlon helped it along with a degree or two of down-thrust from the engines. He picked up his radio handset, and thumbed the button a couple of times.

"Sweetpea, I think we got something. There are three columns of smoke over here. We're past the northwest corner of the preserve."

"All clear, Marlon. I'm relaying the info to the dispatcher now."

* * *

"Ulrich! Ulrich, can you hear me?"

He looked at the flying egg, and then saw a face, and an arm waving. "Helga? Helga, how are you up there?"

The egg came closer, and he saw that it was much bigger than he had thought at first. In fact, it was the largest vehicle he had ever seen, more than a hundred and thirty feet long, and at least forty feet high. And Helga was in a small sort of cart at the bottom.

The ship came closer. Now he could see that not only Helga, but her father, Herr Brenner, and their

employer, Herr Pridmore were in the cart.

"Ulrich, where is Fritz? Where is the other boy?"

Ulrich shouted up, "Fritz fell in a hole over here. We were unable to move him. He has been hurt."

"Stay right there, we will swing around and see him."

The egg moved right overhead where they could look down the hole.

Marlon leaned over the edge, examining the sinkhole, the injured boy, and the path up and down. "Herr Schwarz, I think we can help get the boy out of there. You cut a couple of poles, and use that blanket to make a stretcher. Herr Brenner, here, will help you."

He directed the airship past the signal fires and into the open glade. "I'm gonna drop a rope. But don't touch it until I tell you." He was well aware of the dangers of static electricity. How many times had he seen that footage from the Hindenburg?

Ulrich and J.D. retreated to a large boulder, and watched. Marlon detached the bottom of the bow rope, and let it dangle. It dragged on the ground for a moment. "Okay, Ulrich. Run over here, and grab this rope. You can help steady us as we land. Herr Brenner is climbing out, and I don't want to overbalance."

Ulrich grabbed and held tight to the bow rope. Herr Brenner climbed out of the gondola, then leaned back in to retrieve something. But Ulrich didn't notice exactly what. He was looking into Helga's eyes. Truly, she was the most beautiful woman he had ever seen. Her cheeks were red from the wind, and her hair was fly-away and tangled. But the look on her face was priceless. Her hazel eyes seemed to pull him into deep water. He hoped that she would continue to look at him like that forever.

"All right, you two." Marlon grinned when he saw the two young people gaze at each other as if they were seeing each other for the first time. "You'll have time for that later. Right now, we gotta get this rig back in the air."

Ulrich blushed and hurried backwards. He still didn't take his eyes from Helga. He stepped backward until he ran into J.D., and they both watch the airship lift off the ground.

"You boys get that stretcher put together. I think that with Bernard's help, you will be able to get Fritz up here to the landing zone."

* * *

"Swordfish, you got info for me?"

"Reva, you got the prettiest voice." Reva could feel the blush. Here the man was saying things like that when there was an emergency going on.

"Enough of that. Have you got the boys?"

"Yeah, I got 'em spotted, but one is hurt. I need you to call the hospital and let them know."

"Who's hurt?"

"It's Fritz. He's in bad shape. We have to make this quick. Tell the hospital we have the boy, Tell 'em we're inbound. ETA about thirty minutes."

* * *

The men wrapped the blanket around two saplings, and pinned the ends down to create a rough stretcher. Ulrich and Bernard carried it to the side of the hole and examined the problem. They had to lift Fritz up out of the hole without hurting him more than they had to, and get him on the stretcher for the airship to carry.

Ulrich took the rope and tied a bowline on a bight, making a boson's chair. Then they lowered the chair down to the injured boy.

In his best fatherly voice, Bernard instructed Fritz. "Lad, when this rope comes down, slip it underneath

you like a chair. Then Herr Schwarz and I will pull you up. Hang on tight."

Fritz whimpered a little as the rope lifted him. Tears were streaming from his eyes, and he was holding on the rope with the whitened knuckles of one hand as he came to ground level. Gently, the men took him by the shoulders and hips, and laid him on the stretcher. They splinted the injured leg to the other leg, and bound them both together.

Before picking up the stretcher for the trip back to the glade, Ulrich said, "J.D., you put out this fire, like they showed you in scouts. Use that stick as your shovel, and pour the rest of the water from the canteen on it. I don't want to see any smoke. We will keep the signal fires over there smoking until the others get here."

"Yes, sir."

Ulrich and Bernard carried Fritz to the large boulder. It was worrisome that with every bump and jolt, Fritz would groan a little.

They carefully put him on the ground, and signaled the airship. Not too long now, and everything would be all right.

* * *

"Hello, who is this?" The man's voice sounded almost as frustrated and harried as Reva had felt a few moments earlier.

"This is Reva Pridmore, and I'm trying to let someone over there know that you have a patient arriving in about fifteen minutes."

"Okay, I got that. How are they arriving?"

Reva hesitated a moment, then dove in. "They're coming in on an airship. You know, like a blimp?"

There were a couple of moments of silence, and then the man said, "You mean it's like a life flight? I think we can handle it. I'll get a gurney and a couple of men out into the parking lot to meet it. Don't worry, I'll take care of everything."

* * *

Helga had not taken her eyes from Ulrich and her father. They were both busy taking care of the poor little boy. Then Ulrich looked up at her again, and began to wave his scout scarf.

"Herr Pridmore, I think they are ready. Ulrich is waving."

After settling the airship to the ground, Marlon had Helga pull the pin from the middle seat, and it laid down flat, like a bed. He waved Ulrich and Bernard over. They carefully placed Fritz and the stretcher into the gondola, and stepped back.

Marlon handed another canteen to Ulrich. "You take care, I've got to get this little fellow to the hospital double quick. The search and rescue team will get here as fast as they can." Marlon pulled both the handles to the burners, and pivoted the engines so they were thrusting straight down. Balancing on the thrust and with the heat in the balloon increasing, the air ship rose rapidly in to the air. Still at a full burn Marlon began pivoting the engines to thrust them forward.

He thought for a moment, then eased the throttles all the way to the stops. *Hilde always said that a ship like this could do fifty kph. I'm gonna call him on that.* He could feel the pull of acceleration, and the cold wind whipping past the windshield.

* * *

The parking lot at the hospital resembled a hill of ants that had been kicked open by a curious boy. People hurried everywhere, carrying supplies, watching the sky for the life flight, or just standing in the way gawking.

"All right, listen up!" It was the ER doctor and, as hospital protocol required, all personnel stopped for a moment to listen. "I want this area cleared of anyone who doesn't have a real job. The rest of you, stay over there on the grass. I don't need any rubber-neckers underfoot."

The crowd sorted itself out, and the tumult died down for a moment. The sound of a couple of trucks could be heard down the road, and a police car pulled into the parking lot.

"Albert, get that cop car out of our landing zone, then find out what he wants." All eyes looked into the sky. No one knew exactly what to expect. No description of the airship had been given to anyone.

"There it is! I see it!"

"Wow, it's beautiful!"

"*Coool*."

"Okay, everybody. Just like we practiced it in the drill, only with a blimp instead of an ambulance."

* * *

Marlon looked down in frustration. "This thing needs a horn." The blimp was rapidly approaching the hospital. Pitching down, Marlon began to ease off the throttles.

He leaned over the side and shouted, "Grab the rope. Grab the rope!" The bowline was already dancing across the parking lot.

Luckily, they came to ground with a gentle thump. The gondola slid forward to a stop in the parking lot. As people swarmed over, he yelled, "Grab the sides of the car, so we can stay down." He ignored the furor that was going on behind him as the boy was removed, and people were already shouting orders in incomprehensible medical jargon.

Grinning, he picked up the radio again. "Reva, could you pack up some kind of picnic? I could run it back out to those boys in the bush, and let them have something to eat. They haven't had much since yesterday."

"That's a really good idea, Marlon. You wait there. I'll be there in two shakes of a lamb's tail. Then we'll go home for a proper celebration."

Marlon kept the burners going periodically to keep the envelope inflated, but not lift them off the ground. He had wrangled a couple of bystanders to hook their elbows over the edge of the gondola to keep it on the ground.

One of the men holding the basket grinned. "Marlon, when you gonna build one of these for me?" His jibe stirred laughter from those standing around doing nothing.

"Well, I guess that depends. I'm willing to advise any one of you who wants to build one, but you're gonna have to do the building of it. I'm outta the balloon-making business. Got more than enough on my plate right now."

* * *

Bernard, Ulrich and J.D. were sitting near one of the fires. With the rescue and the excitement over, they all felt just a little let down.

J.D. spoke first. "I wonder how long it will be until they find us?"

"Not so long. You will be home before supper." Seeing the worry in the boy's eyes, Bernard grinned and said, "And if you're hungry now, you can always have an extra drink of water."

Ulrich had been staring at the sky, the last place he had seen Helga. He couldn't believe how wonderful she really was. He had been watching her, and thinking that in a couple of years he would like to settle down with someone like her. Now it seemed much more urgent. He needed a good job, and a bank account, and somewhere decent they could live. It would take at least that much for her father to consent to . . .

"There they are again!" J.D. was on his feet, jumping up and down and pointing. And sure enough, the flying egg had returned. As it came close, Helga leaned out and waved again.

After the landing, Marlon called from the front of the gondola. "We came back to take J.D. home, if he thinks he can stand to fly in this thing."

J.D. hesitated for only a flicker of a moment, then darted to the gondola, jumped over the side, and snapped his seatbelt.

Marlon laughed. "I guess he really wants his mama's cooking. And speaking of food, Helga's got something special."

She bent down and reappeared with a basket. "It is from Frau Pridmore and my mother. I hope you like it."

The airship lifted off the ground again, and Ulrich still stood with the basket in hand, watching.

"And Ulrich, I expect you to call the moment you arrive home, so that we know you're all right."

"I will call, Helga. As soon as I step foot in Frau Moss' house."

Bernard frowned at Ulrich's enthusiasm, and shook his head. It didn't seem as if he was going to be able to keep his daughter from this young man. Perhaps it was time to get used to the idea.

Marlon leaned over the edge of the gondola and waved. "You boys keep out of trouble. Reva says that search and rescue is already halfway here. Be good."

* * *

The sunset painted the sky before Bernard arrived back home. The clouds that had been threatening rain all afternoon cleared and the sun was glorious through the trees to the west. Reva and Agnes had prepared a sumptuous feast for the Sabbath, and everything was ready when Bernard came through the front door.

"Did J.D. get home? Will Fritz be all right? And Herr Schwarz?" Helga tried to sound concerned with the scouts, but everyone could tell that she wanted to know about the scoutmaster.

"Yes, *Liebchen*, everything is good. The police tell me that Fritz didn't need surgery, and is conscious. His parents are at the hospital, and J.D. is home eating fried chicken and mashed potatoes." He frowned a little at his daughter, and didn't mention anyone else.

Marlon slapped Bernard's shoulder. "I'm glad you finally got home. You know, if you had stayed with me, you'd a been here a couple of hours ago."

Bernard held up his hands as if to stop any more such suggestions and began to take off his gloves. "No, my friend, I've had my first and last ride in your airship. If God had intended for me to fly, I would have been born with feathers."

"Oh, Poppi, I think it was wonderful. I can't wait to go again." Helga's eyes still gleamed, and she seemed almost a different girl. She had more of a confident air about her as though she had seen what she wanted, and was going to do her best to get it.

"Now hold on there, Bernard. We still have some business to take care of."

"What is it that is so important? I've not had any decent food since this morning."

Agnes whirled around and put her fists on her hips. "Why you terrible man. How could you say something like that, after the beautiful picnic Frau Reva and I sent to you? Now you just turn yourself around and go out to the barn. We have an important ceremony."

Bernard turned and walked back out into the night while the rest followed. Around back, near the barn, he could see a dark lantern standing on a small table, along with some papers, and a bottle of beer.

Marlon stepped up to the table and lit the lantern. He began in a sonorous voice. "As long as men have been flying in hot air contraptions, they have been honored with entry into the Society of Fire and Air. The

tradition is ancient—or I guess it will be—so you must do as I say. Bernard, you stand here. Helga, over here next to him."

Bernard and his daughter obediently lined up shoulder to shoulder, facing the table. Reva and Agnes stood behind Marlon, who was next to the card table.

"Mother Nature has taken you into the skies and returned you gently to Earth. So you become new creatures, that fly through the air.

"Now, both of you kneel on the ground." Marlon turned to the table, and picked up a long wooden match. He lit it in the lantern, picked up the beer bottle, and set a small piece of Bernard's hair on fire. Before the frightened man could jump up, Marlon poured beer on the flame and put it out. Not even an inch of hair was gone.

He reached over, and caught an end of Helga's hair, but she knew what was coming and held still. The beer drenched her head as well.

"The fire symbolizes the power to reach the heavens, and the beer symbolizes the power to celebrate our return to earth. Welcome to the ranks of the aeronauts!"

Agnes stepped up to Bernard, gave him a ceremonial kiss on the cheek and handed him a small towel. Reva held a towel for Helga, but they could hear the telephone ringing.

"Oh, it must be for me!" Helga grabbed the towel, and sprinted off for the back porch to answer the phone. Nobody had any doubts that the young scoutmaster was checking in as promised.

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Written by Douglas W. Jones

12th of Sivan, 5391 (June 12, 1631)

As Yossie walked down the road Thursday morning, he was struck by an unlikely fact. His surroundings no longer shocked him. When he'd arrived in Grantville, the well-painted houses made of sawn planks had seemed very alien. Now, only a week later, he was living in such a house in the outlying village of Deborah. Then, the sight of the yellow buses taking children to the huge school down the valley would have frightened him. Now, he had ridden such a bus once, and he was about to ride one again.

The marvels that Grantville had somehow brought from the distant future were overwhelming, but after a week, Yossie was starting to see more. The future world from which Grantville had come may have had its wonders, but it had not always been kind to Grantville.

In the world Yossie knew, he could blame abandoned houses and recent ruins on the war that had now lasted for more than a decade. As he passed the remains of abandoned buildings that divided upper Deborah from lower Deborah, he wondered what had happened in Grantville's world to cause such damage.

When he came to the main road through lower Deborah, Yossie put aside his questions. Two men were standing on the corner where he'd been told to wait for the bus. They were wearing the closely cut trousers of faded blue twill that many Grantvillers favored, but his eyes were on their helmets. They were not like the military helmets he knew, and their colors were both bright and strange.

The day before, Yossie had gone to a meeting in Grantville for refugees who wanted work. Most of the Grantvillers with jobs to offer needed the help of translators to address their German-speaking audience. The man who spoke for Grantville's coal mine had been an exception, speaking fluent but oddly accented German.

Yossie had heard several times about the mine, but he had never seriously considered working there until that meeting. The man who'd spoken wasn't a very good salesman, although he did try. He spoke about how important the mine was to Grantville, and about the value of the coal rock they would mine. That was not what moved Yossie. The first thing that impressed him was the man's apparent enthusiasm for working in the mine, while the second was his plain-spoken honesty about the dangers of the work.

Yossie was also curious about the man's strange position at the mine. He'd said that he wasn't the owner or foreman or overseer, but just a *mine safety engineer*. The term was strange, and after he'd explained it, the idea was even stranger. Yossie had never imagined that a nobleman or company would hire someone just to prevent others from hurting themselves.

The bus interrupted Yossie's thoughts as it rumbled into view. After it stopped, he hesitated briefly, watching the Grantvillers get on. The smell and noise were still strange, but if the Grantvillers could ride, he could too.

The bus was another example of Grantville's odd mixture of wealth and disrepair. Yossie couldn't even begin to estimate the value of the machine, but he was sure that it was immense. Why, then, had nobody made an effort to repair some of the torn seats?

The bus stopped several times on its way through Grantville, picking up more men at each stop. The

Grantvillers rode together at the front talking and laughing. It seemed that they all knew each other. The Germans riding in back were quieter. For many, this was their first ride on such a vehicle. They were all refugees as well, strangers in Grantville and mostly strangers to each other.

At a stop in central Grantville, a man sat down beside Yossie. "I'm Thomas Schmidt," he said said as the bus lurched onward. "Who are you? I saw you talking to Herr Koch yesterday."

"Joseph Hanauer," Yossie answered, puzzled by the man's accent. It was not the Thuringian accent he was growing used to, nor any accent he had heard in the lands to the west.

A month ago, he would not have expected a Christian stranger to sit by him. Now, Yossie understood that his status as a Jew was invisible to the man. Yossie was not trying to hide it. His clothing proclaimed that he was a Jew, but the Germans of the Thüringerwald didn't seem to understand what would have been obvious to those of the lands to the west.

"Who is Herr Koch? Do you mean the man from the mine?" Yossie asked.

"Yes," Thomas said. "Herr Koch said this mine needed a smith, and I am the son of the son of a smith. If it can be made of iron, I can make it. Do you have a trade?"

Yossie started to tell about the print shop in Hanau. The bus turned onto a well-graded gravel road that followed the curve of a side valley while he talked. Yossie had just started to explain that he hadn't been an apprentice but merely a common laborer when the view out the window drove thoughts of Hanau from his mind.

A line of alien structures came into sight. Two round gray towers dominated the curving row of buildings that followed the valley floor. The complex was almost half a mile long, and each building was linked to the next by a long sloping tube. The towers looked like they might be made of very fine stonework, but the other parts were a mystery. Were the rust stains on some buildings evidence that they were made entirely of iron?

The valley ended abruptly in a high black cliff not far beyond the strange structures. Yossie knew those cliffs, but neither he nor anyone else understood them. They marked the border between the familiar German lands and the strange land of Grantville that had somehow come from almost four centuries in the future.

One of the Grantvillers riding at the front of the bus stood up, holding the seats at each side for support as he addressed them, in English. "Welcome to Murphy's Run Mine, folks."

The bus went past many of the mine buildings and through a gate in the woven wire fence that paralleled the road. They passed a strange framework with great wheels on top and then came to a stop.

Yossie recognized the man waiting for them despite the helmet he was wearing. It was the man Thomas Schmidt had called Herr Koch.

"Good morning, *Guten morgen*," he said, after they had gotten off of the bus. "I am Ron Koch," he said, and then he repeated himself in strangely accented but fluent German. "Our job today is to take this thing apart." He waved at a long line of machinery that ran up the side of the valley.

After giving more detail about the day's work, he announced that each of the Grantvillers would begin the day by supervising one or two of the new men. Then he began calling out names and handing out slips of paper. Yossie's slip of paper said "Joseph Hanauer arbeit mit Bob Eckerlin." Yossie was briefly puzzled by the printing. It was blurry, almost as if a layer of inked cloth had been set between the type and the paper as it was printed.

After a bit of confusion, Yossie found Bob Eckerlin. Each of them had pronounced the name of the other

so badly that Yossie wasn't sure of their pairing until he'd seen Bob's sheet of paper. Bob's paper was printed in the same odd way as his own, but it said much more, and all in English.

For the next few hours, Yossie did his best to do as Bob directed. Bob began by showing Yossie how to wear a helmet like those worn by the Grantvillers. The *hard hat*, as it was known, had a complex web of straps which had to be adjusted to make it fit his head. It was lighter than he expected and surprisingly comfortable, but it was some time before he got used to wearing it instead of his own felt hat.

Yossie and Bob had the task of removing things called *rollers* from the long framework that led up the hill away from a strange structure in the valley. There seemed to be hundreds of these rollers, and Yossie could easily see how their arrangement had allowed something to slide along the structure with almost no resistance. Each roller was held in place by *screws* that worked exactly the same way as the great screw of a printing press. All of them were iron, though, and perfectly identical.

Bob Eckerlin knew almost no German, except a few stock phrases, but he knew enough to teach Yossie the names of things. They were using *wrenches* to remove *bolts* from the *rollers* that were part of the *conveyor*, and then putting the smaller parts in a cleverly made metal *bucket*.

Unfortunately, Bob's sparse German was insufficient to explain what it was that this conveyor had once done. Above them, the conveyor disappeared over the curve of the ridge, in the direction of the ring of black cliffs that marked what some Grantvillers called the *Ring of Fire*. Only a week ago Yossie had looked down those cliffs to see Grantville for the first time.

Working up on the side of the valley, they had a good view. The conveyor rose from the base of a metal building and what looked like another conveyor ran from there up to the top of a round gray tower. More conveyors linked that tower to a black building, and there were towers and conveyors beyond that.

Other crews were at work along the conveyor. Some were removing the arched roof over the rollers. Others were doing more mysterious things. A teamster with a freight wagon made regular trips along the conveyor taking loads of salvaged material down the hill.

Yossie enjoyed the view of the thick forests covering the hills but he wondered why the cleared land in the valley and along the conveyor looked so poorly tended. Much of the land looked like it had been roughly plowed and then abandoned to grow weeds and scrub.

Around midmorning, Ron Koch called a break. "Does anyone have questions?" he asked.

Many of the men were drinking water from strange conical paper cups, but Yossie ignored the offer of a drink. He was suspicious of the water and he was puzzled about the kosher status of the cup. A tin cup would have posed no problem, but paper cups were a novelty and he doubted that the glue holding them together was made from kosher hide.

"What was this thing?" someone asked, pointing to the spidery structure of the conveyor.

"A *conveyor belt*," Ron Koch said. "It was used to move waste from the coal washing plant to the waste pond. The pond was just outside the Ring of Fire, so we need a new place to put our waste.

"There was a sheet like a wide belt that rode on these rollers. The belt carried the waste. We removed the belt already. We can use it down at the mine when other belts break. We need to get all the iron here, that is your job."

"Do we get to keep these helmets?" someone called out.

"Yes, so long as you work for the mine. If you quit your job, you must return them."

"I thought we were going to mine coal," someone else said.

"We will, "Ron said. "And soon, I hope. First, though, we need to get the mine ready. For that, we need to

make some things from the iron we get here."

"But where is this coal?" another man asked. It was Thomas Schmidt, the man Yossie had spoken with on the bus.

"The *Pittsburgh* coal is about four hundred feet below you," Ron answered. "There are other layers, but that is the big one."

"When we came here this morning, you called this place the mine," another man said. "I'm a miner, and I still see no mine. Where is the hole in the ground?"

"All the buildings down there are part of the mine," Ron said. "See those towers with great wheels on their tops? Those are the *headframes*, the hoists built over the holes. The west one is for lifting people in and out, the east one is for lifting coal. The big towers are *silos* for storing coal. The building between them is for washing the coal."

After the break, Bob Eckerlin left them, and Yossie was paired with Thomas Schmidt. "So Joseph," Thomas said, as they worked at opposite ends of a roller. "You said you came from some town near Frankfort. Was it a Protestant town?"

Yossie knew he was being asked his religion, but he wanted to avoid that question, so he answered literally. "Hanau is just up the river Main from Frankfort. That land is all borders, with Catholics to the south, Lutherans to the north, and Calvinists to the east. All of them come together in Hanau, and we have a colony of Walloon Calvinists too."

"Before I came to Grantville, I would have thought that was crazy," Thomas said. "Now, I am not so sure."

"Grantvillers are a shock," Yossie said. "I have never met anyone like them."

"Where I come from, we were all Lutherans," Thomas grumbled.

"Where is that?" Yossie asked, before putting his weight into loosening the next bolt.

"North of here, on the edge of the Harz mountains, a town called Thale." Thomas grunted as he started the bolt turning on his end. "It was too close to Magdeburg so we came south when foragers began stripping the countryside all around. I thank God that we left when we did."

He paused, with a pained look on his face. "Just a few weeks ago we had to run again. A band of stragglers came and burned the village outside Jena where we were staying, may they be eternally cursed. We didn't run far enough the first time."

Thomas and Yossie lifted the roller free and set it on the edge of the walkway, and then Thomas spoke again. "Why did you leave Hanau with the war so far away from you?"

"The man I worked for died, may his memory be a blessing," Yossie answered. He didn't want to talk about himself, so he changed the subject as they began work on the next roller. "Thomas, you said that you were a smith. I know a little bit about smithing. How did they make this thing?"

Thomas looked baffled. "I have no idea. There are no hammer marks on the ironwork, and all these bolts and rollers seem perfectly identical."

That topic occupied them for a good part of the day as they worked their way up the conveyor. Yossie wasn't bothered by the identical bolts because of his experience with printing type, but he had to explain to Thomas how type is cast so that all the copies of each letter are perfectly identical.

In turn, Thomas had to explain why the ironwork bothered him so much. "This is all wrought iron, it must be," he said, banging his wrench against one of the bars of the conveyor framework. "Nothing else would ring like that. If it is wrought iron, it was hammered to shape, but there are no hammer marks."

He paused to run his fingers over one of the joints in the structure. "These two bars look like they were joined by melting. I could join lead bars that way, but these are iron. Nothing I know would make enough heat to do that, but most of the joints in this thing are made this way. It is as if welding was easier than riveting."

When they stopped work for the midday meal, the divide between Germans and Grantvillers was apparent in a new way. The Germans had all been told to bring food. They had, in bundles or in baskets. In contrast, all of the Grantvillers seemed to have metal boxes or pails to hold their food. Many of them had metal bottles of some evil smelling black drink that smoked as if it was hot, even after being left all morning.

Yossie's bundle held a hard chunk of the sausage he had helped make less than a month ago in Kissingen, a small loaf of home-baked bread, and a bottle of watered wine. Some of the Germans had less, few had anything more elaborate.

Yossie considered the bread he was eating to be something of a miracle. The house they were living in had a very strange kitchen, with an even stranger oven. They had not even understood that it was an oven until the old lady who owned the house showed them how it worked, and then Yitzach ben Zvi had filled the whole house with smoke when he lit a fire in it to make it kosher.

After he'd eaten, Yossie left the group to say the grace after meals. He walked well away before he pulled his *bentscher* out of his pocket. He didn't want anyone to see the Hebrew text of the slim little prayerbook or to hear him chanting the long prayer in that tongue. Grantville was supposed to be indifferent to the fact that he was a Jew, but Yossie wasn't ready to test that indifference, much less the tolerance of his

German coworkers.

That afternoon, there seemed to be no end to the job of removing rollers. Yossie and Thomas were getting better at it, but the number of rollers to be removed was immense. Guessing the total number was an interesting challenge. The conveyor had a set of three rollers every few feet, and if it ran all of the way to the cliffs of the Ring of Fire without a change of direction, they agreed that there must be well over a thousand rollers to remove.

As the afternoon passed, Yossie told stories of the trip east. He said something of the group he'd traveled with, but he carefully avoided all mention of religion. What seemed to interest Thomas most were stories of the smithies and glassworks he'd seen in the Spessart and in the Thüringerwald.

In turn, Thomas told of the Harz mountains south of his home in Thale. He said nothing of his encounters with the war, his departure from Thale or his more recent flight. He'd hinted that he had a family, but he never mentioned them. Instead, he focused on his old smithy and the peaceful years before the war had come to his home.

By the end of the afternoon they were working in silence, and they remained silent on the bus ride home. It had been a long hard day doing very strange work. Yossie was content to sit quietly on the bus and passively watch as it followed the road into Grantville.

When he said goodbye to Thomas, Yossie was startled to realize that, for the first time in his life, he was not an alien Jew among Germans. Despite the gulf that separated them, he and Thomas were as similar as brothers when compared to the Grantvillers. They were two strangers in a very strange land.

When Moses had named his son *Gershem*, which means "a stranger there," he was describing his experience in the land of Midian. Yossie wondered if Midian could possibly have been as strange to Moses as Grantville was to him.

16th of Sivan, 5391 (June 16, 1631)

By Tuesday of the next week, they had stripped almost everything from the upper end of the conveyor. Where it had once gone somewhere beyond the wall of cliffs that bordered the Ring of Fire, it now ended above a small hollow. From there to the cliffs, it had been reduced to bare ironwork, and parts of that had already been cut up.

Yossie spent the morning assigned to work with an American woman named Gayle. He had heard rumors that one of the American miners was a woman, but that didn't prepare him for the fact. From a distance, he might not have known that she was a woman until he heard her voice. She was dressed like a man, in blue twill trousers just like the men of Grantville wore, and her helmet was no different from a man's.

Gayle was an *electrician*, which meant that she worked with the mysteries of electricity. Yossie already knew that the Americans burned electricity in their lights. Apparently, the conveyors had also burned electricity. For the entire morning, Yossie helped Gayle disassemble the electric wires for a device Gayle called a *conveyor drive motor*.

Every day, Yossie had been assigned to one of the Americans for at least an hour, and sometimes much longer. Ron had explained that he wanted the Americans and Germans to work together so that they would learn from each other, and he wanted to let the Germans try their hands at many different jobs.

Yossie could see the wisdom in the American plan. At the same time, he felt awkward being paired with a

woman. In the world he knew, it was improper for a man to touch a woman who was not his close relative, and even taking something from her hand or handing something to her was improper.

The right way for a man to give something to a woman was to set it down somewhere within her easy reach. He expected her to do the same when passing tools to him. Again and again, Yossie was frustrated. Either there was no place to set what he was trying to give Gayle, or she would try to pass things directly to him.

Gayle seemed mildly amused by his awkwardness. Several times, she asked him what was wrong, making it clear that she knew that he was embarrassed. Unfortunately, Yossie's rudimentary English and Gayle's rudimentary German didn't allow for any useful explanation.

* * *

After their lunch break, Thomas Schmidt called Yossie over. "You said you'd done some smith work? Do you want to be my helper?"

"What help do you need?"

"Herr Koch wants a smithy. They have some marvelous tools here. They even have saws that can cut iron and torches that can melt it. Those will wear out, though, and they say that they can't be replaced. If I can make tools to cut iron, I can replace them."

Yossie followed Thomas past the towering iron structure that stood over the entrance to the mine. The Grantvillers called it the *pit head*. A low building next to it housed some kind of machine that made a constant low rumble.

The building beyond the pit head had doors along one wall that were wide enough to drive a wagon through. Thomas walked around the end of the building to a newly built shed where a mixed group men were at work.

"Here is our new forge," Thomas said, gesturing expansively. "It isn't much yet, but we will see what we can do."

The smithy was roofed with the rippled metal that was used for so many buildings at the mine. A half-built chimney stood over a hearth that filled half of the open side of the shed. On the opposite side, there was a door into the larger building.

"None of that is ready yet." Thomas said. "Come in here. This is the mine workshop. They have a bench and wonderful tools we can try using to make the tools we want."

"What are we trying to make," Yossie asked. Rows of shelves filled one side of the room, and several strange iron machines stood on the floor.

Thomas went to a bench along the back wall of the workshop. "Here is the problem," he said, picking up a brightly polished piece of silver. It was bent into a broad U shape, with a dull metal ribbon stretched across the opening and a black handle on one side. "This is one of their metal cutting saws. See how fine the teeth are? It is like a file cut into a slice the thickness of a ribbon."

Thomas began to saw a rusty iron bar, and then paused after only a few strokes. "The trouble is," he said, "these saw blades are not made to be sharpened. They have hundreds of them, but when they are gone, they will have no way to do this kind of cutting. Here, finish this for me. Be careful with this beautiful saw."

Yossie took the saw and set gingerly to work. The iron bar was as big around as his thumb and rusty, with an odd pattern of lumps along it. The saw teeth cut into the metal bar quickly once Yossie learned to bear down properly.

"What are we making?" Yossie asked, after he'd cut halfway through.

"Chisels," Thomas said. "They have some simple chisels, but to cut up the conveyor segments, we need bull-nosed cutting chisels. I think the Americans doubt I can cut wrought iron pieces that big. While we wait for the forge to be ready, we can do some work using these American tools."

After Yossie had cut a foot-long chunk from the bar, Thomas showed him how to reposition the bar in the bench vise so Yossie could start a second cut. While Yossie sawed, Thomas set to work grinding the first piece to shape.

"Stop," Thomas said, after Yossie had cut most of the way through a second piece. "Save the saw. You can break the bar now, just bend it back and forth." Then he smiled. "Did I tell you, my wife and I have moved into a house? We have said goodbye to the grounds of the Grantville fair."

"What kind of house?" Yossie asked, after he'd broken the bar. Thomas had said "we" when speaking of his flight, but he'd never said a thing about his family.

"It is not a whole house, just a room. The couple that live there had three children, but two were left behind by the Ring of Fire, so now we have the room those children lived in."

The conversation ended while Thomas went back to grinding, but continued when Yossie finished cutting off the next piece. "How well do you communicate with your new landlord?" he asked.

"Not well. They have a little phrase book, but most of the phrases are very strange." Thomas chuckled. "It's as if the book was printed for use by the ignorant sons of wealthy noblemen."

"What do you mean?"

"There are so many phrases for dealing with servants. It is all very polite and the servants are doing jobs I do not fully understand. How to tell your coach driver to stop, how to ask your servant for more food, how to tell a porter where to put your baggage. Still, the little book is useful. Here, let me show you how to use this grindstone."

Yossie was fascinated by the grindstone. A touch of a little silver toggle on the machine would start or stop it. The stone was tiny compared to every grindstone he had ever seen. When it was running, it spun incredibly fast, and when he touched his work-piece to the turning stone, the stream of sparks was as intense as a flame. He immediately began to think about how such a machine might be applied to type cutting.

Thomas set to work with the saw while he let Yossie try to duplicate the chisels he'd ground. The most time consuming part of the job involved grinding the front third of each chisel to taper down to half of its original diameter. With that done, the final job was to grind a blunt triangular tip.

"How is this?" Yossie asked, handing Thomas the result.

"Not bad for a first effort, but the tip should be off center. The short edge sits in the groove you are cutting."

It took two more tries before Thomas approved the result. "Good. After we case harden it and temper it, it should cut well. This iron the Americans call *rebar* seems to be very good stuff, but we will learn the truth when we put it to the fire."

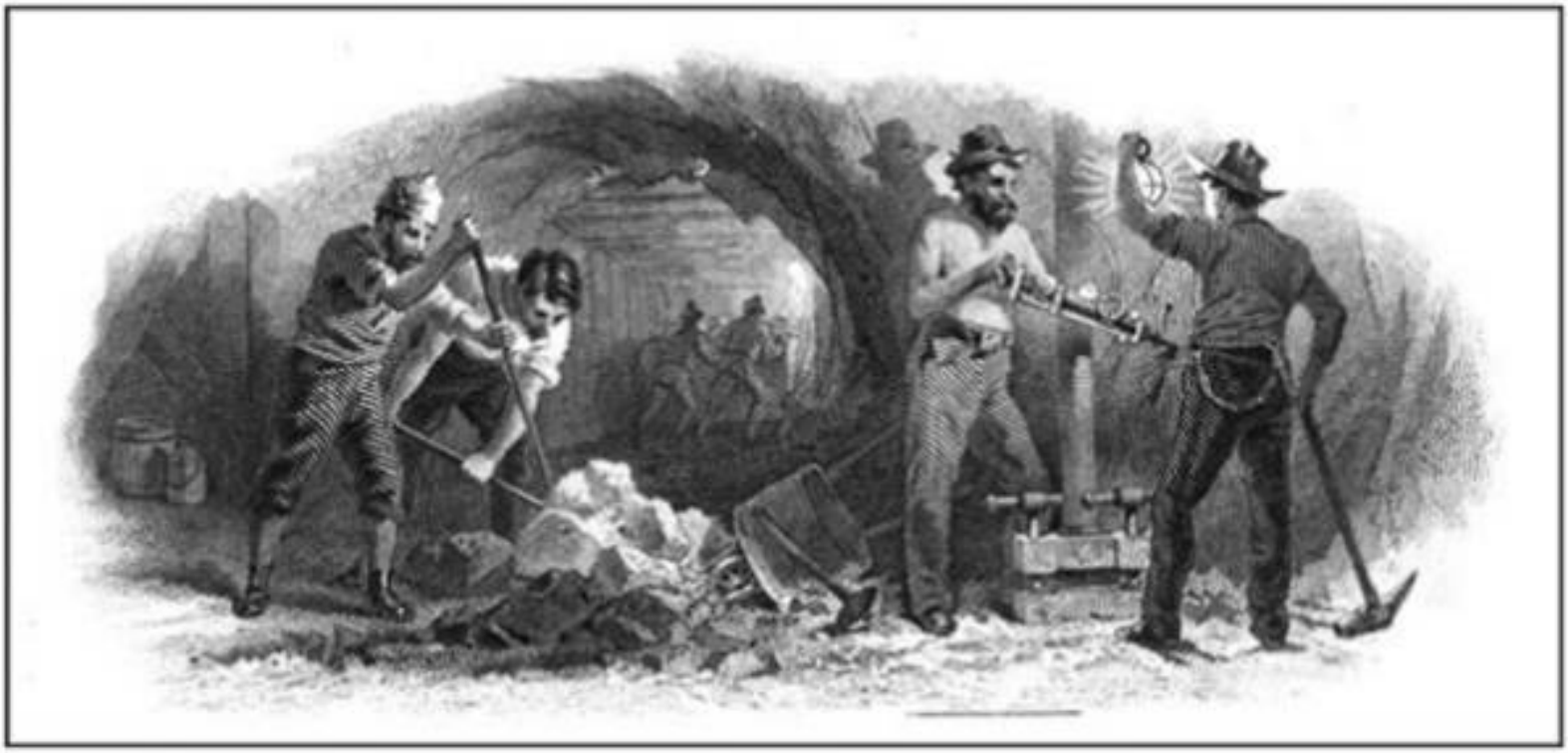
Yossie understood case hardening and tempering. He'd helped harden and temper many type punches in the print shop in Hanau. Those punches had been tiny compared to the chisels he and Thomas were making, but like the chisels, they were made made to cut metal.

"Why are we making so many chisels?"

"You only need one chisel if you have a grindstone to sharpen it every time it gets dull, but when you are

up in the hills trying to cut one of those conveyors, will you take this grindstone with you? A bundle of spare chisels is what you want." Thomas paused. "How are you getting on with your landlord?"

"It is easier now that two of my group have left." Yossie said.



"They found another house?"

"No, the two merchants I came with decided to buy a load of stuff these Americans don't value. Now, they're on a trip selling it so they can buy livestock to bring back."

"Where will they find any buyers? These Americans have wonders, but who today has money to buy? And where will they find livestock? The foragers have stripped the Saale valley."

"Things are better to the west," Yossie said. "They went over the hills to Hildburghausen, we met a merchant there on our trip east. If there is no stock to be had there, they may have to travel as far as Neustadt. There is a big cattle market there."

"I wish them luck in their venture," Thomas said. "This town has too many unused pastures. The open land around this mine could probably support a good herd."

"That was our thought exactly," Yossie said. "There's idle land above Deborah, too. They say it's an old mine pit that was filled in, but it has a good fence around it."

Shortly after they went back to work, they were interrupted by one of the Americans stepping into the shop.

"Tom, come," he said, and then gestured to Yossie. "You too."

"What's going on?" Thomas asked.

"Who knows?" someone said. "They didn't say."

After they'd stood in the crowd for a minute, Thomas picked up the thread of their interrupted conversation. "So how are you getting on with your landlord?"

"One of my companions knows some Latin, and so does our landlord's wife." Yossie hesitated. Paulette Adducci had explained that the reason she knew some Latin was because she was Catholic. The explanation didn't make much sense to Yossie, but he suspected that Thomas might be as bothered by the

Adducci's Catholicism as by his own Judaism. "She has been trying to teach English to my sister and the other women who are with us."

Someone in the crowd interrupted them. "Someone's coming!"

There was a murmur of voices as they tried to make out who was there. Thomas complained that his eyesight wasn't what it had been, while Yossie couldn't see over the crowd. Two or three men on horseback became three and then two Scots mercenaries and an American as they got closer.

As the horsemen rode up to the crowd, Ron Koch came out of the office. "Men," he began. "You know that we have something of value. Here at the mine, we have tons of iron, and in town we have other things. You also know about the war, about the armies that are loose in the land. We need to worry about how to defend ourselves against anyone who might try to take what we have."

"The man is right," Thomas muttered. "If the Imperials find this place, they will strip it bare."

Yossie nodded, mildly annoyed that he had missed some of what Ron was saying. ". . . so I will let him speak." Ron finished, turning to one of the Scots.

"Who of you has before fired a gun?" the man asked.

Thomas raised his hand, as did several others. Yossie had never held a gun, but neither had most of the others.

"These Americans guns, they are strange, but they are wonderful," the Scot continued. "We have here one you can try. We can use it for practice so we waste not powder nor shot.

"This last week, we saw a few small attacks on the north and east of Grantville. They were stragglers and foragers and we beat them. So long as small bands are all we see, Grantville is safe.

"The trouble is, some of them get away. If they speak to their officers about Grantville, we may face a tercio. That would be two or three thousand men, half with guns. These Americans, they think they can win against such a force. Perhaps they can. It seems that every American man has at least one gun."

Yossie nodded. His elderly landlord Randolph Adducci had at least two guns that he was aware of.

"To be sure we win, we need to prepare. If the raiders come here to the mine, you will have to defend. If a tercio comes, every man must be ready to help. So try this toy gun. Learn how it works."

The American stopped the Scotsman and said something to him. While he waited, Yossie recalled the text he had studied the night before with Rabbi Yakov. Yossie had complained that the opening chapters of the Torah portion for the week were some of the dullest in the whole Bible. The old rabbi's response was to point out the passage giving instructions for blowing the signal trumpets.

"When an enemy comes into your land and you rise to war against him, sound a stuttering call on the trumpets," Yakov had translated. "You say that *Parshas Behaaloscha* begins with dull commandments to the Levites, but think. From this one dull *mitzvah*, we can infer that we are obliged to organize for self defense." Now, it seemed that they were doing exactly that.

For the remainder of the afternoon, they took turns trying to shoot holes in a paper target. When it was his turn, Thomas insisted on learning how the toy gun worked. It didn't use powder, so there was no smoke or flame when a shot was fired. "Ah!" Thomas exclaimed, after the Scotsman had explained that the gun used air. "It is like shooting a cork out of a bellows!"

"Aye," the Scotsman said. "But the balls, they are tiny."

Yossie held back while Germans took their turns with the American gun. He understood his obligation to aid in defending the community, but he had no desire to violate the Christian law that Jews were forbidden to bear arms.

The American eventually noticed that Yossie was hanging back and pointed at him. "You, come," he said, gesturing with one hand while he held the gun in the other. "Shoot."

As Yossie nervously stepped forward to take the gun, one of the Scots looked at him sharply, and then turned to the American as if he was about to say something. Yossie was certain that the man had recognized that he was a Jew, but at the last moment, a baffled expression came over the Scotsman's face and he said nothing.

Yossie's attempts to use the gun were no more successful than those of the Germans, but having never touched a gun before, his failure didn't bother him

27th of Sivan, 5391 (June 27, 1631)

Yossie's second full week at the mine went quickly, but it was filled with anxiety. His traveling companions Yitzach ben Zvi and Moische ben Avram had left town nearly two weeks ago. Every day of the past week, he had come home hoping for their return.

Yossie's anxiety had been increased by the rumors he heard. Stories of troop movements to the north seemed to grow more urgent with each passing day. A week ago, there had been a few families a day arriving at the refugee center at the Grantville Fairground. Now, Yossie had heard that there were tens of families a day. Now, there were stories of an army approaching from the north.

Friday afternoon, the bus passed two groups of refugees in town. It was easy to see that they were new arrivals. Each group had an American guide, and they looked as disoriented as Yossie had been only a few weeks earlier.

When the bus left the center of town to follow Buffalo Creek toward Deborah, Yossie saw what he took to be another refugee group ahead. As refugees went, they looked well off. One man was on horseback and they had a two-horse wagon and some livestock. After a moment, Yossie recognized Yitzach and Moische.

"Stop the bus!" he yelled, grabbing his lunch pail. He leapt out as soon as the driver opened the door.

"Yossie!" Yitzach called, as Yossie ran back toward his friends.

"I expected you on Tuesday, what took you so long?"

"It's partly my fault," Yitzach said. "I wanted to visit Kissingen."

"We were worried. There are rumors of an army coming."

"I know," Yitzach said. "Herr Gutkind of Hildburghausen told us of force coming south in the Ilm valley. Do you think Grantville can stand against a tercio?"

"The Americans seem confident." Yossie turned to walk beside the wagon. "To be sure they will win they want everyone to learn to shoot a gun. We do some shooting practice at the mine every day."

"So now you are becoming a soldier?" Moische arched his eyebrows.

Yossie laughed. "Hardly. Most of our practice shooting is with toy guns, they call them *bee-bee* guns, and they shoot a ball the size of a grain of wheat. Tell me about your trip!"

"Taking glassware from Grantville was a wonderful idea," Yitzach said. "But wait until my wife can hear as well. Right now, I'd better round up our cattle."

"Only four?" Yossie asked as Yitzach rode away.

"We sold the others to Herr Mobley," Moische said. "Now that there are only two cows, Yitzach can be a lazy herdsman. Climb up, the wagon is light."

"I see four animals."

"The calves will follow their mothers," Moische said. "We had three more cows with calves, but we lost a calf on the road." He paused. "Reb Yitz is right, though. I want my wife to hear our tales. Tell me about Grantville."

"I am working at the mine, apprenticed to a Saxon smith."

"Apprenticed?" Moische said. "Since when is a Jew an apprentice, and to a Saxon, no less? And aren't you a little old for an apprenticeship?"

"He doesn't know I'm a Jew, and I don't think the miner's guild cares."

"The miners guild? Since when have guilds permitted Jews?"

"The UMWA is a very strange guild, but yes, I am a member now."

For the next few minutes, Yossie talked about his work at the mine smithy. After they had turned off the main road onto Deborah, Moische changed the subject.

"Reb Guildsman Yosef," he said, only half mockingly, "please tell me how my wife is doing."

"She is well," Yossie said. "Frau Adducci is working hard to teach the women English, and she seems eager to learn German."

"How is Herr Adducci?"

Yossie frowned. It had been obvious that Randolph Adducci and his wife were not in full agreement about taking in a refugee group. She seemed convinced that she was doing God's will, and that the three empty bedrooms that her children had once occupied were there for the needs of the homeless. Her husband, on the other hand, had acted quite unhappy about the strangers who had moved into his house.

"Randolph Adducci is still cross much of the time," Yossie said. "but things are better. I think he was unhappy before the Ring of Fire. He is old, and it seems that he is ill. He complains that his feet hurt."

"He is sick?" Moische asked.

"It was only when we started eating with the Adduccis that we found out. Frau Adducci can eat anything, but Herr Adducci must avoid all honey and sweet fruits, and he must have a set amount of bread or flour in every meal."

"You are eating with the Adduccis?"

"Yes. Frau Adducci liked the smell of Chava's cooking, and so they began to work together in the big kitchen. Chava is happy not to be confined to the small kitchen that the Adduccis call the *bar*."

"But how does she manage to keep things kosher?"

"She's very strict about *kashrus*, so she boiled all of the Adducci cooking pots and silverware, and she only uses your crockery at the table. Chava says that Frau Adducci keeps a very clean kitchen. She doesn't know that we keep kosher. I think she sees the care Chava takes as just a foreign kind of cleanliness. To her, it is just one more strange difference between the American world and our world.

"I think it was eating together that helped Herr Adducci. I don't think he'll ever learn German, but he gave me this *lunch pail*."

"What is it?" Moische asked.

"It is for carrying my noon meal to the mine. Herr Adducci was a miner back when the mine here in Deborah was still open."

When they reached the Adducci house, they had time for only the briefest of greetings. Their first priority was to take the horses and cattle to pasture. They'd gotten permission to use a fenced field above the upper village for their goats before they moved to Deborah. The sloping field had once been an open mine pit, or so they'd been told, but nothing visible to Yossie and his friends hinted at that history.

Moische's wife Frumah was outside looking over the wagon when they got back from the pasture. "What are the barrels?" she asked.

"Wine from Kissingen," Moische said, pointing to one barrel, "and grain," he added, pointing to the others. "We came east with a full load, but we sold the rest in town, along with three cows and two calves."

"You went all the way to Kissingen?" Frumah asked. "Was that prudent?"

"We thought so at the time," Moische said. "On the way home, we thought we might have made a mistake. The rumors of war seem to be chasing us. Where are the others?"

"In the kitchen. *Shabbos* is coming and you men had best get ready."

"And what of *Rav* Yakov?"

"He is teaching at the Grantville *cheder*, what they call the *elementary school*. He teaches German to some of the Americans. He is only supposed to work there for two hours after the noon meal every day, but they have a library. He should be here soon." Frumah paused. "Enough talk. You men put things away and get ready."

By sunset, the wagon had been unloaded and parked in the vacant half of the Adducci garage. Everyone had bathed and changed into their good clothes, and the men had convened for their prayers.

Worship was difficult in the Adducci household. They didn't want the Adduccis to know that they were Jews, so they said their prayers in the bedroom that Moische and Frumah were using.

The crucifixes in every room of the Adducci household posed a second problem. Plain Christian crosses were bad enough, but these had statues of the Christian God on them, and it was impossible to see them as anything less than a blatant violation of the commandment forbidding graven images. They covered the crucifixes when they could, but they were careful to leave them exposed whenever the Adduccis might see them.

There were ten people around the dinner table that night, Paulette and Randolph Adducci, Rabbi Yakov, Yitzach Kissinger, his wife Chava and daughter Gitele, Moische Frankfurter and his wife Frumah, and Yossie and his sister Basiya.

Eating with the Adduccis was awkward, and the fact that it was a Sabbath dinner made it doubly so. They couldn't chant *Kiddush* properly over the wine to start their Sabbath dinner. That would reveal who they were. At every meal, the Adduccis added to their discomfort by saying a prayer in the name of the the Christian God before they ate.

Language at the table was another problem. When Randolph Adducci had difficulty understanding what they said, he would complain that he couldn't follow their jabber.

"How was your trip?" Paulette asked.

"*Wir*, we go," Yitzach started. "*Montag*, to Schleüsingen we go by Schwarza way. *Zweitag* to Meiningen."

"Speak English," Randolph insisted.

Paulette sighed. "Dear, if you would just try. Isaac said they went on the Schwarza road to Schleüsingen a week ago Monday, and then to Meiningen on Tuesday."

"Where is this Slushing place?" Randolph asked.

"Dear," Paulette said. "it is a town west of here. Am I right, Moses?"

"*Ya, und* Meiningen is more west."

It took several more rounds to learn that the travelers had reached Neustadt on Wednesday. On Thursday, Yitzach had taken the wagon onward to Kissingen. Meanwhile Moische stayed in Neustadt finding a good price for the glassware they'd brought from Grantville.

"In Neustadt, I hear of *Soldaten*," Moische said. "So, *wir*, we go here on south way, Königshofen und Hildburghausen. In Hildburghausen, I hear *Soldaten* make one tercio. They coming south."

"What's a terci?" Randolph asked.

"A tercio. Three *Tausend Soldaten*," Yakov answered. "One *Tausend* with guns. Two *Tausend* with *Speissen*."

"With what?" Paulette asked?

"A *Speisse*. A *Pfahl mit* a *spitze*," Yakov answered, pantomiming a two handed thrust with a pike.

"Spears," Randolph said. "They'd protect the muskets while they reload. Where is this tercio thing?"

"In north, coming south," Moische answered. "*Zwei Tage*, a *Woch*e."

"Two days or a week!" Paulette said, looking worried. "Can Grantville handle that many?"

"Probably," Randolph said. "Our guns are a damn sight better than anything these krauts have, and the emergency committee is on the ball."

As the Adduccis began speaking to each other, their English was too fast for Yossie to follow.

"People are going to get hurt," Paulette said. "You heard what happened to Dan Frost and Harry Lefferts."

"Damn, I wish I could do something." Randolph said. "If my damned feet didn't hurt so."

Paulette frowned. "Calm down, Randolph."

"Calm down?" he said, turning red. "There's a God damned army coming this way!" He paused, frowning. "Paulette, you phone Tony and Bernadette after dinner, see what they know about this."

Yitzach leaned toward Yossie. "What are they saying?" he asked, in a low tone.

Yossie had no answer, and as the Adduccis' discussion continued, he understood less and less of what they said.

After he'd eaten, Yossie and Moische went out to say the grace after meals under the porch light. *Bentsching* privately to himself drove questions of the approaching army from his mind, but it intensified another burden. Chanting the *Birkas* quietly after the noon meal at the mine had not bothered him, but the Sabbath Grace was different. From the opening words of Psalm 126 to the closing prayer for peace, Yossie ached to chant the long prayer with his companions around the table.

"So," Moische said, after they had pocketed their *bentschers*. "We will soon see what these Americans can do. You seem less worried about our news than our hosts. Why?"

"I told you about the shooting practice at the mine. I have seen the Americans shoot. Bang, bang, bang, with no pause to reload, and every shot hits the center of the target. That was with a gun that the Americans said was a toy. How did you lose a calf?"

"We gave it to a refugee family."

"You just gave it away?"

"I was young, now I am old," Moische said, quoting part of the prayer they had just said.

Nothing more needed to be said. Yossie knew the Hebrew by heart. ". . . and I have never looked on one

who is just and forsaken and let his children go begging for bread."

After a pause, Moische continued in a wry tone. "Besides, they might have robbed us if we hadn't given them the calf."

"Moses!" Paulette called, from inside. "Telephone."

Yossie followed his companion inside, curious. He'd seen a telephone used several times, but he'd never used one himself. Moische looked awkward as he took the strange instrument from Paulette, and for the next several minutes he listened and then spoke, telling again the stories he'd heard on the road.

After he handed the telephone back to Paulette, he looked dazed. "That was odd."

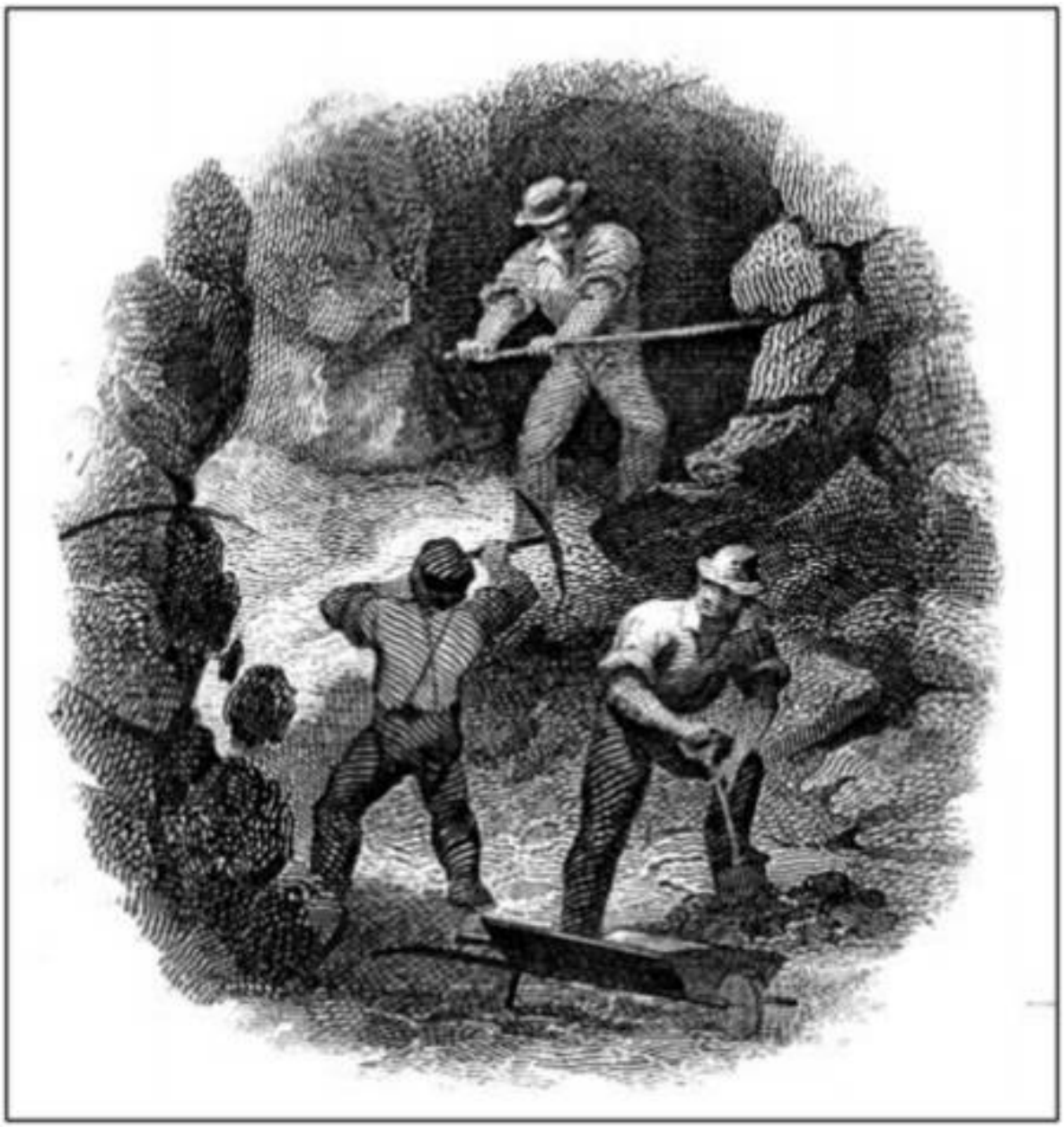
"Who did you talk to?" Frumah asked.

"That woman Bernadette, Paulette's daughter. And someone else, an American. They wanted to hear what we had heard about the soldiers."

"Did they tell you anything?"

"Yes. They already know they will face a tercio. They think it will attack Badenburg soon. That is on the road from the Ilm valley to Grantville. She said that we should not worry. They have been expecting something like this to happen, and they have been preparing for it."

7th of Tamuz, 5391 (July 7, 1631)



Most of the week following the battle at Badenburg was uneventful. Yossie's work at the mine continued uninterrupted. Yitzach and Moische did set off on another mercantile trip west. After the success of their first trip, Moische had decided to send a letter to his cousin Shlomo in Frankfort, inviting him to join them.

The news of the victory and of the huge number of prisoners was certainly interesting. Every evening, Yossie and Yakov shared what they had learned at the mine and at the elementary school, but the news had little direct effect on their lives.

Monday, a week after the battle, Yossie got on the bus expecting things to continue as they had. Thomas was happy to see him and began talking about the celebration the town had after the battle.

Thomas was still talking as they got off of the bus. "Michael Stearns, the *President* of the UMWA was in command at the battle of Badenburg, and he had the place of honor in the procession. What I do not understand is why the Jewess they call *Becky* was also there. The Americans cheered her as if she was as much of a hero as Herr Stearns."

Yossie knew of Grantville's court Jews, members of the famous Abrabanel family. He'd heard Americans speaking of Rebecca Abrabanel, and he was curious to hear what Thomas might have to say about her.

Several mine officials were waiting for them as the bus emptied, so Yossie had no chance to probe Thomas's feelings about Jews. Yossie had begun to recognize some of the officials. Quentin Underwood was there, along with Ken Hobbs, representing the Miner's Guild. Ron Koch's German was by far the best, so as usual, he was their spokesman.

"Men," he said, as the empty bus pulled away. "You know we defeated an army a week ago, and we took hundreds of prisoners. We released most of them. I talked to some of them, to see if they could work at the mine. As soon as the bus gets back, we will welcome them.

"You remember your first days here. Now, you are the ones with experience. To these new workers, you are going to be seen as Americans. Be warned, though. All of them were soldiers, and all of them suffered a terrible defeat a week ago. They are tough, but some of them are still stunned by what happened.

"Many of our new workers are Catholics, and most of you are Protestants. We want you to remember one thing. Our law, our official policy and the rules of the United Mine Workers of America all agree. We do not draw lines between men based on the color of a man's skin, based on his religion, or based on the land of his origin. In our eyes, all men are equal, Catholics, Protestants or Jews. I want you to remember this."

* * *

Yossie's first job every morning was to fire up the forge. The coal they were burning was difficult to light, so Yossie began by lighting a wood fire on the hearth and then he gradually built it up with coal.

Thomas had mixed feelings about the forge the Americans had built. He loved the electric blower that did away with the need for a bellows, but he disliked the coal fire and the sulfur smell it gave off. But even Thomas had to admit that once it was burning properly, the coal fire was good enough to use.

Yossie had built a perfect pile of burning coal perched over the air jet from the blower when two strangers arrived at the forge.

"Thomas Schmidt? Joseph Hanauer?" the older of the two asked, speaking with a backwoods Bavarian accent. "They said we was to work with you."

"And you are?"

"Karl, and this is Fritz."

"Are you smiths?" Thomas asked.

"Till a week ago, we were soldiers," Karl said. "I'd a pike, Fritz a musket."

Thomas glared at them. "What help can you offer here?"

"I was a farrier's apprentice before the army, I've shod plenty of horses since."

"That's something," Thomas said, grudgingly. "And what about you?" he asked turning to the other man.

"Fritz can fix anything," Karl said. "I seen him take apart a wheel lock pistol and put it right."

"Can he speak for himself?"

Fritz nodded. "I speak," he said, slowly and precisely. "And I can't fix everything. These Grantvillers have stuff I can't figure out."

"What's wrong with him?" Thomas asked.

"Bit his tongue in battle," Karl said, with a bit of a grin. "Day ago, 'twas big as a sausage."

"Let's get to work," Thomas said. "Fritz, you tend the fire, try to keep a good mound of coal burning. Add new coal as soon as we take the work off the fire to start hammering, and keep the coal mounded over the air flow so that it is burning hot and clean by the time we finish hammering. Karl, can you follow hammer signals?"

Karl looked baffled, so Thomas had to explain how he would use his small hammer to direct the forging, and then he and Yossie demonstrated. Thomas, as the master smith, held the piece they were forging on the anvil while Yossie swung the long-handled sledge hammer. Thomas used a small hammer to direct each blow of the sledge, tapping the work to show where and how to strike it.

"What are we making?" Karl asked, after he'd taken a turn at the sledge.

"Tongs," Thomas said. "They want twenty pairs for lifting iron rails." He finished mounding the coals around the iron on the hearth and then picked up a finished pair of tongs. "Joseph, help me."

Yossie took one handle while Thomas took the other and then used them to lift a yard-long chunk of rail. "The Americans say this weighs a hundred pounds. The rails they want to move are more than ten times as long."

"So much iron?" Karl asked.

"Yes, and it's not just iron, it's fine steel," Thomas said, going back to the fire and poking at the coals. "There is an iron road to the electricity mill, and they want to connect it with this mine.

"Yossie, Karl," he said, pulling the glowing iron bar from the fire. "Now we will try something. Both of you take hammers, and each of you strike in turn. The work will go much faster."

Yossie had only learned to follow Thomas's hammer signals the week before and Karl was a complete newcomer. They made many mistakes, but by noon, they'd forged another pair of tongs. When the three of them did manage to work together smoothly, it seemed that the rain of hammer blows on hot iron was almost musical.

Yossie had experienced something similar during long press runs in the print shop in Hanau. When the printer, the pressman and the ink boy got into perfect rhythm, the work became like a dance. When that happened, they seemed to get far more done without working any harder than usual.

As they ate their noon meal, Yossie noticed that Fritz was eating very slowly and with extreme care. "You must have really hurt yourself," Yossie said.

Fritz nodded. "I was in the front ranks," he said, carefully.

"Everyone round him was shot down," Karl added.

"Man beside me exploded," Fritz went on. "Bit my tongue to stop scream." He shook his head ruefully. "American guns are horrible. Don't know why I'm alive."

Thomas had been silent, but now he spoke, in a low angry voice. "Were you at Magdeburg?"

"Yes," Fritz said, looking glum.

"The American guns were worse than what you did in Magdeburg? At least the Americans had the mercy to stop shooting when you were defeated."

"I wasn't there when the city fell," Karl said. "I was out foraging."

"And did you show any mercy to the villagers whose food you took?"

A tense silence fell over the group while they finished their meals. The two Bavarians sat apart from Yossie and Thomas, and several times. it seemed that Thomas was about to say something more to them.

When Yossie finished saying the grace after meals, he wanted to take a few minutes at the forge to work on a project of his own. He had a broken knife blade in his pocket, good steel, and he wanted to re-forge it into a punch. He'd helped cut type in Hanau, and in his spare time, he was slowly working on cutting his own Hebrew alphabet, a project that had begun when he'd complained about the letter *shin* in the Hanau type face.

When he got to the forge, he found Thomas stirring the coals with his back to the two Bavarians, pointedly ignoring them.

"So," Thomas said, turning abruptly. The look on his face was grim. "After Magdeburg, where did you go?"

"South to Halberstadt," Karl said, "We stuck it to the Jews there, then followed Father Tilly to Eisleben."

Yossie froze.

"Thale?" Thomas said. "Did you go through Thale?"

"I don't remember the names of the places we visited. Why do you care?"

"Because I come from Thale," Thomas barked. "I lived my whole life there, my smithy was there, until your accursed army drove me out."

Yossie hardly heard a word after the words "we stuck it to the Jews." Karl had said it in passing, as if it had hardly been important. Yossie knew Jews from Halberstadt. Two families had arrived in Hanau's Jewish quarter a decade earlier, bringing stories of mob violence to rival the horrors Yossie had survived as a small child in Frankfurt.

Yossie wanted to confront the Bavarian, but for a Jew to confront a Christian was to invite disaster. Just the day before, Yossie and Rabbi Yakov had spoken at length about whether it was time to tell people that they were Jews. The Americans of Grantville were proud that they didn't ask about a man's religion. Yossie and his companions hadn't set out to live like Spanish Marranos, hiding their Jewishness in fear of the Christian world. That is what they were becoming, and they didn't like it.

They were fairly certain that it was safe to tell the Adduccis that they were Jews. Shortly before the two Bavarians had arrived, Yossie had even begun to think that it might be safe to tell Thomas. Now though, the arrival of the Bavarians made it clear that there was no safety.

While Yossie's recovered his composure, Thomas was losing his.

"Why d'you care 'bout this place, this Magdala?" Karl asked.

"Because I was there!" Thomas choked out. "For a month, I thought I'd found a new home on the road between Jena and Weimar, and then your damned foragers burned me out."

"I was just a pikeman!" Karl said. "Not a general."

Thomas grabbed Karl by the throat and shoved him hard against the chimney of the forge. "It was pikemen like you that killed my daughter!"

"Stop," Yossie shouted. "Karl didn't kill your daughter."

"No," Thomas said, slowly loosening his grip. As he let go and backed away, he looked almost as beaten as Karl.

Yossie found that he was shaking. As he offered a hand to Karl, he wondered what had come over him. From childhood, he'd been taught not to interfere in disputes between Christians, and he was fairly certain that Karl would be among the last to come to the aid of a Jew.

"We didn't go east of Weimar," Fritz said, in Karl's defense. "We were in Erfurt, then south to Ilmenau and Badenburg."

Thomas' anger at the Bavarians was a shock. Yossie had known that Thomas was avoiding talking about his family, but he had always seemed to be a very calm man.

"Come on, folks. We have tongs to make," Thomas said, with a sigh. "Work is easier than yelling at each other."

Shortly after they set to work, Bob Eckerlin stopped outside the forge to watch them. He stepped inside when they put the iron back in the fire to reheat. "Thomas, Joe, I need you to make something."

"*Was*?" Thomas asked.

"Can you come take a look?"

Thomas looked at the iron in the fire and then at Yossie. He hesitated for a moment, and then handed him the small hammer. "Joseph, see what you can do."

As Thomas walked away with Bob, Yossie realized that he'd just been promoted. He wasn't entirely sure he was ready to direct the work of the two Bavarians, but he had to try.

He took hold of the cold end of the bar they'd only begun to forge and pulled it from the fire, setting the hot end on the anvil and tapping it with the small hammer. They'd begun work beating the handle to shape, but it was still far from the long graceful taper that was their goal.

Even with the heavy leather glove he wore on his left hand, each hammer blow sent a shock up his arm. Only when he held the work-piece at exactly the right angle against the anvil was it bearable. The iron cooled quickly. After five blows of the heavy sledge, it was already time to put the work-piece back in the fire.

"How long you been with these foreigners, these Grantvillers?" Karl asked.

"I came here," he said, and then paused while using a piece of rebar to mound the burning coals over the iron. "It was a month ago, just before Pentecost," he finally said, remembering the conversation with Pastor Green that Sabbath afternoon.

"What d'you make of these Grantvillers? Do you believe their story about the Ring of Fire?"

"I have no reason to doubt it," Yossie said. "The first rumors I heard called it the pit of Hell, but that's because I came from the south-west." He pointed out the open side of the smithy toward the dark cliff of the ring wall. "To the folks living up there, one moment there was a high hill here, and then bang, they were looking down at Grantville."

"You believe that story, that it just happened with a bang?"

"I was on a hill outside Kissingen that Sunday afternoon. That's a town three or four days west of here. I saw something." He paused. He'd never told anyone this story. "It was a flash to the east, as bright as the sun, and as brief as a lightning bolt, but perfectly round, the size of an Imperial thaler sitting on the horizon. The iron is hot, let's get to work."

Thomas came back into the smithy as they were finishing forging the taper of the handle. He watched them until they finished hammering, and then took the cold end of the bar from Yossie and inspected their work.

"Not bad," he said. "Start forging the handle on another bar while I make what they need."

"What do they need?" Yossie asked.

"This broke," Thomas said, holding out two pieces of iron. "It was a brace for part of the coal-washing machine, and it broke because there was only one where there should have been two."

As Thomas went into the shop building to look for an iron bar, Fritz picked up a piece of coal from the bin beside the hearth. "They wash this?" he asked puzzled.

"That building is all for coal washing," Yossie said, pointing to a large building that seemed to be made entirely of rippled metal. "I don't understand how coal can be washed, but they are having some trouble making those machines work."

When Thomas came out of the shop building, Yossie, Karl and Fritz were hard at work. As soon as Yossie put his work-piece in the fire, Thomas took over the anvil, and for some time after that, Yossie and Thomas alternated at the anvil while Karl swung the hammer for both of them.

When they finally took a break, Yossie spoke. "Thomas. You never told me about your daughter." The question on his mind was an innocent one, but by the end of the day, he would regret speaking.

* * *

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Butterflies in the Kremlin, Part Five, The Dog and Pony Show

Written by Gorg Huff and Paula Goodlett

Natasha alighted from the carriage at her family's dacha outside of Moscow, along with her aunt, Sofia Petrovna. Both were wearing full regalia, "dressed to the nines," as Bernie put it. Aunt Sofia served as her chaperone, necessary in Moscovy's culture. While her brother, Vladimir Petrovich, was away in Grantville, someone had to assume responsibility for the lands. That responsibility fell on her. Young for it she might be, but she and Vlad were the last of their branch of the family. It was a wealthy branch. Thankfully, she and Vladimir had been raised by a free-thinking father who had been rather enamored of the west. She had been educated alongside Vlad. Fashionable or not, someone had to take care of things.

Aunt Sofia turned to Boris. "Well, Boris Ivanovich, what do you suppose Bernie has done this time? I thought the stinks and noises from his bathroom were quite enough. What now?"

Boris smiled. "One never knows, not with Bernie Janovich Zeppi, my lady. We shall just have to see. I am most concerned that he be well-behaved for the visit. And, Bernie being Bernie . . . one never knows."

"It's not Bernie we need to worry about. It's the nerds," Natasha corrected. Boris knew she was right. What he was worried about wasn't really Bernie. After a good bit of pressure and growing interest in the Dacha, the Grantville Section of the Embassy Bureau, and the new products that were coming out, Boris and Natasha had arranged a tour of the Dacha for several people who had been pushing to see and know more about it. On the one hand, Boris had no objections. On the other, some of the spectators were very opposed to the changes that were happening in their society. He feared they might use this visit as an excuse to protest more. The problem wasn't just Bernie or just the nerds or even just the information coming from Vladimir. It was a combination of all of them.

* * *

The czar and czarina, Patriarch Filaret, several members of the cabinet and some of their wives, arrived over the next few hours and had to be provided quarters in the Dacha for their stay. The normal inhabitants of those rooms had been moved into outbuildings, and even into a large, heavy, double-walled tent. Natasha greeted each guest as they arrived.

* * *

Boris listened to the lecture on soil chemistry with half an ear. It wasn't that it was unimportant. In the long run, it might turn out to be drastically important. But Boris had other things on his mind.

Boris Ivanovich Petrov was a spy. He was not the least bit ashamed of either the title or the meaning that it encompassed. He had been a field agent in Poland, England, and, most recently, Grantville. He had, on occasion, found it necessary to kill quietly from behind in defense of his czar and his mission. He took no joy in doing so, but didn't hesitate to, either. His new job as head of the Grantville Section of the Embassy Bureau was supposed to be a job in which that sort of thing was no longer necessary. That, unfortunately, hadn't proved to be the case.

Starting about three months after his return to Moscow, several of the other bureaus wanted the up-timer reassigned to them to focus on their projects. The pressure had been increasing ever since, with only limited relief when he had given Cass Lowry to the military. The roads bureau wanted Bernie to spend all his time on road-making equipment. The farming bureau wanted him making farming machinery. He was also wanted to make medicines, concrete, steel, plastics, and who knew what else.

There had been time for some of the effects to be felt since Bernie had arrived in Muscovy. Some road crews had the equipment he introduced and had been building and repairing roads much faster. A new quick-loading rifle was in limited production. Bernie insisted on calling it the AK3. This time Boris somewhat approved of the joke. Andrei Korisovich was head of the team that was developing the new rifle, but that wasn't the only reason he approved. Boris had seen up-timer movies that mentioned the AK47.

Both the Swedish and Polish sections of the Embassy Bureau wanted Bernie transferred to them, and the Grantville Section shut down. The Swedish Section claimed jurisdiction because Bernie had become a subject, sort of, of the king of Sweden since he had left Grantville. The Polish Section claimed jurisdiction because Bernie was teaching what he knew about firearms.

The knives were out, all over Moscow. Some of them were political and some made of steel. The political ones were by far the more dangerous.

"By introducing nitrates into the soil." For a moment Boris was distracted from his thoughts. Nitrates and the nitric acid that could be produced from them, played an important role in the production of smokeless gun powder. No, the lecturer was talking about using clover and beans to enrich the soil on the Yaroslavich family estates this coming spring.

Somehow, and Boris wasn't entirely sure how, he had gotten involved with the financial workings of the Yaroslavich family. It had seemed so innocent at the time. Vladimir Petrovich had merely offered letters of introduction to his sister, as well as several letters for her. In the letters to her, he had suggested that the Yaroslavich family should pay the czar a phenomenal amount for the Bernie/Grantville franchise and offered his dacha as a good place to put Bernie. By long-standing tradition, great houses and merchants of the empire paid the czar for the right to run commercial enterprises, like the import or export of goods, mining, or whatever.

So the Yaroslavich family owned the Bernie/Grantville franchise. Bernie was a big part of the Grantville, or American, Section's turf. The American Section, along with the Yaroslavich family, controlled access to Bernie and, through Bernie, controlled access to the experts who had been brought to the Dacha to work with him. The Yaroslavich clan

had the patent on everything that came out of the Dacha.

It didn't seem like a large sum now, aside from the direct income to the Yaroslavich clan, which wasn't all that great. Yet.

But the favors flowed like rivers. And favors were the currency of political power in Muscovy. If the mining bureau wanted a road to a new mine, it would not have to come just to the roads bureau, not now. Now it would have to come to the Grantville Section and the Yaroslavich clan. Boris had collected more favors since being made head of the Grantville Section than in all the rest of his career. On the downside, when people came to him for favors he couldn't grant, he made enemies.

With Bernie placed in their dacha, it became clear that the Yaroslavich family were backing the Grantville Section. So far, no one had had enough influence to change that. Which also meant that the Yaroslavich family was passing out favors. Natasha was picking up more and more IOU's from the high nobility. They weren't being stingy in a monetary sense, but there was a degree of political selectivity in their choices.

But this was Moscow. Alliances could change at a moments notice. Or not. Now the patriarch was nervous, Boris heard. There were rumors that the Yaroslavich clan would try for the throne. Boris was confident that they had no such goal, but power carries its own implications.

A more realistic concern was that they would gain influence with the czar. Mikhail was loved, but not that well respected. Not considered . . . particularly strong. Of course, his hands were tied. The Assembly of the Land had seen to that when he was elected. Those limitations might well explain why he was so popular. When the government got blamed for something it was usually his advisors, not the czar, who got the blame. It was known that Mikhail had cried when told he had been elected czar. As well, it was known that he had refused the crown. He had continued to refuse until told that if he didn't accept, the blood of the next "time of troubles" would be on his hands.

Natasha knew the czarina, Evdokia. Before Bernie, that acquaintance would have given her family protection, but not much influence. Now that acquaintance was a way for up-time ideas to reach the czar without going through his father, who was also the patriarch of the Orthodox Church. And the ideas had gotten to Mikhail, some of them, anyway. Hence this little event.

* * *

Ivan Ivanovich had read the reports. That was one of the reasons that he had pushed for this general demonstration of the products of the Dacha. One of the reasons. The other being his increasing concern about the influence of the Grantville Section. Increasingly, he had been forced, almost against his will, to realize the importance that the Ring of Fire was going to have on the rest of the world, including Russia.

He watched Pter Nickovich pace about in a dither, getting in the way of the workmen handling the ropes. And found himself tempted to do the same thing. He knew what was about to happen he'd read about it in the reports. Then as the ropes were let out, it began to rise. Two poles, about five feet apart with ropes going from them to a basket below and balloons above. He had thought that he knew what was going to happen, but he hadn't realized what it would feel like. Twenty feet into the air, then twenty five, thirty, supported by nothing but air. It's only connection to the earth the ropes that held it down. And in the basket that hung below the dirigible testbed, Nikita Slavenitsky smiled and waved to the crowd of dignitaries.

Ivan Ivanovich waved back, it was absolutely the least he could do. What he wanted to do was jump up and down and shout. A Russian was flying in the air, held aloft by the knowledge and craftsmanship of his fellow Russians. He had read that the up-timers had already flown. But knowing about it from a report was one thing, seeing it was something altogether different. The up-timers with their machines doing it was one thing. Russians making a flying device out of wood, rope and cow guts—that was something altogether different. Even in his excitement about the flight, Ivan realized that it meant that one of his goals in forcing this demonstration had backfired. If anything it would increase the influence wielded by the Grantville Section. He looked over at the czar's pet up-timer, in time to see as Bernie, looking bored, snorted a laugh.

* * *

Bernie could understand why Pter Nickovich was so nervous. Today the czar, the czarina and some members of the cabinet had come to see his baby fly. Bernie looked over at the big shots. They were gawking. Totally gone. You'd

think the aliens were landing or something. Then he thought about it. Granted, it wasn't that much of a dirigible. It had no power and there wasn't much you could do with it, not yet. But, Nikita was the first Russian to fly in this time line.

Shit, this was history. For here and now, this was like the first rocket ship to the moon or something. Bernie found himself giggling a bit. Nikita Ivanovich Slavenitsky was a nice guy and usually had a joke to tell or a dirty story. But he wasn't the sort of guy you would think of as Neil Armstrong or whoever. But Nicky was going down in history.

One of the big shots was looking a bit offended. "You find this funny?"

Bernie had forgotten the guy's name. He was the head of the Embassy Bureau, Bernie knew that much. "It's not that, sir. I just never thought that a guy I had a beer with every now and then would make history."

"History?" The guy paused. Looked up and nodded. "The first Russian to fly."

"Yes, sir," Bernie said. "Nikita Ivanovich Slavenitsky and Pter Nickovich have done Russia proud today. Real proud."

The big shot looked at Bernie a bit sharply for a moment, then he smiled. "You will excuse me, Bernie Janovich. I must speak to the czar."

* * *

Ivan Ivanovich headed back to the czar in a rather bemused state of mind. He wasn't sure what to make of the up-timer. He hadn't tried to take credit for the flight, even though Ivan knew that Bernie's explanations had been a large part of making it possible. Nor had he been demeaning of the Russian efforts. Ivan didn't know what to make of the man, and that bothered him. He glanced up at the flying carriage. He wanted control of such devices if he could manage it. He thought they would be important.

* * *

"We can fly," Evdokia, Czarina of All Russia—and sometimes a real pain in the butt—insisted. Mikhail looked at his wife and sighed. He knew he was going to lose the argument. They were in the best room in the Dacha and it had been an interesting day.

"I know how you feel," he tried, though in truth he didn't. He knew his Doshinka had dreams of flight but he never had. Mikhail's dreams tended to be dark things, best forgotten. "But we have real problems that we must deal with."

Evdokia, thankfully, didn't ignore the problems, though Mikhail was fairly sure she wanted to. "I know, Mikhail. But I think that Pter Nickovich made some excellent points about the usefulness of such a flying ship. More importantly,

though, is the useful thing he didn't mention."

"What useful thing is that?"

"Pride. Pride in being Russian. Pride in being a part of something great. Who is, ah, was . . . will be that up-time general that Mikhail Borisovich Shein is always quoting about eggs?

Mikhail shook his head, not able to remember the name. He thought the general was French but that was all he remembered.

"Well, that's not the only quote. The general Nappy something also said that the moral is to the physical as three to one." She grinned. "I think to the fiscal, it's even more. Let us fill the hearts of the people of Russia with pride in who they are. Not with fear of the bureaucrats."

Mikhail looked at his wife for long time, just taking in the bubbling excitement. She fairly glowed with it. Could Pter Nickovich's big balloon really produce such a reaction? And if it produced that sort of reaction in the Russian heart, what effect would it have on the Polish heart and the Cossack heart? "Very well. I will support the project. I can make no promises, mind."

Evdokia just grinned. Somehow, as pleasant as that smile was, it made Mikhail a bit nervous.

* * *

The dog and pony show had been going on for three days. Bernie had been moved into his garage, because of all the important people who had shown up. He didn't mind it, especially. The garage was where he was trying to fix the car, without a lot of success. The VIP visit, Boris said, was going quite well. But it was still a total pain in the butt.

Bernie had spent most of the last three days explaining that it was really Vanya, Misha, Filip, Grigorii and the others who had actually worked out all the improvements. He had just helped a bit. Really, the whole thing was kind of embarrassing. The only good thing about the whole dratted business was the thankful looks he got from the brain cases. They had apparently not expected to be given credit. Finally, he had had to sneak away. When Grigorii Mikhailovich started explaining orbital mechanics and Newton's laws of motion, Bernie's brain started to fry. He just didn't want to hear it again, not right now.

He was having a beer in the kitchen when the door opened unexpectedly. At first Bernie was afraid that one of the brain cases had come looking for him again. But, no . . . it wasn't a brain case. Jeez. This was the boss, the big boss.

"Howdy, Your . . . ah . . . Majesty." Bernie snaked out an arm and grabbed a chair. "Have a seat."

The big guards who followed the czar around were looking daggers—or maybe swords—at Bernie. Apparently they thought he was supposed to be doing something differently, but Bernie was tired and couldn't figure what. "Say, Your Majesty, why is the muscle looking pissed at me?"

Bernie knew that the czar knew some English but it didn't appear to be modern English. "Muscle? Pissed?"

"Ah, guards looking angry. I figure that I've done something I'm not supposed to do. That, or I ain't done something I am supposed to do. But I don't know what."

The czar nodded. "Probably you didn't bow. Bernie, is it?"

"Yes, sir. Bernard, really, but that makes me sound like some kind of old coot. I like Bernie better."

"Do you?" The czar laughed. "I'll call you Bernie, then."

"I'd appreciate it more than I can say. Thank you, Your Majesty." Grinning, Bernie stood up and swept the czar the most impressive bow he could manage. After watching movies all his life, it wasn't all that bad. Not really right, but impressive, in its own way. For some reason the guards were looking daggers at him again, but the czar cracked up. That laugh made Bernie feel better. Looking at the guy, Czar Mikhail, Bernie figured he didn't get to laugh all that much.

Bernie sat down again and repeated his offer of a chair. "I'm playing hooky. I'm supposed to be in one of the lectures explaining that I didn't do anything. You want a beer?" Sure, he was an older guy, and the czar, and all that crap . . . but he was a guy. Bernie figured he could use a beer now and then, just like anyone else.

* * *

Mikhail Fedorovich Romanov was more than a little bemused by the up-timer. He had been impressed, seriously impressed, by the demonstrations. There was a telegraph that allowed messages to be sent from one part of the estate

to another. The plumbing system . . . ah, the plumbing system. He wanted that in his palace. Also the telegraph, all through the Kremlin. That would be good.

The military applications of the telegraph were obvious—if it could be made to work over any real distance. And they talked of radios that might be made that would not need the wires. He had been briefed on most of it, but hearing was not the same as seeing.

Mikhail had also noticed that Bernie was constantly giving credit to the local experts for doing the work and solving the problems. He had wondered how much of that was truth and how much politics. "I noticed you explaining again and again that you didn't do anything. Is it true?"

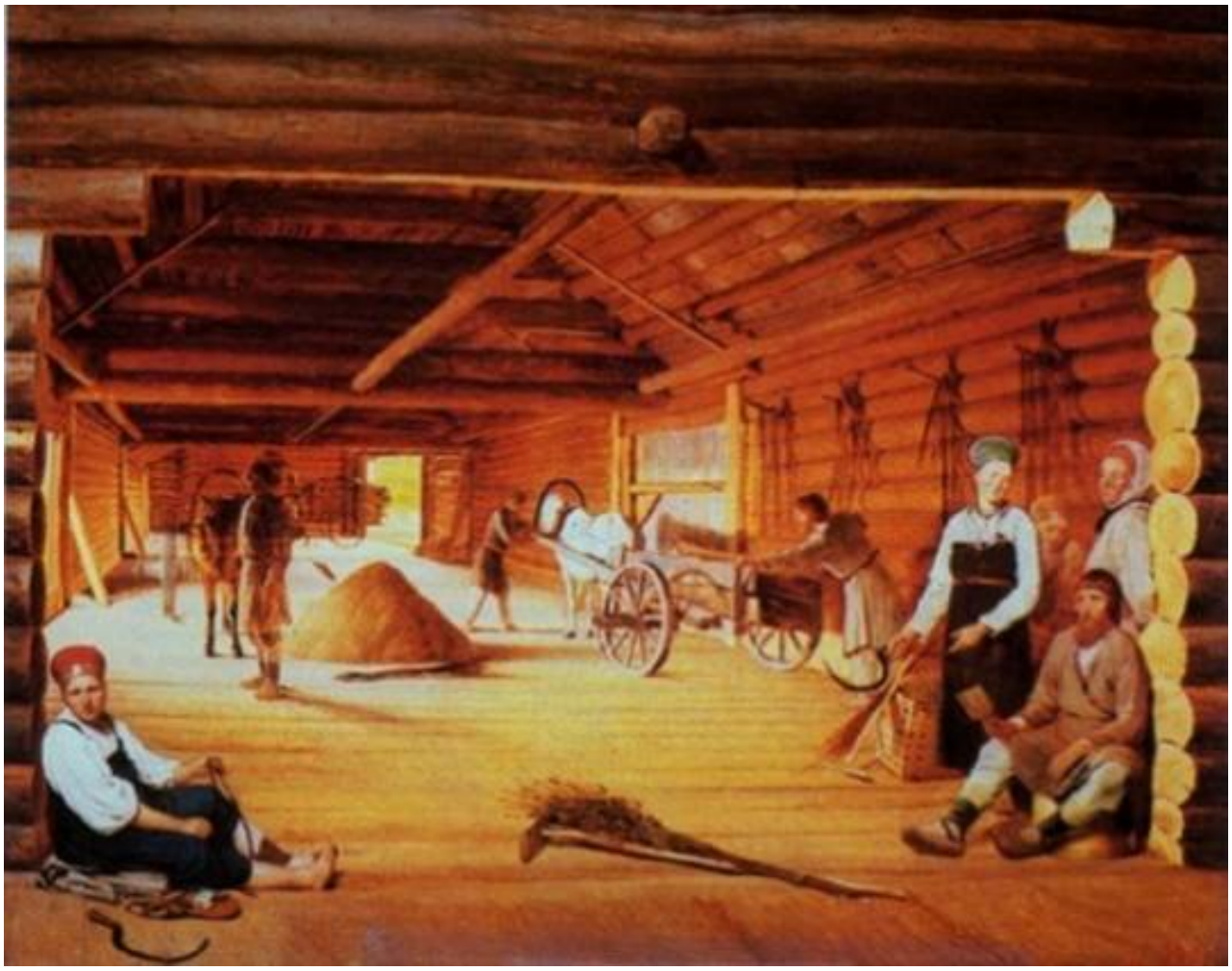
"Mostly, yeah." Bernie shook his head. "When I got here . . . well, I was never the smartest kid in class but I figured with a four-hundred-year head start, I ought to be able to teach you guys something. Mostly, though, I'm sort of a glorified dictionary. I explain words that have changed meanings and words that English didn't have, doesn't have, now, that it had up-time. And everyone here is smarter than I am."

"Surely not everyone?" Mikhail pointed at Anna. He assumed the maid would be illiterate. And she was a woman, after all.

"Yep, her, too." Bernie grinned. "She's picked up English fast, really fast. And she can do Arabic numerals and paper spread sheet bookkeeping. All that, while my Russian is still the pits even after I've been here so long. And she's better at the bookkeeping than I am. What's worse, I taught it to her."

"Yes." Czar Mikhail's eyes were hooded and dark. "There has been a great deal of talk lately about your accounting and taxes. An income tax. The patriarch is quite enamored of it."

Bernie shifted in his seat. It was pretty uncomfortable, all of a sudden. "I sort of opened a can of worms with that one. No one really wants to explain anything to me, just have me explain things to them, so I don't know how it works here. Anyway, the most important thing about taxes back up-time was that they were mostly fair. Mostly everybody paid them. There were people who had good lawyers and sometimes folks cheated. Still, it sort of spread the burden around, so no one group had to do it all."



Mikhail nodded. "We are considering that. It does seem that it will increase revenues, at any rate. The, ah, what was it called . . . the Fica, that one. That one we're having a little trouble with."

Bernie grinned and took another sip of beer. "Yeah, I heard. I had to explain what 'retire' meant. And no one understood that one. What do people do here, just work until they die? No chance to just kick back and relax, just live. I had a lot of trouble getting that clear. And when I told them about the Social Security numbers and how everybody had one, well, the brain cases just went nuts."

They sat and chatted for a long while. It was interesting to listen to someone who was mostly unguarded and not weighing every word to make his case. Mikhail finally, once the servants unfroze, got his beer and the discussion ranged all over.

Mikhail enjoyed especially the discussion of what it was like to live up-time. Cars, first dates and bananas in winter were only a part of it. Mikhail was the wealthiest and, in theory, most powerful man in Russia and had never had a banana in any season, much less a banana split.

Mikhail brought the discussion around to representative government. He wanted to get a feel for how it worked from someone who had experienced it to compare with the theory. Bernie seemed to assume that Mikhail would disapprove of it. It was the most guarded Bernie had been all evening. Mikhail liked the concept, but wasn't sure how well it would work on the ground in Russia. From his reading, it had almost seemed that every citizen of the nation must be a scholar of the law. All in all, Mikhail found Bernie's ignorance of how the details worked according to the books reassuring. It didn't take him long to figure out that Bernie actually knew less about the mechanics of how the constitutional laws of the United States of America worked up-time than he himself did.

It was clear to Mikhail that Bernie didn't have the slightest clue about how Russia worked. Russia did have a history of electing officials and representatives. But the constitution—that was a bit different. It was not like England's Great Charter or Poland's. Nor like the agreement that the Assembly of the Land had insisted he sign when they forced the throne on him. The constitution . . . those were a list of restrictions on the crown. They restricted the czar's power, but

the constitution seemed to do more than that. It provided a concrete structure that was designed from the beginning, rather than growing just any which way.

"I don't know, Bernie." Mikhail stared into the mug he held. "I was elected to be the czar, but that was a special case. They picked me because I was only sixteen years old and they felt sure they could control me. Even so, they limited my power. Which wasn't something that bothered me, then or now. Mostly, my father runs things. He is the one who really should have been czar. But the reason that the election happened at all was that there was no one left in the direct royal line. And because they needed someone after the time of troubles. Anything was better than continuing to fight over everything. Even then, it was the Assembly of the Land and the cabinet who voted. The people of Muscovy aren't used to voting on everything."

"Yes, I get it. That's sort of the point of representatives," Bernie said. "The people elect them and they are the ones who vote on the laws and stuff. Were the people who voted elected?"

Mikhail shrugged. "Some, not all. The Assembly of the Land has men who represent the crafts or a place or who are high in the church. Some representatives of the merchants and tax collectors participate."

* * *

"That sorta sucks." Bernie had not cared in the least about the people of Muscovy when he agreed to come. It had just been a job; keep your head down do what the man tells you and get your pay. It had been good pay, so who cared. Gradually, without his really noticing it, that had changed. Bernie knew he was living in a very privileged situation. He had no desire to endanger that privilege by upsetting people—especially the frigging czar. The comment had just sort of slipped out. At the same time, he felt sort of obligated to help these guys get it right. He started to apologize. "Sorry about the profanity, Your Majesty."

He should have stopped there; he knew it. And he intended to, but some how it all just came poring out. "What does someone who has a lot of power and money care about the little guys? It's not a representative government unless, well, all the people get represented. Everyone, not just churchy guys, not even just guys, and not just people with money, should have a vote. If you just listen to the guys with the money and power, they're going to tell you what they want, not what people need. You ought to get rid of them and get yourself some regular folks to advise you."

Mikhail was looking at him like he was crazy. Then slowly his expression changed. Now he was looking at Bernie like Miss Mailey used to look when Bernie said something stupid in class. "Have you considered the possibility that I might not have a choice? When I was selected as Czar of Muscovy, I was required to sign an document. It had four major provisions. First, I promised to uphold and protect the Orthodox Church of Russia. Second, I promised to give up any possibility of revenging myself or my family for wrongs done to us."

The czar paused for a moment and a pained look crossed his face. "And there were wrongs done to us, Bernie, severe wrongs. Third, I promised to make no new laws or alter old ones, and to take no important measure which might contradict the existing laws, or suspend the legal proceedings of the court of justice. Finally, I promised to begin no wars and to make no peace by my own will."

Mikhail Romanov shook his head a bit and took a sip of beer. "I cannot dismiss those 'churchy guys,' as you call them, Bernie. Not my father, or any of the others. Nor the boyars or *dvoryanstvo*, ah . . . councilors and bureaucrats. I cannot restore the elected officials from the provinces. It is not within my power."

Bernie paused for a moment or two, trying to take it all in. Mikhail wasn't the all powerful figure he had thought. Then something occurred to him, the constitutional convention that Mike Stearns had set up and all the campaigning. "I'm in over my head, Your Majesty. I don't think anyone from up-time ever considered that you might not be all-powerful. I don't know what you can do about it. All I know is that representative government should represent everyone and that the representatives will only really represent the people who can fire their asses."

Bernie signaled the cook to pour a couple more beers. "We didn't actually vote on everything, you know. We elected the people who would run the government and then every few years we voted again. If we liked the way they had been running things, we reelected them; if we didn't, we elected someone else. Truth to tell, I usually didn't bother voting. After the Ring of Fire, though, we had a big meeting and set up the Emergency Committee to draft us a constitution. Maybe you could do something like that."

Mikhail sighed. "Not easily, Bernie. From what I understand, your Mike Stearns was setting up a government from

scratch. There was no government in place because it had been left in the future."

"Yeah, mostly. There was the mayor and stuff, but he sorta stepped back from it right at the start."

"Somehow, I don't think the boyars and men of the cabinet are going to politely step aside." Mikhail grinned, but his eyes were kinda sad. Somehow Bernie figured that if he could, Czar Mikhail Fedorivich Romanov would step aside faster than Henry Dreeson had.

* * *

Mikhail and his father were already consulting with the "brain cases," as Bernie called them. Mikhail wanted a way out of the trap the up-time history had put him in. Since the history of that other future had leaked, people with power were not happy. He and his father, as czar and patriarch, had been carefully dancing in the mine field of Russian politics, focusing on the danger of a return to the time of troubles to keep the various factions in check. Even so, power was shifting between the factions. The one led by Fedor Ivanovich Sheremetev, for instance. Sheremetev felt that the information from the up-timers and the actions of Peter the Great really sort of ruined the Romanov credentials as arch-conservatives.

"Interesting, perhaps." Fedor Ivanovich set his glass on the table. They had been discussing the history of the United States of America and its constitution. "Interesting, but not that impressive. It was their day in the sun, that's all. The Mongols had theirs and this United States had theirs. They were only two hundred years old. Barely a youth, as nations go."

Mikhail looked across the table at him. There were only three men at dinner tonight. Filaret, Mikhail and Fedor. Mikhail wanted Fedor's support. "I am more concerned with something else. The general agreement—and I read this over and over again—was that Russia continued to lag behind much of the rest of the world. We can change that, and I believe we should. Right now, we should start. Because right now, everyone is four hundred years behind Grantville. We have Bernie here and Vladimir in Grantville. We can modernize."

Fedor nodded, but Mikhail didn't think he was listening. Not properly at any rate. "The army, most assuredly. Right away. That I agree with. But this other? This constitution? Why? A firm hand on the reins. That is all that is needed, Mikhail. A firm hand on the reins of Rus."

Mikhail shook his head. No, Fedor wasn't listening.

* * *

Fedor Sheremetev left the dinner and considered most of the way home. He understood what Mikhail and Filaret were contemplating. Oh, yes. He knew that Mikhail was afraid of power. Let every peasant vote. Introduce a constitutional monarchy, maybe even that perverted idea, a democracy. He snorted. Hardly.

Fedor had a lot more sympathy for Joseph Stalin than he had for Nicholas Romanov. Stalin, if he had nothing else, had had a firm hand. And a firm hand was what Russia needed. Always had and always would.

Fedor looked down at the hands that gripped the reins of the horse. Mikhail didn't ride, did he? No. Always the carriage. Always the passenger. Never in control. That described Mikhail Romanov as well as any other phrase.

* * *

"I don't care if he wants to fuck the czarina," Mikhail Borisovich Shein said. "We have our own up-timer now, and he's one who can fight."

His aide took it in stride. General Shein was a volatile man by nature. The calculation hidden by the volatility was harder to see; most people never did. "What should we do with him, sir?"

"Stick him in the gun shop." The Russian army had a dacha of its own that was not publicized. The general snorted. "And keep him away from anyone important. Question him extensively, but not harshly. If that doesn't work, we can use stronger measures. From what I understand, the main reason we got him is that he managed to piss off or piss away the opportunities in Grantville. No one will miss him much."

The aide made a note and went on to the next item on the agenda. "The musketeers are arguing with the outlander solders about their walking walls again." The aide was a bureaucratic noble and therefore an officer in the Russian army. He didn't think all that well of the foreign mercenary companies. Or the city musketeers, the *Streltzi*—who, when not called to active service made up the merchant class in Muscovy.

The general gave him the look. Mikhail Borisovich Shein had commanded a force made up mostly of musketeers at Smolensk during the last war with Poland. They had held out for twenty months against a force ten times their size. Whatever the traditional animosity between the two classes, General Shein didn't share it. At the same time, he was fully conversant with the Russian army's need to modernize. Slowly, he began to smile. "But what is modernize in a world where we have people from the future? Find me two men, Georgi Ivanov. Rough men. One outlander officer and a musketeer. Put them in a room with the up-timer and let them argue about it."

* * *

Cass Lowry found Russia to be cold, and—after his education at the hands of Natasha's guards—more than a bit frightening. That impression was in no way diminished when he met Ivan Mikhailovich Vinnikov and Samuel Farthingham.

The issue was whether the Russian moving forts were useful. Cass wasn't entirely sure what a moving fort was, so the first thing Ivan and Samuel had to do was arrange a demonstration.

* * *

"Have you seen the latest?" Pavel Egorovich Shirshov asked, handing a pamphlet to Ivan Mikhailovich Vinnikov.

The guard captain looked at the pamphlet and began to read silently.

"Out loud if you don't mind," Pavel Egorovich said testily. Though a skilled craftsman, he didn't read.

Ivan Mikhailovich cast him an apologetic look and began to read out loud. "If we are to have a constitution it must ensure the rights of all Russian citizens . . ." He continued reading. It was an argument that without a section limiting government, the constitution would be just another way to tie the people down. The writer actually seemed to wonder if a constitution was a good idea at all. Then he went on to—purportedly—quote a conversation between members of the boyar class. A cousin and a younger son of one of the great families. They were reported to have said that the great families thought that a constitution would be a great thing if they got to write it. The conversation was supposed to have been overheard in a brothel.

"Any idea who wrote this?" Ivan asked, a bit nervously. This was the sort of thing that could get people in serious trouble.

Pavel shook his head. "A boy in Muscovy was selling them on the street. Couldn't have been more than ten or so." That was happening more and more frequently. Scandals mixed with political opinion.

"I talked to one of them a bit a few days ago." Pavel commuted back and forth between the Army's dacha and the Kremlin every few days. "He sells his papers to make a bit of money. He buys them from a man he thinks is a Bureau man, but it could be a merchant. There is apparently more than one man, and they don't all meet in the same place."

* * *

"It says here that this Patriarch Nikon caused it." Colonel Pavel Kovezin stared at the broadsheet with distaste clearly showing on his face.

Machek Speshnev, who had brought this news to the colonel, nodded. A lieutenant in this regiment of *Streltzi*, the musketeers, Machek was a pious man. This information had struck a chord with him, as well as with many other members of the Palace Guard Regiments.

"I'm surprised this information became public, but it has. The question is, is there anything we can do about it?" Machek's family would most definitely wind up as oppressed "Old Believers," he was sure. "I don't think I'd care to be sent up north, chasing, beating and killing priests."

The very idea was repugnant.

A lot of information that was coming from the up-timer histories was repugnant. Inconceivable, a lot of it.

Colonel Kovezin stopped staring at the broadsheet. "How many people have seen this?"

"A lot of them," Machek admitted. "The things have been being passed around all over the city. Along with the ones about killing rats, boiling water, not drinking so much . . ."

"This city is being buried in paper," Colonel Kovezin said. Then he grinned. "We live in interesting times. Never mind this. I'm sure the patriarch is well aware of it and will make a pronouncement. Try to keep the men calm. Today is a big day for us and I want everyone's attention kept on his duty."

Machek grinned back. "Today is the day?"

"Yes. Today we receive our new rifles."

* * *

Sofia's eyes sparkled like cold black diamonds. "Nevertheless, it cannot be you that goes. You are needed here. Bernie needs you. Boris and Daromila need you. You may not abandon that trust."

Natasha stopped her pacing. She'd been trying too hard to justify being the person who went. She knew it. "But I so want to see it, Aunt Sofia. So very much." She threw herself onto a bench. "Vladimir is there. I miss him. And I want to see it."

"Even so." Sofia's eyes softened. "I know, dear." She patted Natasha's hand. "I know." She grinned. "So do I want to go." Then she straightened her shoulders. "But we must carry on here. Czar Mikhail has said that he will consider this marriage, but there must be a senior female of the family to examine Brandy. And I know just who to send." She cackled in laughter. "Oh, my. It will do them so much good."

* * *

"I didn't really believe it. Not until I saw that." Vlad watched the Las Vegas Belle until it was out of sight. Even after several months, he still wasn't entirely sure he believed it. And slowly he began to smile. "I believe that turnabout is fair play, Brandy. Perhaps I should write Bernie that I insist that he build me an airplane. And a factory for cars. And an oil refinery."

"Soda pop." Brandy looked in the direction where the plane had disappeared. "Real, old-fashioned Coca-Cola. I miss those. New movies, instead of re-watching all the old ones. Xerox machines for quick copies. Um, we can probably think up a bunch of stuff to demand, really. They won't be very realistic, I imagine, but it might be kind of fun to make a demand instead of trying to satisfy them. Besides, they might just do it."

They walked slowly to Brandy's house thinking up ever more outrageous things to demand of Bernie and the "brain cases" in Muscovy and laughing at their demands. No one could be sad on a day like today.

They turned up the walk to Brandy's house and she hesitated a bit. Vlad knew that it was because her mother had died there.

He'd been surprised, three days after Donna died, by the attendance at her funeral. It seemed like a large number of people showed up. Most unusual was the cluster of young girls around Brandy. One of them was one of the most beautiful girls he had ever seen. Her hair was a deep auburn and her skin was clear with just a few freckles.

Brandy had, in compliance with Donna's wishes, arranged a simple graveside service. It was very brief. Afterwards, people visited with one another and everyone spoke to Brandy and Vernon for a moment or two. Brandy introduced

Vlad to the cluster of young girls. They were . . . quite exceptional, he thought.

Much to Vlad's surprise, Vernon was one of the first to leave. "He's just not good at emotions." Brandy had noticed Vlad watching Vernon. "He never has been. He's closed up, like in a shell or something. It drove Mom crazy. That, I think, is why they got divorced. Mom was too emotional for him, I guess."

Vlad looked down at her. "I promise you. I promise you that I will never be so, so . . ."

"Calm and dispassionate?" Her tears started flowing again. "Good. I don't think I'd like it any better than Mom did."

* * *

The sound of the doorbell jerked Brandy to alertness. She smoothed down her dress and checked her reflection in the mirror before opening the door. Here goes, she thought.

Vladimir stood on the porch, smiling at her. Her breath caught a bit. They'd been dating a long time, but this was the first time they'd been alone together. Really alone. No servants. No Mom. Brandy still felt Donna's loss keenly. But a person had to move on. This dinner was an effort to do that.

"Come in, please." Brandy smiled as Vlad brought his left hand from behind his back with a flourish. His eyes twinkled a bit. "The little books, they say a man should bring a gift to dinner. So, I brought you this."

This was not flowers or candy, or even a bottle of wine. Vlad had brought a bag of coffee beans. Brandy grinned. "Good. We'll have some later." She stood aside and waved Vlad inside. "Dinner will be ready in just a moment. I hope you like it."

Vlad divested himself of his heavy fur coat and looked around the room. "You have changed a few things, Branya. Not much, just a little. The home seems somehow more your own, now."

"Just a little." Brandy felt sad for a moment. "I loved my mother, but I never cared for that 'country' look she liked so much. So I sort of streamlined the room a bit." A dinging sound came from the kitchen. "One thing about a house this size, you can hear the timer. Come on in. The table is ready and it sounds like dinner is, too."

Brandy ushered Vlad into the small dining area where she had used Donna's best china and crystal to set the table. "Have a seat. I'll be right back."

* * *

Brandy came back with a large platter of something. Noodles, Vlad thought. He'd become fond of noodles. But what was covering them? It smelled wonderful, whatever it was.

Brandy set the platter on the table. "I've got no idea if this is really a Russian dish. But Cora said it was, so I tried it. I hope it's good. I'm not really much of a cook. Mom tried, but I wasn't very interested, to tell the truth."

The smell had Vlad salivating. "I don't care if it's Russian, Branya. It smells wonderful. Just wonderful."

Brandy smiled widely and served Vlad a portion of the dish, whatever it was. She poured wine for them both and indicated the salad and bread on the table. "Thank heaven for greenhouses. We always had lettuce back then. I'd miss it, if we didn't have it here, even if it isn't the iceberg I'm used to." Apparently noticing Vlad's hesitation, she urged, "Go ahead. Dig in."

Vlad did. The scent was marvelous and the taste even more so. It only needed one thing. "Is there, perhaps, some *smetana*?"

Brandy gave him a look and he grinned guiltily. Brandy had commented before about his liking for *smetana*. He put it in nearly everything he ate, including stew. "It has quite a bit in it already." She passed him the dish full of sour cream. "But I knew you'd want more. Is it all right? Does it taste good?"

Vlad nodded, busying himself with the dish. "Marvelous." He added sour cream to his plate. "Marvelous. I'm afraid I'm ruined for Russian cooking, at least the cooking back in Muscovy. Ruined. I may never wish to go back, just for the flavor of the food alone. What is this called?"

"Beef Stroganoff."

Vlad ate until Brandy was pretty sure he was about to explode.

"Marvelous," he said. Several times. Well, it was, but that was only part of the reason he kept saying it. Vladimir was terrified.

* * *

After dinner, over coffee in the living room, Brandy began to feel a little awkward. What did you say now? How did you handle this kind of privacy when you didn't have any intention of needing, well, this kind of privacy? Not yet, at any rate.

Vlad solved the problem by beginning to speak. "Natasha tells me that the situation in Muscovy is quite tense. Czar Mikhail has vaguely suggested a constitution to replace the agreement he made on assuming the throne. Such a document would be binding not only on him, but on all future czars. Most importantly though, it would also be binding on the *Duma* and Bureaus and replace the *Zemskiy Sobor* with an elected legislature or perhaps turn the Assembly of the Land into such a congress."

"Yes. Natasha mentioned it. I understand that the income tax and the business tax are meeting quite a bit of resistance."

"That's a diplomatic way of putting it." Vladimir laughed. "I worked it out. It would cost my family several million of your dollars every year. While my family is quite well off, we're not the richest nobles in Muscovy, not by any means. If that tax is done just a little bit wrong, it could ruin half the nobles in Muscovy. I sent my sister a description of your system of tax deductions for things like capital investment along with Cass and Bernie's 'Precious.' Frankly, I don't think it will happen unless Czar Mikhail can come up with something to sweeten the pot."

"So, what can he give them?"

"For right now, I'm not sure." Vlad leaned back on the couch. "But in a few years, relief from having to have serfs might do it."

"Don't count on it, Vlad." Brandy shook her head. "The serfs could end up as factory workers and have even less freedom than they have now. 'I owe my soul to the company store.' If it could happen in America, where we—at least in theory—all had the same rights, think how much easier it could happen in Muscovy where serfs are already restricted in when they can quit."

Vladimir sighed. "I know. Adam Smith and all your economists tell us that free labor is more productive than slaves or serfs. That slavery and serfdom is bad for the economy of the nation. But what they usually neglect to mention is that it's still very profitable for the people who own the slaves." He looked down at his coffee cup.

"Brandy, I've lived here for a long time and have accepted many of your principles, but that doesn't mean my countrymen have. I agree that serfdom must be eliminated but I don't see any way to do it."

* * *

When Brandy got up to light the gas lights against the darkening of the room, Vlad moved just a tad closer to her end of the sofa. Whenever she leaned forward to pour more coffee, or stood to busy herself with something, he moved just a little bit closer. Eventually, Vlad was right where he wanted to be. Close, nearly touching.

Brandy looked a little nervous when she discovered just how close he was. Deciding not to give her, or himself, a chance to bolt, Vladimir took one of her hands in his own. "Branya, I have something I want to speak of, something that is not about Bernie or even about Muscovy."

Brandy's breath caught just a bit before she nodded at him. "You can speak to me about anything, Vladimir. What is it?"

He had been quite confident of her response when he had written the letters asking permission from Czar Mikhail and informing Natasha of his intent. Somehow, that confidence had disappeared when he had been informed that Mikhail had agreed to the marriage—at least conditionally. The condition being that she make a valid conversion. And Natasha had informed him that several ladies of the family would be coming to Grantville to look Brandy over. At that point he had seen the looming disaster of his aunts arriving to inspect her before he even asked for her hand.

But Vladimir was still hesitating and Brandy was looking at him expectantly. "I am not one of your up-time men, Branya. And I may not have the correct words. But I have grown very . . . fond of you. Very fond. And I, I . . ." Vlad paused a moment. "I wish you to be my wife, Branya. I wish it very much."

Brandy's eyes glittered in the candlelight. "Wife? You want to get married?"

"I do," Vlad said. He watched her face closely. What would she answer?

"Yes."

* * *

Half an hour later, after some very pleasant kissing and some not so pleasant explanation. Brandy wasn't quite so sure.

"We don't do that," Vladimir said, sounding a bit desperate. "Abandon thy family, abjure thy name." He shook his head. "It sounds glorious, but Romeo and Juliet ended up dead. When my sister married an English count—with my father's permission but without his converting—it almost ruined the family. Were I to marry without the czar's consent, our family's property could be seized and my sister could end her life in a convent. Forced to take holy orders. Not because Mikhail would want to do it, but because the cabinet would insist."

Brandy knew that was all too likely an outcome. But Vladimir was continuing. "If I asked the czar first and you said no, I would look foolish. But if I asked you first and the czar said no, I didn't know what I would do. I didn't wish to make a promise to you until I was sure I could keep it."

* * *

"All right!" Judy was grinning from ear to ear. "All right, Brandy. So, when's the wedding? What are you going to wear?"

"I don't know to the first question." Brandy took a sip of root beer. "And I don't know to the second one, for that matter."

All the members of the Barbie Consortium who were attending the monthly lunch looked confused. "It's more complicated than I knew." Brandy sighed. "It turns out that Vlad is sort of a prince or something like that. He can't just get married, not to a foreigner, not to anybody, really. He has to get permission."

Vicky Emerson looked outraged. "What, from his father? He's a grown man. Why ask for permission?"

Brandy shook her head. "His parents are dead. Both of them. Two sisters, Natasha in Muscovy and Adelia in England. No, it's not his parents, it's the czar. He had to get permission from the czar. He apparently asked him before he asked me," Brandy added, with some resentment. Vladimir had explained that he had to do it that way but it still pissed her off. "And then there's the religion thing, too."

"Religion thing?" Hayley Fortney paused in the act of sipping tea. "There's a religion thing, too?"

Brandy nodded again, and sort of sighed. "Yeah. It's all going to take a while, it looks like. I'd just as soon go down to City Hall and have a civil ceremony, get all the hoopla over with. But Vlad's church will not recognize a civil ceremony, he says. It's against canonical law. And, it turns out that if he gets married in any church except a Russian Orthodox church, he could be charged with treason. So we figure we better wait."

"That's kind of hard, isn't it?" Judy looked around at the girls. "Your Vlad is a nice looking guy. A nice guy in general, for that matter. I bet you hate waiting."

"Well, one thing about it." Brandy shrugged. "At least we ought to be really sure about it when it does happen. Vlad says he probably ought to have a priest come here, anyway. Natasha is sending a bunch of people from his lands and they're all going to go to school here. And to the oil field. So they need a priest. They wouldn't be comfortable going to St. Mary's. We're probably looking at six or eight months to wait."

"That's just about enough time," Judy muttered.

"Enough time?"

"Yeah," Judy grinned. "Just about enough time to plan a really big, really nice wedding."

* * *

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The Music of the Spheres . . . er, Ring

Written by David Carrico

A lot has been said in the various 1632 discussion threads on Baen's Bar, as well as in print, about how early modern Europe's populace really weren't too different from people of today. They were technically adept, given the tools that they had, so they would have been able to reproduce a great deal of modern technology. It might have taken them some time, but it would have been possible. The people would have adapted to practical technology quickly.

Early modern Europeans were highly literate, frequently in multiple languages. They were sophisticated in both philosophy and in religion. And they would be very quick studies when it comes to politics.

Even in the arts, for the most part the people of Grantville would have had little to teach them, aside from photography and sound recording. These are technologies that are really relatively straightforward once modern chemicals and tools are available.

There is one area of modern life, however, where the natives of the 1632 era would not embrace the up-time offerings with open arms: music.

Why? Because the 350+ years between their era and ours produced some of the most radical changes in musical thought and practice imaginable. More changes occurred in that time frame, and faster, than had occurred in western European music in the previous thousand years. From 1800 on, every generation produced music rather different from the previous generation; even significantly different.

Music, as much as—perhaps more than—any other art form, is learned and heard and judged by the ears of a cultural context. That's why they wouldn't just swallow the up-time music and musical forms. If you plucked a German from 1631 Mainz and dropped him into New York City today, he would have been as shocked and appalled and bewildered by the music of today as if you had plucked a South Sea islander from a secluded Pacific island in 1920 and done the same thing to him. (Okay, that is perhaps a bit of an exaggeration—but not much of one.) The down-timer culture and societies were at the bottom of that 350 + year learning curve, and it would take them time to learn to like the music; not 350 years, but more than a year or two.

Music Technology

This article is going to focus on the sound of music, on the forms of it, on how people hear it, and why it will take a while for most of the up-time music to catch on. But there are technologies to music that will now be available to the down-timers, so let's first do a quick review of those.

Strings—Violin family

When you try to research the history of the violin, you quickly discover that in the 1632 time frame there

were no standardized instrument forms such as there are today. There were a variety of bewildering names: viol, violon, vihuela, viola, viola d'amore, viola da gamba, and others.

What we would think of as modern violins had by this time been pretty well standardized in overall shape, proportion, and number of strings – 4. The other three instruments of the modern string family—viola, cello, and double bass—were a long way from standardization. The viola d'amore, for example, typically had fourteen strings; seven that were played, and seven more that were pitched an octave higher that were sympathetic resonators. And the viola da gamba, despite its name, was a very large instrument, larger even than a modern cello. Double basses were just beginning to make their appearances. String counts for violas, viola da gambas and double basses varied with the luthiers who made them, or perhaps the patron or artist who commissioned them, but five or six or even seven strings weren't unheard of.

Even though 1632 is pre-Stradivarius, Grantville really has nothing to teach seventeenth-century luthiers about these instruments, other than showing them the latest refinements in proportions and preaching the advantages of standardization. The standardization required longer necks, which required fewer strings to provide the needed notes to play the music. It also required the metal wrapped gut strings that would be forthcoming from Nürnberg in the near future. The strings would hold more tension than other materials to handle the tuning changes that would be coming and which also allowed for longer necks to provide the needed notes to play the music with fewer strings. The standardization will happen quicker in the 1632 universe because of the up-time examples.

However, one big technology advance that can be brought to the down-time instrument crafter and players is the refinement of the bow. The modern bow design was established by Wilhelm Cramer and Francois Tourte in the late eighteenth and early nineteenth centuries. I won't list the individual modifications, other than red pernambuco wood from Brazil becoming the wood of choice for bows (still true today), but the result was a bow that could be held lightly with the fingertips, rather than having to be grasped with the whole hand. This in turn allowed for much greater flexibility in playing style, which was the necessary development for the rise of the violin as a virtuoso solo instrument.

Strings—Guitars, etc.

The guitar was definitely available in 1632 in various forms. Known by the names gittern, vihuela, guitarra, or vialle, it tended to be smaller than today's instrument, with a body that was narrower in proportion than today's instruments. It had a smaller sound than today's instruments, partly due to the use of gut strings, and partly due to the smaller size. The common pattern had four strings, usually doubled to be four courses of two strings each that were pitched an octave apart. By the late 1600s, luthiers were beginning to add a fifth course.

There were renowned guitar luthiers in Paris, Venice and Spain.

Again, Grantville would have little to teach the luthiers about guitars, other than to show them the larger bodied modern instruments as templates and teach them about using metal strings when desired.

The luthiers and performers will be intrigued by the banjo, however. (Concerto for Banjo and Orchestra by George Telemann? It would be possible.)

Mandolins are available in down-time forms. If any modern versions exist in Grantville, down-time luthiers may identify some refinements. Otherwise, the presence of up-time guitars may also cause some down-time experimentation with changes to mandolins.

For electric guitars, see Electronic Instruments.

Strings—Harp

Harps have been around for thousands of years, and large floor standing harps weren't uncommon in the seventeenth century. The one technological improvement that Grantville could introduce would be the tuning pedals that allow certain sets of strings to be raised or lowered in pitch. This could be done even in the middle of a performance, allowing harps a similar flexibility as pianos. Pictures are surely available in some reference works somewhere in Grantville, either the encyclopedias or some kind of music history book or music dictionary in some music teacher's private library.

Keyboards—Organ

Organs in 1632 came in three main varieties.

First is the pipe organ, where sound is produced by pumping air through what amounts to giant whistles, some with brass reeds in them. These typically were rather large instruments, usually found in cathedrals or very large churches.

They are capable of large volume gradations, and a large organ will have a very large pitch range and a wide variety of timbres available to it. It was often referred to as the "King of Instruments." Grantville has nothing to teach the seventeenth century about how to make these, other than introducing electric blower motors to fill the wind chests instead of requiring manual or mechanical mechanisms to fill them.

Second is something called a regal. It in essence was kind of like a giant keyboard operated harmonica. There would be a case containing a variety of brass reeds, with a small keyboard on one side and a couple of bellows protruding out the back. This was a portable instrument. In some cases, they would fold up to the dimensions of a very large book. Again, Grantville would have nothing to teach the down-timers about this instrument.

Third is the "portative organ," which goes back to medieval times at least.By the seventeenth century, at least some of these had grown to 52-note, foot-bellows-powered instruments about the sizeof a console upright piano. These would be comparable to more modern portable organs with foot powered bellows. There may be one still in a back room in one of the churches, else someone of the older generations will remember them. They used to be a staple of the tent revival evangelism circuits. The down-time craftsmen might pick up some refinements if a modern portable organ is still somewhere in town.

Keyboards—clavichord/harpsichord/clavier

These are all instruments which are very common in 1632. Grantville will have nothing to offer here.

Clavichord—keyboard instrument in which the strings were struck by a thin brass "blade." Strings were apparently single strands of metal, but were paired together. Sound was not large. Volume gradations

(soft to loud) were possible. Sustained notes were only possible by continuing to hold down the key after the string was struck. Their range was narrow; typically three to four octaves.

Harpsichord—keyboard instrument in which the strings were plucked by a plectrum. In earliest versions, the plectrum was commonly leather, but over time crow quills became popular. As with the clavichord, strings were apparently single strands of metal. Volume gradations were not possible—the string was plucked one manner regardless of how hard or soft you hit the key. Again, sustained notes were only possible by continuing to hold down the key after the string was struck. Similar range to the clavichord.

Clavier—in French (klah-vee-ay), a term that simply means keyboard. In German (klah-veer) originally a generic term describing any keyboard instrument (including organ), but later it became a synonym for clavichord. Early pianos were sometimes referred to as hammerklaviers.

Keyboards – piano

Here is where the down-time instrument makers hit the mother lode. The piano did not exist in 1632. The first instrument recognized as a piano (pianoforte) is credited to Bartolomeo Christofori of Florence, Italy, in the early 1700s. Four major innovations had to come together in one place for the modern piano to be produced: the use of steel strings; the wrapping of the lower pitched strings in copper (tightly, so they won't buzz) to produce strings that would stand up to a hammering to produce a loud volume; the cast iron harp to reinforce the sound board to hold up to the tension of the strings; and the pedal ensemble of a grand piano, featuring three different pedals that provide variation in how the sound will be sustained or muted.

The piano is truly remarkable in its volume gradations. An eighty-eight key grand has a pitch span of almost eight octaves, putting it on a par with the organ in those categories. There is nothing contained within a piano that will be beyond the capabilities of down-time crafters, and the impact the piano will make in the 1632 musical era cannot be underestimated. It is canon that Grantville had three full-size grand pianos (two of which are spoken for), a few baby grand pianos (one in a church, one or more in schools, one or more in residences), and an unknown quantity of upright pianos of various ages and conditions. Canon does not explicitly state that some of the older uprights are player pianos, but the possibility is there, which would be of interest to both clockwork makers and instrument makers alike.

Wind Instruments—Woodwinds

The modern woodwind group covers flutes, piccolos, the oboe family, the bassoon, the clarinet family, and the saxophone family, of which only the flute would be directly related to instruments of 1632. Modern flutes and piccolos are typically made of metal, but are classed as woodwinds due to the fact that they were often made of wood well into the 1800s. Even today the bodies of piccolos are frequently totally or partially made of wood. Saxophones have always been hybrid metal and wood instruments, but are classed as woodwinds because they use a woodwind style mouthpiece with a reed and because the fingering system is like that of most woodwinds.

Most of the woodwind family would be new to the down-timers, but they would embrace them with

open arms, because they would fill musical niches of older, less musical sounding instruments, such as the shawm and the serpent. It wouldn't hurt that the modern designs would for the most part be easier to play as well.

There are two technologies needed to make modern woodwinds a success. One is the Böhm key system developed by Theobald Böhm in the 1830s. It makes playing the instruments (metal or wood) easier, but it requires many many little tiny steel wire springs—preferably stainless steel—and very small screws. It simplifies the fingering, which allows for more notes and faster playing; and it allows for holes that are larger than a normal fingertip can cover. The other technology key is that during the last 350+ years, there has been a great deal of development in determining exactly how the bore of these instruments should be shaped and tapered. These relatively subtle changes allow instruments such as flutes to play much louder than the 1632 versions. Instrument crafters will mug each other to get to this information.

Wind Instruments—Brass

The big news here is valves. Down-time crafters could produce the horn forms already, including the trombone (sometimes known as a sackbut in this time). The concept of valves, however, will send down-time players and crafters into spirals of delight because of the flexibility they will provide the players. And when nickel is available for both nickel plating and for stainless steel, that will only make things better.

Instrument bore shaping and tapering improvements will be just as big an issue for the down-time brass crafters as for the woodwind crafters. Modern trombones sound much better than the 1632 sackbuts. Trumpets will sound better as well. French horns may or may not sound much improved—the ideal bore of a horn was determined fairly early.

Subtler technology improvements will come in the areas of improved mouthpiece designs, spit valves, and steel springs for all the valves. Working with up-time models will also teach the down-timers a few things about how to properly flare the instrument bells for the best sound. And the emphasis on standardization of models will also be felt.

Percussion

Modern percussion instruments were basically adopted wholesale from the Turks in the eighteenth century when military bands began to be formed. Everything Grantville has will be new to 1632, including the pedal tuning mechanism for tympani, but none of it will be beyond the abilities of the down-time craftsmen. They will need some big pieces of cowhide for some of those drumheads, though.

Electronic instruments

These instruments are all subject to the limitation/requirement that reliable electrical power supplies of

the correct voltage are available. That means for the first few years their performance venues would be pretty limited. It's also likely that most of them won't be reproducible by down-time craftsmen; at least not until the down-time electronics industry reaches a particular level that will begin making certain types of parts available. That may take a while; i.e., years, maybe generations for some of them. This would include electric pianos, synthesizers, MIDI instruments, and using computers to generate music.

Electric Guitar

I will speak to this one directly, since so much popular music utilizes it. Yes, electric guitars could be reproduced by down-timer craftsmen. Amplifier speakers are possible with down-time technology, although the magnets might be electromagnets rather than the modern types currently in use. The big problem with reproducing the electronic guitar technology is that it will be at least 1637, more like 1638-9, before tubes for amplifier power heads are available in commercial quantities. Combine that with the requirement for reliable power, and it will be hard to see these as much of a force on the musical scene for quite a while.

The Building Blocks of Music

In this next section we will try to cover at a very high level some of the things that make music work. From time to time distinctions will be drawn between "street" music and "art" music. Street music would be the music of the common man, what he would hear in the homes and taverns of his town. Art music would be the music of the courts of the nobility and upper church prelates. Church music could find itself in either camp, depending on the style and who it was produced for. Most of the simple hymns could be classified as street music, especially since the words were often set to the tunes of popular songs.

Modes and tonality

Mode is a word that can have different meanings in music land, depending on whether you're talking about ancient Greeks or medieval music, or melody vs. rhythm. Most musicians would probably think of the medieval/Renaissance melody context if the word is mentioned. But to talk about modes, I first have to deal with some building block concepts.

Think of a piano keyboard. Find middle C on the keyboard. Now, move to the right up the keyboard to the next key that's a C tone. Counting all the white and black keys between middle C and the next C you have thirteen keys—eight white, five black. However, only eight of those keys (including both C tones) will be used in making what is frequently called a scale. From C to C is a tonal interval called an octave, based on the eight tones of the scale.

Now, between any two adjacent keys, whether white to black or white to white, is an interval called a half step. So, from C (white) to C# (black) is a half step. From C (white) to D (white) is a whole step.

From E (white) to F (white) is a half step, because there is no black key in between them. Same story from B (white) to C (white).

Okay, now for the interesting part. A mode refers to an octave scale built on a pattern of whole and half steps. Different modes have different patterns. And pretty much all of the modes can be found just by playing octaves on white keys on the piano.

For example, from middle C to the next C up represents the Ionian mode. The pattern is:

C-whole-D-whole-E-half-F-whole-G-whole-A-whole-B-half-C

Or

1-whole-2-whole-3-half-4-whole-5-whole-6-whole-7-half-8

This Ionian mode also happens to be the major scale used in most music since not long after the 1630s.

If you do A to A on white keys only, you get the Aeolian mode, also known as the minor scale, and the half steps fall between 2/3 and 5/6.

If you do D to D on white keys only, you get the Dorian mode, where the half steps fall between 2/3 and 6/7. And so on.

There are several other modes, but you get the point. Composers, of course, can use a mode beginning on any tone. Strictly speaking, the mode is dependent on the pattern of whole and half steps, not the tone on which it begins.

The main point to grasp is that if you have different interval patterns in the melodic scale, these are also the notes you use in producing the harmony, especially in this period of time when the bulk of the church and art music is polyphonic—each "voice" line is its own melody. So, if I use a scale starting on G, I will have different harmonic chords available in Dorian mode than I will have in Lydian mode than I will have in Phrygian mode than I will have in. . . . You get the idea. The composer's choice of mode makes a *big* difference in the sound of the composition. Think of the difference between major and minor keys today, then think of having six to ten more choices.

There was a definite evolutionary process in the area of modes and tonalities. The drive to the established major/minor tonality "palette" was well under way during the 1500s, and was pretty definitely over in the late 1600s. Older 1632 musicians, although familiar with the major/minor concepts, would probably consider them somewhat "newfangled." Up-time music won't be totally strange to them from that standpoint at least.

There will be plenty of other issues for them to have collective apoplexy over.

Keys

This is actually a continuation of the discussion begun in the modes and tonalities section. Remember that modes were actually octave scales with differing patterns of whole steps and half steps. The Ionian mode has the half steps between 3/4 and 7/8, which is the pattern used in major keys. The Aeolian mode has the half steps between 2/3 and 5/6, which is the pattern used in minor keys. Between the time of J.S. Bach and about 1900, almost all Western European (I include North America in this category) music was written in either major or minor keys. Since 1900, a pretty high percentage of "serious" music uses other tonalities, but almost all of the popular music, including Broadway, is written in it. In modern

musical usage, most music is written in either major keys or minor keys.

That part's pretty clear, I hope. But what are these sharp and flat things that keep showing up in music? The sharp symbol looks the same as the pound sign—a #. The flat symbol looks kind of like a lower case "b" with a pointy bottom. (The standard Microsoft symbols directory doesn't seem to contain it.) The purpose of a sharp is to raise a note's tone one-half step from its normal tone. A flat is to lower a note's tone one-half step from its normal tone.

This implies that note names can actually be used to represent three different tones on the piano, which is exactly the case. For example, let's take G. If a G note is indicated, it is the white key G on the piano. But if a sharp symbol is placed in front of the note, that turns the note into G-sharp, which would require the pianist to not hit the white G key, but to hit the black key immediately to the right of the G key. Similarly, if a flat symbol is placed in front of the note, that turns it into G-flat, which requires the pianist to hit the black key immediately to the left of the G key.

Okay, so what do the sharps and flats have to do with keys and scales? Remember that major and minor are defined by the patterns of whole and half steps. There is only one major key that can be played on white keys only, using only the natural tones, and that is C major. But what if we want to use a key starting on G? Using all white keys starting on G, you don't get the half steps in the right place to have a major key. So, to get the major key step pattern, instead of playing a natural F, you have to play an F-sharp. Same problem if we want to start the scale on F. To get a major key step pattern, instead of a natural B, you have to play a B-flat. And so it goes. Unless you start on a C, you will have to have sharps or flats. And some of the keys have a lot: B major, for example, has five sharps, and G-flat major has six flats.

It is common musical practice that for a given key, the sharps or flats for that key will be placed at the beginning of each line of music in the piece. It makes it easier to print and easier to read. Of course, the musician has to keep in mind what key he or she is in, or it starts to sound a little strange. Seriously, if you've played or sung for very long, it becomes second nature to you.

Everything said so far also applies to minor keys, except that the half-steps are in different places in the scale.

Harmony

Most Western European music is based on what's known as tertiary harmony. As you can tell by the name, it has something to do with thirds. To explain that, let's go back to the piano keyboard. We talked about octaves and steps. The musical term usually used to describe those is "interval." An interval is a measurement of distance between one tone and another.

So, let's start with middle C again. From middle C to the adjacent black key (which is called either C-sharp or D-flat, depending on what key we're in) is a half step, which is a minor second interval. Moving from low to high/left to right, from C to D is a whole step, which is a major second interval. From C to E is two whole steps, which is a major third interval. From C to F is two and one-half steps, which is a perfect fourth interval. From C to G is three and one-half steps, which is a perfect fifth interval. From C to A is four and one-half steps, which is a major sixth interval. From C to B is five and one-half steps, which is a major seventh interval. And from C to C is six steps, which is a perfect octave. You can

continue past that point (ninth, tenth, etc.), but for our purposes we'll stay within the octave.

First question is probably why the octave, fifth and fourth are perfect, while the others are major or minor? The answer goes way back into early music history, to the time when the church was the sole repository of musical learning. Gregorian chant is monophonic—only one melody, everyone singing the same thing. For a long time the church wouldn't accept the concept of multiple lines of music. Finally, they accepted the concept of a second line, but they still insisted there could not be dissonance of any kind, so they sang the second line on the same notes, only an octave higher. And lo, they blessed it, and it was perfect.

So more time passed, and some musician wanted to make the music richer. He probably was listening to some of that low class street music, liked what he heard, and wanted to sneak it into the church music. The next interval that they allowed was the fifth. They didn't understand why it sounded good to them—the understanding of acoustics was pretty limited back then. They didn't realize that the fifth interval is one of the major harmonics of a tone, and that by singing at the fifth they were singing at one of the acoustically harmonious points. It just sounded good. And lo, they blessed it, and it was perfect.

Pretty soon someone realized that a fifth is just a fourth turned upside down (or vice-versa). From low C to G is three and one-half steps, but from that G to the higher C above it is only two and one-half steps, which is a fourth. And lo, they blessed it, and it was perfect.

It's psychology interacting with acoustics. It sounds good.

Yes, you can sharp or flat a fourth or fifth, but you don't call it major or minor. If you sharp it, it's augmented, if you flat it, it's diminished. I supposed technically you can augment or diminish an octave, but in six years of formal training in music theory I never heard it.

Back to harmony. The next interval inserted into the harmonic mix was the major third, but when you put a major third in the middle of a fifth—C-E-G, for example—you get a structure called a triad, which is the first real musical chord. From C to E is a major third, from E to G is a minor third—hence the tertiary harmony label that we mentioned at the beginning.

Most music that people enjoy listening to today is built on tertiary harmony—maybe with some added tones, but still recognizably built on thirds.

As you might imagine, there are quite a few rules on how to build chords, and which chords must precede or follow other chords, which is a level of detail we're not going to dive into for this discussion.

Last thing I will mention is to go back to the fifth interval. If I'm in the key of C, using the C scale as the foundation for my harmonies, the fifth tone of the scale is G. Musically, that is referred to as the dominant. It goes back to the psychology/acoustics thing again . . . it is the strongest harmonic to C, the root of the scale. It took on a special place in the minds of the early musicians, hence the dominant name. Likewise, a chord that is built on the fifth of the scale is referred to as the dominant chord in that key. In C, the dominant chord would be G-B-D, maybe with an added seventh or ninth.

Tempering/Temperament/Temperatur

Okay, this is going to be way simplified. For a more thorough but still reasonably brief discussion of the issues, see the Acoustics and Temperament articles in the Harvard Dictionary of Music.

This issue has to do with the physics of sound generation. In nature, there is no such thing as a pure tone. All natural tone generating objects, whether animate or inanimate, resonate when they generate tones. They generate complex wave-forms consisting of the primary tone and then the secondary harmonics or partials that are associated with it. The only way I know to get a pure naked tone without harmonics is to use a sine-wave generator, although modern tuning forks come close.

This generation of harmonics is not an issue as long as we are producing monophonic music. However, as soon as we move to polyphonic or homophonic music (more than one note sounding at the same time), we have a problem. (See the musical lexicon section.)

The human ear is capable of discerning some pretty subtle distinctions in tonality. When two different tones are generated, we instinctively want them to be consonant, to sound good, so we want the higher-pitched tone to match into one of the partials of the lower-pitched tone. The closer the match, the more consonant/less dissonant the harmony, the more "perfect" it becomes.

The problem is the proportion of tones one to another to produce "perfect" consonance is not consistent if you change the lower tone. If my lower tone is a C, to achieve perfect consonance with a G the pitch of the G will be slightly different than the pitch of a G will be if it is perfectly consonant with a lower D tone.

This isn't normally a problem for vocalists, obviously. They tend to adjust their sound to blend without even thinking about it. This is also true of good wind musicians. Players speak of "lipping" a tone, of shifting the "embouchure" (position of the mouth in relation to the mouthpiece) to make a subtle difference in the pitch. And of course standard string players can just slide a fingertip a hair one way or another to blend in.

However, for hammered or plucked instruments (bells, glockenspiel, piano, harpsichord, harp, etc.), this is not possible. This means that practically speaking, their "palette" of available tonalities would be limited to one base key with perfect tuning and at most three or four keys closely related to it. As you get farther away from the base key that the tuning of the instrument is perfect for, the less consonant/ more dissonant its music would sound within itself. Needless to say, it's rather laborious to retune one of these instruments, if it's possible at all. And the thought of trying to adjust the tuning of a pipe organ can't even be seriously considered.

The limitations of this approach are pretty self-evident. Composers chafed at being limited to a handful of keys/tonalities.

A number of "temperament" systems were proposed over the years with different methods of adjusting pitch ratios and dropping certain keys from usage.

Eventually, however, the system that won out is the "Equal Temperament" system. It had been proposed in one form or another as far back as the early 1500s, but it didn't gain dominant status until about 1800 in Germany and about 1850 in France and Britain. In this system, the only truly perfect interval is the octave—A to A, B to B, etc. Between the two tones of an octave, the frequency spectrum is divided into twelve equal semitones (a/k/a half steps), each of which corresponds to one of the white and black keys of a piano in that octave.

The net result is that the non-octave intervals in equal temperament are never "perfect," but many of them are so close it's hard for even the human ear to detect the difference. The big thing is that all keys/ tonalities are just a little bit off, instead of some of them being nearly perfect and some of them being rather dissonant. This opened up the full musical palette for composers, which made for the richness of

the classical and romantic periods of music.

This was a very serious subject in musical circles of the 16xx era. Lots of debate (i.e., impassioned arguments) occurred over this.

Of course, even today, you will sometimes hear wind instrumentalists muttering that equal temperament is a folly, and we should go back to the true Pythagorean/just tunings. J

Pitch and tuning

Standard international pitch today is a' (the a above middle c) = 440 Hz. This was established in 1939 by an international conference under the sponsorship of the International Standards Association. (Precursor to ISO?)

Prior to that, the standard was a'=435 Hz, established by the Paris Academy in 1859 and ratified by a conference in Vienna in 1885.

Prior to that, there was no international standard. It was whatever the local musicians decided. Most probably, it was whatever the local pipe organ had been tuned to, as that would be the instrument that would be hardest to re-tune. It was not unknown for composers to have to transpose works if they took them to a different locale because the tuning in their new location was significantly off compared to their old location.

Historical evidence is that in the early 1700s, the closest thing to a standard was b' = to something around 422 Hz. 16xx probably was not too different. This means that the a' would probably have been around 370 Hz. This is a difference on the order of a full step. The down-time a' would be around the up-time g', maybe even lower.

Net effect = down-time musicians playing up-time music with local tuning values would generate music that was actually lower in pitch than the up-time performance of the same piece. This actually gives a break to sopranos, tenors, trumpeters, and anyone else who was performing in their personal upper register. A difference of a step is a huge difference. It would also explain why composers would sometimes produce copies of the same work in multiple keys, as the local organ might have a different pitch than the organ in the last place he was at, so to get the sound he wanted he'd have to change to a different key.

Why was the international move to raise the pitch? One suggestion is that they wanted a brighter sound.

What Does All This Mean?

Okay, we've talked about all this to get to this point: the music from the future is going to sound very different to 1632 ears. This is the part that is hardest for our generation to understand. I'm actually going to quote some words I wrote for one of my characters, Marla Linder, in the story "Suite for Four Hands," which was published in *Grantville Gazette*, volume 5. I can't think of a better way to describe what's what.

" There has always been a difference between the music done for art's sake, and the music done to please the common man. You know that's true. The music you create for patrons, and I include the church in

that category, is different from the music you create on street corners and in taverns. It may be related—you know as well as I do that melodies from the street and the taverns have a way of sneaking into even the music written for the churches—but there is a definite difference in complexity between the two. The more complex the music grows, the smaller it seems the audience is who can truly appreciate it.

"As I said, this has pretty much always been the case, but until the early 1900s the music of the streets was more of an undercurrent in the stream of music. That changed with the invention of mechanical devices that could record music played in one place onto some kind of medium, such as wax or types of plastic—" They all nodded at the reference to the magic stuff that was so prevalent in Grantville. "—or even the CDs.

"What happened was once the average citizen could own a device that would play whatever music he wanted whenever he wanted it, he began buying the music he liked. That changed the way music was created and performed. By the 1970s, it was becoming difficult for many orchestras to exist, partly because people were buying different music than what the orchestras played, and partly because even the music the orchestras did play could be recorded, bought and played any time.

"The popular music, the outgrowth of the music of the streets, took many forms. Most people would like a few types. Very few people liked them all. But in almost every case, the popular musicians became like heroes, and it became a status symbol to people to have a lot of these recordings. The more you had, especially of rare or new or avant-garde musicians, the more status you had among your friends. By the time I was in high school, a ridiculously large amount of money was being spent every year by people all across our nation to purchase these recordings.

"The styles of music diverged for a while, but inevitably they began influencing each other again, both between different types of popular music and between the popular music and the art music."

Another conversational quote from the same source.

After they regained their composure, Friedrich said, "How can so many different styles have developed so quickly? Our music develops slowly, changes slowly. Why did theirs change so rapidly?"

"We've already talked about the access to mechanical and electrical systems to play music," Marla said as she walked back into the room. "Another factor, though, is the changes in the place and authority of the church in society. For most of its existence, the church has been a conservative institution. That can be a good thing, at times. However, it can also be a drawback, for conservative organizations tend to be very slow to change. Ultraconservative organizations actively resist change. Hence the boiling pot of Europe that Luther and Calvin have lit a fire under."

She moved to the stereo, and continued speaking while she searched for a CD. "One of the areas where the church exerted its control was in the arts. Musical forms changed very slowly over the years. But as a result of the changes that occurred beginning with Luther, the influence of the church—whether Roman, Lutheran or Reformed—over music began to ebb, and musical evolutions began to cycle faster. By the 1800s, musical generations were occurring on a level with human generations. By my lifetime, musical generations were occurring every five to ten years."

There you see the evolution of modern music described in a nutshell. Now to talk about what the down-timers would hear.

There are three factors that define what sounds "good" to people: using notes that fall within the harmonic series of the previous note, using notes that fit within the harmonic series of the chord in place at that moment of the music, or using notes and intervals that are acceptable within the cultural

experience of the people. The first two do have some grounding in acoustics. The last is purely a factor of what the people have learned to be acceptable, and please do not underestimate it.

Singable melody carries with it implied harmony, created by the intervals between the notes of the melody line. Even if all you ever heard sung was the melody line, if you can hear the melody well enough to pitch-match and sing along with it, you gain a feeling for the key the song is in. It's an unconscious thing—most people don't even realize that it's happening. And in the street music of the 1632 era, changes of key during a song just weren't common, whether sung, played on a pennywhistle or played on a bagpipe. I won't say they didn't occur, but they weren't common.

As an example of something that would really affect the down-timers, let's look at the old standby, "Do, a Deer," from *The Sound of Music*. Even performed with only the melody, I think that song would drive most of the down-timers nuts. It seems so simple to us, but we grew up with it in the twentieth century. If you really listen to the melody, though, that song seems to shift keys about five or six times in the verse and chorus, and then it starts over and does it again. You don't have to be a trained musician to hear that, and it would just sound "weird" to them.

As another example, take the song "Maria" from the Broadway musical *West Side Story*, music by Leonard Bernstein . Down-timers would hate this song because of an interval in the melody that would *never* be used in melody writing at that time in either street or art music. The interval is an augmented fourth, basically from C to F#, also called a diminished fifth or a tri-tone. That is the single most dissonant interval in Western European music using what we would think of as normal instruments and scales. Nobody then would use it in melody writing. In fact, supposedly Bernstein intentionally used the interval just to prove that it could be used in a melody. It definitely caused a certain amount of furor in academia when he did.

Any down-timer who heard "Maria" would cringe. The professional musicians could tell you why–they actually referred to that interval as "diabolus in musica." The common people would just know that the song really sounded bad. And yet, by our standards, that's a pretty song. That's probably the most extreme example I can present, but it's not the only case.

Relatively minor changes in style can produce severe reactions in the public. Remember how Bob Dylan's career almost tanked when he picked up an electric guitar? In the same way, relatively small differences in the "sound" of up-time music would cause acceptance of it to be somewhat less than universal or fast.

Another issue would be syncopation, the playing of notes on the off-beat. Some of the art music of the time used syncopation, but it was narrowly defined to a certain style of syncopation, not the full gamut of syncopation used today.

The street music of 1632 is very simple. The up-time music that would come closest to matching it would be simple folk music (not the sophisticated Peter, Paul and Mary stuff), early country/hillbilly music not far removed from the Appalachian hill country folk songs, and hymns written before about 1920. There will be exceptions—the melodies of the Beatles songs "Michelle" and "Yesterday" would translate well, although the original harmonies might not.

A lot of music will make an easy transition. I intentionally picked Irish folk music for some of my characters to perform in the taverns for several reasons, one of which was that the people would accept it quickly. But a lot of songs that seem plain vanilla to us (cultural experience) are really going to sound weird to the down-timers, and it will take some time for them to become accepted. There is such a thing

as cultural inertia. For some of the songs it may just be a matter of a year or so. Some of them will be years, some a generation or more. Dixieland, ragtime, jazz, heavy metal—anything with lots of dissonance in it is going to be on the long end of the scale. There might be an occasional exceptional character that stands out early on as liking one or more of those styles, but wide-spread acceptance will take a while.

The art music of 1632 is pre-Johann Sebastian Bach. This is a full generation before he was even born. It's pretty simple, comparatively speaking. Bach and Handel will seem avant-garde to them. Mozart and Beethoven will blow their doors off. Chopin will cause harpsichord players to freak out. Most everything written above applies to the art music, and more so.

One more quote, and then we'll move on. This is a 1958 quote from Igor Stravinsky, one of the most well known composers of the twentieth century.

"I am often asked if I would consent to conduct in the Soviet Union. For purely musical reasons I could not. Their orchestras do not perform the music of the three Viennese and myself, and they would be, I am sure, unable to cope with the simplest problems of rhythmic execution that we introduced to music fifty years ago. The style of my music would also be alien to them. These difficulties are not to be overcome in a few rehearsals; they require a twenty- or thirty-year tradition. I discovered something of the same situation in Germany at the end of the war. After so many years of Hitler in which my *L'Histoire du Soldat,* Schoenberg's *Pierrot lunaire,* Berg's and Webern's music were banned, the musicians were unable for a long time to play the new music, though they have certainly more than made up for it since." (From Conversations with Igor Stravinsky, by Igor Stravinsky and Robert Plant, © 1958, 1959, University of California Press)

I will grant you that Stravinsky's music would be challenging to any musician, but the point he makes relates to and underlines what I've been saying above. Much of the up-time music will not be assimilated easily or quickly.

A Musical Yardstick

Some time back three members of the editorial board were polled to ask them to rate several modern pieces of music as to how they think they would be accepted by the down-timers in the year 1632. The scale was 1 = that's just noise to 10 = I like that. Below are the consolidated scores. It's a subjective analysis, but that in itself tends to prove the point that a lot of acceptability is in the ear of the hearer.

Edelweiss (from The Sound of Music) 9.5

Shady Grove 8.5

Blow the Man Down 8.0

The Gambler 7.5

The Rising of the Moon 7.5

Throw Mama from the Train (a kiss, a kiss) 7.5

Streets of Laredo 7.0

Boll Weevil 7.0

Long Black Veil 7.0

Swanee River 6.5
Bach's G minor Fugue 6.5
Amazing Grace (standard hymnal version) 6.5
Will the Circle Be Unbroken 6.5
Battle Hymn of the Republic 6.0
Give My Regards to Broadway 6.0
The theme song from The Brady Bunch 6.0
Hello, Dolly 5.5
All the Girls I've Loved Before 5.5
I Saw the Light 5.5
White Christmas 5.5
Blowing in the Wind 5.0
Some of the Mozart concerti? 5.0
16 Going on 17 (from The Sound of Music) 4.0
California Girls 4.0
Up a Lazy River 4.0
Alexander's Ragtime Band 3.5
Dixie 3.0
Putting on the Ritz 3.0
Goodbye Norma Jean 3.0
Hotel California 3.0
Girls Just Wanna Have Fun 2.5
It Don't Mean a Thing if It Ain't Got That Swing 2.5
Rock Around the Clock 2.0
A Day in the Life 2.0
Blue Suede Shoes 2.0
Benny and the Jets 1.5
Maple Leaf Rag 1.5
Purple Rain 1.5
Maria (from West Side Story) 1.0

Musical Lexicon
(Note: much musical terminology is Italian in derivation)

Monophony—music characterized by a single melodic "voice" with no harmony. Best example is Gregorian chant.
Polyphony—music characterized by multiple melodic "voices," the interweaving of which creates

vertical harmonic structures. Most Renaissance and Baroque era music is polyphonic. Most anything by J. S. Bach would serve as a good example, but I would point to the fugue section of the "Toccata and Fugue in D Minor" as being one of the easiest to find and recognize.

Homophony—music typically characterized by a single melodic "voice" supported by other "voices" which may parallel the melodic voice or may move contrary to it, but still interact with it to produce vertical harmony. Most music produced since the beginning of the Classical era is homophonic: Mozart, Beethoven, Rodgers & Hammerstein, etc. Simple examples can be found in standard church hymnals.

Symphony—as with most words ending in -phony, it's derived from Greek. The original form of the word meant an octave, and was later broadened to mean consonance. It's had various other applications over the centuries, but since the classical period began in the eighteenth century, it usually means a work for orchestra written in a particular form called a sonata form. Secondarily, it has also been applied as an adjective to the orchestra itself, as well as various other forms of music written for orchestra—i.e., symphonic poem, etc.

Adagio—a musical term with at least two different meanings:

1) a relatively slow tempo

2) a piece written to be played in the adagio tempo. A very well known and extraordinarily beautiful example is Samuel Barber's Adagio for Strings, which was used in the soundtrack of the movie Platoon.

Tempo (plural is tempi)—the speed at which a piece of music is performed.

Ritard (yes, it's spelled correctly)—musical direction that basically means slow down

Accelerando—musical direction that basically means speed up

Crescendo—musical direction that means get louder

Diminuendo—musical direction that means get softer/quieter

Forte—loud

Fortissimo—very loud

Piano—a musical term with at least two different meanings:

1) the instrument

2) soft/quiet

Pianissimo—very soft/quiet

Embouchure—the correct formation of the mouth and placement of the lips in relationship to the mouthpiece of a wind instrument.

Timbre (yes, that's how it's spelled, r before e)—a French word correctly pronounced something like "tahm-bruh"—it basically means the characteristics of the sound of a voice or instrument. The timbre of a piano is different from the timbre of a trumpet. The various stops and pipes of an organ produce tones of different timbres. The timbre of a soprano is different from the timbre of an alto.

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The Wooden Wonders of Grantville

Written by Iver P. Cooper

The "Wooden Wonder" (or "Timber Terror") of World War II was the De Havilland Mosquito, a highly successful aircraft, made primarily from wood, used in both fighter and bomber configurations. The fact that it competed effectively with aluminum-based aircraft shows that it is a mistake to discount wood as an important resource for the USE.

Wood, of course, is a very familiar material to the down-timers, but that doesn't mean that they have nothing to learn from the up-timers. The latter can offer advice as to where to find valuable tree species not already in European use, new wood products, new uses for existing products, new equipment for processing wood, and more sophisticated forestry management techniques.

Social Aspects

The use of wood is pervasive in seventeenth century society. In consequence, changes in "wood technology" or forest management can create unpleasant surprises for the up-timers.

For example, the up-timers might want to limit the cutting of trees to "sustainable growth" levels. Yet one of the goals of the Swabian peasant rebellion of 1525 was to restore "the right to freely collect building materials and firewood from the village's forests," unless those rights "had been specifically sold off." (this was article five of "The Twelve Articles") (Sands 31; Handisides)

Another example is that we might want to build more modern sawmills, which process wood faster, with less labor and less waste. But in England, the first sawmills were attacked by mobs of handsawyers, who feared that the new equipment would deprive them of their source of living. Sawmills weren't accepted in England until 1788. Sawmills were quickly accepted in America because where there was a labor shortage (and plenty of timber)(Lillard, 23; Cox 14; Pike 39).

We might also want to protect the trees which are most suitable for shipbuilding—it will be a while before we are building all-iron ships. But Pike says that the eighteenth century British "broad arrow" policy (marking selected pine trees to reserve them for use as ship masts, and punishing scofflaws) "did more to cause the American Revolution than the Stamp Act and the tea tax put together." (Pike 48)

Grantville Forestry Resources

The up-timer Gordon Alexander (1938-) is a former employee of the USDA Forest Service. (If he were employed in West Virginia, it was most likely at the Monongahela National Forest.) While he has only a high school diploma, the Grid says that he has taken "lots of specialized courses from the Graduate School of the Department of Agriculture." The USDA Graduate School offers certificates of

accomplishment in Natural History Field Studies, Horticulture, Landscaping, and other subjects. The available courses include tree identification, but not forestry management per se. Hopefully, he learned that on the job.

The Grid doesn't reveal Gordon's job title. The most common positions at the Forest Service are forestry technician (7457), forester (5287), civil engineering technician (1771), clerk/administrative assistant (1599), and civil engineer (1073). Nowadays, a forester usually will have a suitable college degree, but that might not have been true when Gordon started. A formal college education is not required for a technician, but some have associate degrees.

Phil Jenkins is a young up-timer (14 as of the RoF) with interests in "forestry and forest management." David Caine is a contractor whose company trimmed trees for the power company. Grantville also has biologists and gardeners.

Grantville residents could conceivably have taken forestry courses in West Virginia. West Virginia University (Morgantown) has an accredited professional forestry degree program, while Glenville State College (Glenville) has a forest technology program. The Grid identifies college graduates, but not the schools attended.

* * *

There are articles on trees, woods and forestry in the Grantville encyclopedias. I have checked the catalogue of the Mannington Public Library (which is the model for the Grantville one), and it has a number of useful books. There are at least seven guides to trees (they concentrate on American trees, of course) and at least two on West Virginia logging, Clarkson's *Tumult on the Mountains* and Blackhurst's *Of Men and a Mighty Mountain*.

* * *

It is somewhat more difficult to determine how much forest is in the Ring, and which species of trees it contains.

West Virginia, in 2000, was 76% timberland. There were eight state forests; the nearest to Mannington was the Coopers Rock State Forest in Monongalia and Preston Counties.

Grantville is in Marion County, whose timberland, in 2000, fell into the following stand-size classes: 99,300 acres of saw-timber, 17,600 pole-timber, 13,100 saplings and seedlings; total, 130,000 (65% land area). (Table 68). In terms of forest-type, there were 80,700 acres of oak/hickory, 7,200 of elm/ash/red maple, and 42,000 of northern hardwoods (Table 69).

The 2002 Census of Agriculture profile for Marion County reported that its 50,153 acres of farms included 5,887 acres of pastured woodland and 11,786 acres of unpastured woodland (figures were a little lower for 1997). Marion County has a total land area of 310 square miles (198,400 acres). The Ring has a diameter of six miles, so it has an area of 28.26 square miles (18,100 acres). If it has its fair share of the county's farm property, then it should include at least 6,500 acres of farmers' woodland. And there will be trees on residential plots, and in public areas, too. And perhaps also some outright timberland.

In Coopers Rock State Forest, about half the forest cover, found on dry ridge and upper slope areas, is dominated by trees belonging to the oak-hickory group (e.g., white oak, black oak, northern red oak, scarlet oak, chestnut oak), and are associated with yellow poplar, blackgum, sugar and red maples white and green ash, elms, basswood, cucumber magnolia, and occasional bech, black cherry, black walnut and eastern hemlock. The other half, found on stream bottoms and lower slopes, and in "moist coves," is the yellow poplar group (yellow poplar, eastern hemlock), associated with cucumber magnolia, black

cherry, northern red oak, red maple, ash and black lotus. (Coopers Rock State Forest: Forest Resources Management Plan)

The state has an active "urban and community forestry" program. Their website (wvforestry.com) says that red oak, sugar maple, hackberry, white ash, scarlet oak and hophornbeam are good for street tree use, and that serviceberry, black gum, hornbeam, swamp white oak, tulip tree and river birch are good for landscape use.

There was a state tree nursery in West Columbia WV, from which West Virginia landowners could purchase "urban green units" (minimum order of two units, 25 trees per unit) of white pine, Scotch pine, red pine, Virginia pine, Norway spruce, Japanese larch, Douglas fir, European black alder, black locust, black wlnut, Chinese chestnut, chinquapin, "Streamco P. Willow cuttings," red oak, chestnut oak, white oak, American chestbut, and butternut.

There are several tree farms in Marion County (e.g., the 378 acre Crawford Tree Farm), but none, so far as I know, that would have been captured by the Ring of Fire. Of course, Grantville residents may have purchased trees from these tree farms.

European Forests

Deforestation—the loss of forest cover—has been a recurring problem in world history in general, and in Europe (and its colonies) in particular. The principal cause of deforestation was the clearing of land for farming. However, the use of wood as a fuel and building material was also important.

So far as early seventeenth century forest cover is concerned, it is a mistake to treat Europe as a monolithic entity. At one extreme, we have Poland, Russia, Norway (part of the Kingdom of Denmark) and Sweden (including Finland), which export timber to less fortunate countries. At the other extreme, we have Spain (including Portugal), Italy, the Netherlands, Denmark proper, and to a lesser extent England, which are largely denuded, and thus heavily dependent on the Baltic timber trade. France and Germany are in-between; there are still significant forests, but those countries have been forced to take various conservation measures, and also to import some wood. (Elliot, 11-12)

Cox says that in the late seventeenth century, only one-eight of England's original forest remained. (Cox 26). According to Clark, the price of firewood was 7.81 shillings per cord in 1540, 16.94 in 1570, 18.62 in 1600, and 26.09 in 1630. Timber prices were anomalously low (3.11 shillings per cubic foot) in 1630; the price was 8.00 in 1631, as compared to 2.87 in 1600.

In France, forest area declined from 35% at the beginning of the sixteenth century, to 25% in the middle of the seventeenth century. (Sands 32)

In 1602, Denmark banned the export of oak; they needed it for their own navy. This forced the British (and Dutch) to rely primarily on timber from Konigsberg and Danzig. (Tossavainen sec. 6.2.1) By 1628, oak was once again a Danish-Norwegian export, but the trade in large timbers (e.g., for masts) was forbidden in 1640 (6.5).

The 1911 *Encyclopedia Britannica* (EB11) reports the forested area, relative to total area, for each European country. Bear in mind that it is likely that these values are mostly lower than those which prevailed in the early seventeenth century, except that there was some reforestation in the nineteenth century. In particular, 1911 Norway is probably lower than in the seventeenth century, and Greece, Italy

and Spain higher. This probably reflects the depletion of Norwegian timber by exports to England, and the recovery of southern European forests thanks to diminished naval and merchant fleet building.

Country	%Forested	17C Political Control
Bosnia-Hercegovina*	50%	(Ottoman)
Sweden*	48%	
Russia *	40%	(this includes Finland, which was Swedish)
Austria*	32%	
Luxembourg	30%	
Serbia	32%	(Ottoman)
Bulgaria	30%	(Ottoman)
Hungary	28%	(one-third Ottoman, one-third Hapsburg, one-third independent)
Germany	26%	
Norway*	21%	(Denmark)
Switzerland	20%	
Turkey	20%	(Ottoman)
France	18%	
Belgium	18%	(Spanish)
Romania*	18%	(Ottoman)
Spain	17%	
Italy	15%	
Greece	13%	(Ottoman)
Holland	7%	
Denmark	6%	
Great Britain	4%	
Portugal	3.5%	(Spanish)
(* net exporters of timber in 1911)		

The large-scale transportation of timber down the Rhine, from sources in the Black Forest, Alsace, and around Lake Constance, began around 1250. The trees were cut in the winter, when sap was low and the logs could be dragged across ice or snow, and then rafted downstream come spring.

In the 1650s, the Dutch got their timber primarily from Norway (about 125,000 "lasts"), but the Rhineland was also a source (about 22,000 lasts). In the following decade, their Rhineland imports

climbed to over 60,000 lasts. (De Vries, 427)

Deforestation was certainly a problem in parts of seventeenth century Germany. In 1662, John Evelyn wrote that in Alzey, Germany, near Worms, the inhabitants were so "miserably distressed for wood," as a result of their own destructive habits, that "they were reduced to make use of straw for their best fuel." (Evelyn XXI 4). But Thuringia, at least, is still heavily wooded. (*1632*, Chaps. 11, 51).

In general, deforestation in Germany (especially in the south) wasn't as severe as in England. The literature on the American colonies refers repeatedly to how clueless English settlers had to seek forestry guidance from those of German as well as Scandinavian descent. For example, discussing American architecture, Cox says, "Log [cabin] construction techniques were introduced by Europeans from more heavily forested areas—Germans, Finns, Swedes. . . ." (Cox 8; Lillard 15) Later, referring to the production of tar and turpentine, Cox states, "Authorities tried to increase efficiency by sending knowledgeable Germans, Poles and Scandinavians into the woods. . . ." (17) Fire-clearing, and communal logrolling bees, were introduced to Pennsylvania by Swedes, Finns and Germans. (10) Axwork was taught by Swedes and Germans (Lillard 19). The Germans wouldn't have had this expertise if they didn't have forests to acquire it in.

The principal forests of Germany include the Thuringerwald in Gotha, the Schwartzwald (Black Forest) in Baden-Wurtttemberg, the Odenwald in Hesse, the Spessart between Aschaffenburg and Wurtzburg, the Baierischerwald near Bohemia, the Kranzberg near Munich the Frankenwald in northern Bavaria. German trees included spruce, silver fir, Scotch pine, birch, beech, and oak ("Forests and Forestry", EB11).

Trees and Wood

To botanists, trees are either gymnosperms (plants with needle-shaped leaves, bearing cones and naked seeds) or angiosperms (plants with broad leaves, which produce seeds encased in a seed coat). For commercial purposes, trees are divided into two major classes: softwoods and hardwoods. The softwoods are usually gymnosperms (conifers) and the hardwoods are usually angiosperms (broadleaved trees). There are, however, tropical angiosperms with soft wood, and there are conifers whose wood is quite hard (e.g., pitch pine).

* * *

Within a given tree, the wood is differentiated into the central heartwood and the peripheral sapwood. The average commercial log is 25-30% sapwood, so we would prefer not to waste it, if that can be avoided. Heartwood is more strongly colored than sapwood, and so, for ornamental use, heartwood is usually preferred (although sapwood can be stained). Sapwood and heartwood are usually of equal weight if they have the same moisture content. Sapwood is not significantly inferior in strength to heartwood of the same moisture content and density. Unfortunately, sapwood is usually more vulnerable to attack by fungi and insects than heartwood. So durability is a problem if the wood is to be used outdoors, or elsewhere where the risk of attack is significant. One consolation is that sapwood is more readily impregnated with preservatives. (Desch, 51-56).

The branch of a tree bends in response to gravity, putting the top into tension and the underside into compression. If the trunk of a tree leans, the wood is tensed on one side and compressed on the other.

The living tissues of a wood react to stress by forming lignin-rich tension wood on top (hardwoods), or cellulose-rich compression wood underneath (conifers). These reaction woods are usually considered undesirable. However, for skis, compression wood had the advantages of drying faster without warping, and of not sticking to thawing snow. (Wikholm)

* * *

In temperate climates, cut wood displays annual growth rings. The early (spring) wood is softer and lighter, while the late (summer) wood is harder and darker. (The late wood contains more wall material.) The difference is pronounced in some species, subtle in others. (Desch 16, 26; EB11/Timber) In the seventeenth century, it was already known that the age of a tree could be determined by counting the number of rings (Evelyn), and of course one could readily deduce that a tree with a low density of rings was growing rapidly. Strength is related to the growth rate; there is a rate at which strength is optimized. (Desch 56)

To a botanist, a tree is mature when it starts producing seed. The white cedar can drop cones when it is merely six years old, but it is most prolific when it is over seventy five years old. Likewise, a white pine can bear cones at five years old, but good production comes several decades later. The paper birch, a deciduous tree, starts seed production at age fifteen. (Error! Hyperlink reference not valid.) Oaks don't produce acorns until they are twenty years old.

To a logger, a mature tree is one which can be cut into merchantable timber, which usually means that it is over thirty centimeters diameter (the smallest base diameter for lumber) at "breast height" (1.3 meters). A "pole" has a diameter of at least seven centimeters, and can be used in paper production. A tree is considered "overmature" when decay becomes substantial. "Snag" is deadwood which is still standing (firewood in the eyes of neighborhood farmers, but an important wildlife microhabitat so far as environmentalists are concerned). (Wikipedia).

* * *

It isn't surprising that wood is a useful structural material because the successful growth of forest trees is dependent on the physical properties of wood. From an engineering standpoint, wood is a bundle of cellulose fibers. If stretched along the grain, it does quite well (the tensile strength of spruce is about 17,000 p.s.i.). On the other hand, it is weak if compressed in the same direction, which causes the fibers to buckle (for spruce, the compressive strength is 4,000-5,000 p.s.i.). The lateral (across the grain) strength of wood is rather low, whether it is compressed or tensed (a few hundred p.s.i.).

Wood is also quite stiff (stiffness is the resistance to bending); it has a Young's modulus of about two million p.s.i. Both the tensile strength and stiffness of wood compare favorably, on a *by weight basis*, to that of steel.

* * *

Generally speaking, the denser the wood of a particular tree, the greater its average strength (Desch 147). The specific gravity (density relative to that of water, which is 62.4 pounds per cubic foot) of the actual wood material is actually about 1.4 or 1.5. Timber floats because it contains a lot of air, and some timbers have more air space than others. The specific gravity of timber varies a great deal:

balsa 0.1
spruce 0.45
oak 0.7
lignum vitae 1.1

(Gordon, 157)

While an increased density has a favorable effect on strength, it has an unfavorable one on transportabity; the denser the timber, the less floatable it is.

* * *

The principal dimension of lumber ideally runs parallel to the grain. Any slope reduces the bending strength, stiffness and impact resistance. A slope of only 1 in 25 reduces bending strength by 4%, stiffness by 3%, and impact resistance by 9%. (Desch 65).

Wood contains water and, the lower the moisture content, the greater the strength. Air-dry wood (moisture content about 12%) has about twice the strength in bending and endwise compression as it did prior to seasoning, and if kiln-dried (moisture content 5%) the factor is threefold. (Desch 168-9).

* * *

A tough wood is flexible; it bends instead of breaking. The *Encyclopedia Americana* "Wood" article (EA/Wood) notes that hickory and ash are flexible while hemlock and pine are brittle. However, a tough wood must also be strong. EA/Wood says that elm and hickory are both tough. High moisture content increases toughness. (Desch 168-9)

Hardness is also different from strength, and it is something of a mixed blessing. The harder woods are less likely to be scratched or dented, but they are harder to saw across the grain. EA/Wood classifies twenty nine woods according to their hardness.

Wood is split by cleavage along the grain, and EA/Wood gives information on the relative splitting qualities of eighteen woods.

* * *

The durability of a wood is its resistance to decay caused by fungi and bacteria. EA/Wood classifies forty seven woods according to their durability. Woods can be treated with preservatives; the tradeoff is between a cheap wood of low natural durability treated periodically with preservative, and an expensive wood of high natural durability.

In general, these decay organisms require warmth and moisture (wood moisture content over 20%) to do their work. That is one reason for seasoning (drying) wood. Good ventilation also helps to inhibit fungal growth (Desch 248).

* * *

Color is of course relevant to the marketability of ornamental woods used in furniture. However, dark woods tend to be more durable, because the same chemicals which provide the coloration may also be part of the tree's defenses against microbial attack. Resins, gums and latexes seal the attackers off from oxygen, while tannins counterattack them.

Contemporary European Trees

Trees have preferences as to soil and climate, and what thrives in one place may languish somewhere else. Oak, for example, didn't grow particularly well in the Norwegian forests, whereas Norway was an excellent source of fir. (Tossavainen 1.1)

The woods used in Western Europe during the Middle Ages and the Renaissance included alder

(German erle), apple (apfel), ash (esche), beech (buche), birch (birke), boxwood (buchsbaum), cedar (zeder), cherry (kirsche), chestnut (katainien), cornel cherry (kornelkirsche), cranberry schneeball), cypress, ebony (ebenholz), elder (holunder), elm (ulme), fir (tanne), hawthorn (weissdorn), hazel (haselnuss), holly (stechpalme), hornbeam (weissbuche or hainbuche), juniper, larch (larche), laurel (lorbeer), linden (linde), maple (ahorn), oak (eiche), pear (birne), pine (kiefer), plum (pflaume), poplar (pappel), roeswood, rowan (eberesche), service (speierling), spindle (pfaffenhuten), spruce (fichte), sycamore (bergahorn), thorn (schedorn or schawrzdorn), tartary dowood (hartriegel), wanut (walnuss), whitebam, willow (weide), and yew (eibe)(Halstead/Wood). The above list probably omits a few imported luxury woods.

I don't have a chronology of the introduction of forest trees to Germany. However, Nesbet's British forest tree list may be of interest:

Pre-Roman: oak, beech, Scots pine, birch, ash, mountain ash, Scots elm, sallow, aspen, alder, yew, hawthorn.

Introduced by the Romans: plane, chestnut, walnut, English elm, lime (linden), alder, poplar, box, and many ornamental and fruit trees (mulberry, service, hazel, medlar, apple, pear, prune, cherry, peach, apricot, quince and rose) which didn't fully develop .

Before end of fifteenth century (15C): hornbean, sycamore, willow, poplars (white and grey).

16C: spruce, walnut (re-introduced), laburnum, juniper, holly, holm oak, stone or cluster pine, alderberry, viburnum, mulberry.

17C: silver fir, maple, plane (re-introduced), horse-chestnut, larch (1629), robinia, buckthorn.

The trees brought to Britain only in the eighteenth or nineteenth centuries include Weymouth, maritime, cembran and pitch pines, service, cedar, Austrian, yellow and Jeffrey pines, Normann's and Douglas firs, deodar, and eucalyptus.

European Exploitation of Exotic Trees

Down-time Europeans are well aware that there are many new tree species to be found in Africa, Asia and the Americas. However, it was only economical to ship timber by water. Hence, the only tree species likely to make major contributions to the timber trade are those found near the coast, or the banks of navigable rivers.

For the woods of other trees to be exploited, either they must be harvested locally, and their products exported, or the seeds must be transplanted to Europe. Orange trees were brought from India to Europe (protected, if need be, by growing them in orangeries) and re-exported to the Americas. The American *Robinia* (black locust) was brought to Germany in 1638 (Fernow 62).

Successful transplantation, of course, requires suitable soil and climate conditions, and, even then, it may be many years before the newcomer is mature enough to be commercially exploited. These transfers tend to be either latitudinal (e.g., South America/Africa, or North America/Europe), or between equivalent north/south regions, because the climate has to be the same. New World trees which found homes in the Old World include the Para rubber and cinchona trees. Likewise, the New World was enriched with Old World trees, including coffee, apple and coconut (Robinson).

America's potential as a source of wood and wood products was recognized by Thomas Harriot (1587) (Cox 11). European exploitation of American forests began prior to the RoF. The James River colony began shipping clapboards to England in 1607, and the first American sawmill was built near Richmond in 1611. The Dutch had three sawmills in operation in New Amsterdam as of 1623. New England followed suit soon thereafter; its first sawmills appeared in the early 1630s, one on the Neponset River (Massachusetts) and the other on the Picataqua (New Hampshire). However, lumbering for export was on a small scale until the Dutch War of 1654, which blocked British access to the Baltic. (Cox, 14-15, Cronon, 109-10)

Certain Asian (sappanwood, *Caesalpinia sappan*, native to India, Malaya and Sri Lanka), Brazilian (brazilwood, *Caesalpinia echinata*), and Yucatan (logwood, *Haemotoxylum campechianum*) trees were valued because their heartwoods contained brilliant red dyes. In the 1600s, fifty tons of logwood was worth in excess of 1000 pounds sterling. (Armstrong)

Lignum vitae (gaiac) is highly durable, and has been used in "sheaves for blocks" ((Baker, 226). It was exported by Martinique (settled in 1635) to France in the seventeenth century; 35,000 metric tons were shipped in 1672 (Richards, 433).

Other woods exported to Europe, albeit in small quantities for high-end furniture, included mahogany (used in the Armada ships), rosewood, ebony, teak and sandalwood. (Elliot, 12; Edlin, 218) There was limited trade in ebony beginning in the fourteenth century, rosewood in the fifteenth, and Caribbean mahogany in the sixteenth (Halstead/Trade).

Exotic (or once exotic) trees valued for plant parts other than the wood (e.g., fruit, seed, flowers, leaves, roots) include coffee, cacao (source of chocolate), nutmeg, clove, and various citrus trees.

Grantville Trees

West Virginia trees include red spruce, hemlock, white oak, yellow poplar, laurel, chestnut oak, walnut, cherry, white pine, persimmon, sassafras, sycamore, hickory, chestnut, locust, maple, beech, basswood, dogwood, and pawpaw. It is uncertain how many of these passed through the Ring of Fire. Of course, those that didn't are still available (if indigenous to America) in the down-time West Virginia!

There are also likely to be some ornamental and fruit trees, of more exotic origin, in Grantville yards and farm plots.

It is interesting to note that both Marion County, West Virginia and modern Thuringia, Germany are in USDA hardiness zone 6 (Plant Hardiness). However, because seventeenth century Thuringia is experiencing the Little Ice Age (albeit not the worst of it), some trees which throve outdoors before the RoF might need to be moved indoors during the winter.

Exotic Trees Known in Grantville

The encyclopedias of Grantville may provide motivation to seek out economically interesting trees in other parts of the world. A few examples follow.

Balsa (*Ochroma pyramidale*) is found, scattered, in rainforests in much of Latin America. The tree is ready for cutting at 6-10 years. Balsa is the lightest commercial wood. In the seventeenth century, it was used in native rafts. Centuries later, it was one of the component woods of World War II's "Wooden Wonder." It is the premiere material nowadays for model airplanes.

Redwood (*Sequoia sempervirens*) is lightweight and resistant to both fire and decay. It is found on the Pacific Coast of California and Oregon. Seeds of the sequoia were planted in England in 1854. A century later, some of the trees had reached a height of 150 feet. (Baker, 48).

Greenheart (*Chlorocardium rodiei*) is noted for its strength (density 61 pounds per cubic foot), and its resistance to marine organisms. It is found in British Guiana. (EB11, "Greenheart").

Teak, because of its strength and durability, is a favored wood for the planking of ships. Indeed, it can be laid as decking over iron plates, since oils in the wood help preserve the iron. Some may question its inclusion in this section, since teak has been used in Asia for over 2,000 years. While there was trade between Europe and the teak-producing areas of Asia (India, Burma, northern Thailand) in the seventeenth century, "the first reference to teak was in the second half of the eighteenth century" (Teak). Kew Gardens didn't obtain its first specimen of Tectona grandis until 1777 (Aiton 57).

Numerous rubber-producing trees are discussed in my article "Bouncing Back" (*Grantville Gazette*, Volume 6).

Contemporary (Down-Time) Wood Products and Their Uses

Firewood. Regardless of the species of tree, logs which are equal in weight and moisture content have about the same energy content, ranging from 10 megajoules/kilogram for "green" wood to 20 for kiln-dried wood. However, since tree species vary in the density of their wood, they also vary in their heating potential per unit volume.

As populations increased, firewood demand rose, and wood had to be brought in from greater distances. In London, the price of wood in 1600-1650 was in the range of 6-9 grams of silver per million BTUs, up from 4-6 in 1400-1550. Coal, in 1500-1650, sold for 2-4. (Allen 8) Outside London, the price differential was less acute (Unger, 7).

This price differential ultimately encouraged the use of mined coal as a residential heat source, in place of firewood or charcoal. Anthracite coal has a heat content of 26-33 MJ/kg, while that of bituminous coal is 21-30.

Firewood wasn't needed just for residential use. Wood-burners included smiths, bakers, barber-surgeons (who kept bathhouses), brickmakers, glassworkers, saltmakers, cutlers, dyers, potters, founders, and innkeepers (Warde 272, 300-1).

Charcoal. An alternative to burning firewood is to use charcoal. Charcoal may be derived by pyrolyzing wood (heating it in the absence of oxygen, so it chars but doesn't burn). One metric ton of wood yields 150-300 kg charcoal, depending the moisture content of the wood and on kiln efficiency (Keita).

Charcoal's advantage as a fuel is that it "burns hotter and cleaner than wood." (Wikipedia). It has almost three times the energy content of an equal mass of wood. (Logan 127) Consequently, charcoal was the fuel of choice in the iron industry. (Cox, 15) A charcoal fire could achieve the temperature needed to smelt iron (1500 deg. C.). Charcoal is also the "fuel" element of gunpowder (because charcoal burns

rapidly).

In 1603, Sir Henry Platt urged that coal could be charred to produce a product ("coke") analogous to wood charcoal. Coke was first used commercially in 1642, for roasting malt. The first use of coke in iron making was in 1709.

Still, even in modern times, some wood is used to make charcoal. Small branches and stems, which might otherwise be wasted, can be used for this purpose. (Edlin, 80)

Fencing. Logan (95) says that in the Middle Ages, fencing was the second most common use of wood (after firemaking). Palisades, used for temporary or outer defenses, were constructed by driving tree trunks vertically into the ground, without gaps, and then binding them together. One could also make anti-cavalry protection by diagonally emplacing stakes, sharpened at both ends, into an earthwork.

Other fences were used merely to restrict the movement of livestock or to establish property lines. The simplest such fence to build was the "zigzag" rail fence ("worm," "snake"). While economical of labor, it was wasteful of wood (Williams 69), and therefore was most popular in North America and perhaps in far northern Europe. The post-and-rail fence was more labor-intensive.

Lumber. Lumber is wood sawn into boards. The lumber, in turn, can be used to construct buildings, ships, furniture and other articles.

Machinery parts—gears, screws, bearings, and so forth—can be made from stout woods such as dogwood (Tree Safari). In the nineteenth century, Peter Mitterdorfer constructed a typewriter almost entirely out of wood! However, the parts will wear out more rapidly than metal ones.

Barrels. Barrels are not just a medium of storage, but also one of transport. A barrel can be rolled.

Log cabins. While the standard English and Dutch construction was sparing in its use of wood, that wasn't true in the more forested parts of Europe, including southern Germany, Sweden and Finland. Immigrants from those regions were the first to construct log cabins in America, from 1638 on. (Lillard, 15).

Saps. Saps are plant fluids. In the seventeenth century, the Europeans collected a type of sap (pine resin) from pine trees. The raw resin was separated by distillation into volatile liquid (turpentine) and non-volatile solid (rosin, pine tar, pitch) components. Turpentine was used medically, or as a solvent in paint, while pine tar was used as a waterproofing agent, especially on ships. Resins were also used directly as coatings and adhesives. Tar and turpentine were considered strategic materials, "naval stores."

The British sought to develop a domestic naval stores industry in the American colonies, to reduce their dependency on the Baltic trade. However, through ignorance, there was much waste. Trees were felled which were unsuitable for pitch production, and trees were tapped for turpentine in a manner which caused them to die prematurely. (Cox, 17)

Wood ash. Burning beech trees (and certain other hardwoods) results in an ash rich in potash (potassium carbonate). Potash is used as a flux in glassmaking (see Cooper, "In Vitro Veritas," GG5). As an alkali, it can also be mixed with fat to make soap.

At least in America, the production methods were crude, the final product being less than 25% potassium carbonate. "Three to five acres of timber had to be burnt to yield a ton of potash." (Cox, 16). Pearlash is 3-5 times more concentrated (Williams, 74).

Wood ashes, being sources of calcium, potassium, magnesium and (to a lesser extent) sodium, can also be used as fertilizer, or to neutralize acid soils. Unfortunately, they don't provide nitrogen, because that

element is lost in the burning process.

Cork. Cork lies just beneath the bark of the cork oak (Quercus suber), which grows in Portugal, Spain, France, Italy and on the Barbary Coast. Its best known use, of course, is in stopping wine bottles. Cork's key advantage is that it is impermeable to gas and liquids, thanks to the presence of the wax suberin. Cork is also used in life preservers and buoys. Cork can be harvested once the tree is at least 25 years old, and thereafter every decade or so.

Tannins. Animal hides can be tanned (converted into leather) by soaking them in solutions rich in tannins. The tannins are extracted from the bark, or other parts, of certain trees, such as the oak and sweet chestnut in the Northern Hemisphere, and the quebracho tree and various Acacias in the South. Inks and dyes were made from the tannin-rich galls of various oaks. (Logan 189).

Drugs. In 1535, Jacques Cartier's expedition halted a scurvy outbreak by use of an Indian remedy, an infusion prepared from the bark and leaves of the "Annedda" tree. Scholars are not entirely sure which tree this was; the best candidates are (in decreasing order of probability) the Eastern white cedar (*Thuja occidentalis*), the white spruce (*Picea glauca*), the black spruce (*Picea mariana*), the Eastern White Pine (*Tsuga canadensis*), and the Balsam Fir (*Abies balsamea*) In the late eighteenth century, the British Admiralty advised that "Spruce Beer" be given to not-yet-Limey sailors. (Houston; Lillard 28-29). Quinine, an anti-malarial agent, is extracted from the bark of the *Cinchona* trees of the Andes.

Spices. A number of spices, including cloves (from *Eugenia caryophillus*) and cinnamon (from *Cinnamomum zeylanicum*), are produced by trees.

Oils. The nuts of oil palms, native to West Africa (*Elaeis guineensis*) and tropical America (*Elaseis oleifera*), produce an edible oil. The nuts of wild trees have been harvested and traded since ancient Egyptian times, and were used by the European slave trade to feed their human cargoes. It was later used by British factories as a lubricant, and this in turn led to the establishment of plantations in southeast Asia as well as in Africa.

The oils of other trees found other uses, e.g., sandalwood oil as a pharmaceutical and a perfume.

Timber Requirements

Firewood. A recurring problem with firewood estimates is failure to specify whether the volume is of solid wood or stacked lumber; for the latter, 25-50% is air. Halstead says the average annual per capita use of firewood in early modern Europe was 3-4 cubic meters (m^3). Warde (265-6) says that in Wurttemberg, a "household" (mean size probably 4.25) needed 3.4-10 m^3 of stacked lumber. That implies perhaps 1.2 m^3solid wood /person. (Estimates of late 18th century annual consumption ranged from 0.4-3.9.) In 1760s America, consumption was about 22 m^3/person (Williams 81, 78).

Shipbuilding. Timber was needed for the masts (pine and spruce), frames (oak), and planks (cedar, pine, oak) of sailing ships. Something like 3,000-4,000 "loads" (each fifty cubic feet of wood, the product of a single large tree) were needed for a Napoleonic 74-gunner. (Wood 14, Cordingly 19) Vast quantities of timber were needed for just the frames of naval vessels: 34,000 cubic feet for a ship of the line, 23,000 for a first class frigate, 8,000 for a sloop, and 1,800 for a schooner. (Wood, 55)

It was also important to find the right kind of tree for a particular use. For example, for the masts, the

builders wanted tall (perhaps 120 feet), straight trees, which were ever more difficult to find in European forests. The American mast trees had to be transported in special cargo ships, with ports in the stern. (Pike, 49).

Oak, because of its strength and resistance to rot, was the preferred hull wood. Each part of the hull had a certain desired shape, and the trees were chosen to suit (Wood 8). Thus, forest oaks were used for the sternposts and planking, which needed to be straight, while isolated trees, with greater branching, provided the curved "compass timber." (Cordingly 19-20).

Buildings. "Each new [medieval] house required 12-16 oak logs and a new church might require the wood from 300-400 trees." (Halstead/Trade) Thirty oaks were allowed for a new building in Lippe, Germany, in 1600 (Warde 276). Clark says that around 1700, the average Englishman consumed almost five cubic feet of construction timber.

In Wurttemberg, ducal ordinances encouraged the use of stone for the first floor. (Warde, 274).

The influx of displaced Germans into the vicinity of Grantville caused a building boom, and the "massive amount of wood construction going up" led car dealer Keith Trumble to become a nail manufacturer. (*1632*, Chap. 43).

Charcoal iron. Williams (106), for eighteenth century America, estimates 10-30 cords wood/acre cleared; 20-40 bushels of charcoal [bushel ~20 pounds] per cord [cord=4800-6000 pounds] burnt; 125-400 bushels charcoal per ton pig iron produced. (Cp. Logan 127; Clark)

An internet discussion of late nineteenth century practice says 30-100 cords wood/acre; 40-50 bushels charcoal/cord, 128 bushels charcoal/ton iron. A single pit might process fifty cords in 7-10 days. (Europa)

Potash manufacture. "Three to five acres of timber had to be burnt to yield a ton of potash." (Cox, 16). Halstead says that a glassworks used the equivalent of 80 hectares (198 acres) of forest in a year. Warde (300) reports that producing one kilogram of glass required 1-3 cubic meters of wood (both as a source of potash and as fuel).

Pitch, tar and turpentine. Two thousand pine trees produced about five barrels resin a day. The resin was distilled; the distillate was turpentine, the residue, tar. (A cord, 3.62 m^3, of wood yielded 40-50 gallons tar.) Removing more volatiles from the tar by a further distillation yielded pitch, which cost twice as much (Williams 84-88).

Prices

The price of wood is very much dependent on transport costs. Warde (312) says that "the hospital of Markgroningen bought wood from the rafters at Bissingen for around 3 fl. per fathom [3.3 cubic meters] in the late 1590s, wood that could be purchased for as little as 0.07-0.14 fl. upriver in the Black Forest. . . ."

In Amsterdam in the 1640s, 100 pounds of "Sappan Wood" (a Philippine dye wood) could be purchased for 11-18 guilders. In 1632-35, the price of "Yellow Wood" (*Podocarpus latifolius*?) was 4-6 guilders, whereas Pernambuco Wood was 43-45. (Posthumus)

Potash is made from wood. In 1632-35, the best Danzig potash cost 13.2-20.25 guilders per 100 pounds.

New Uses for Wood Products.

In railroading. Early locomotives were wood burners, and we are talking about a lot of wood; say, 140 cords per track mile per year. The "iron horses" pulled rolling stock which, in the nineteenth century, were primarily made of wood. While they steamed along steel rails, those rails were supported by wooden ties. American railroads used 39,000,000 cross-ties in 1870 alone. Wood was also used to construct bridges and stations. (Cox 100, 113). For more information on wood-burning by locomotives, see my "Saddling the Iron Horse" (GG7) and the "Locomotive Addendum" posted to www.1632.org .

Corduroy and plank roads. While there was limited pre-RoF use of wood in constructing roads over swamplands, the heyday of the wooden road, the "Farmer's Railroad," was in the nineteenth century. Corduroy roads used whole or split logs; plank roads, obviously, used planks and gave a smoother ride. The wooden roads appeared first in Russia, then in Canada, and finally in the United States. A fuller discussion appears in my article "All Roads Lead to Magdeburg: Roadbuilding in 1632" (*Grantville Gazette*, Volume Seven).

Aircraft. Wood has high strength and stiffness in proportion to its weight, which is a very good thing if you are trying to build an aircraft. This is particularly true for the "aircraft woods," such as Sitka spruce, Douglas fir, Noble fir, canary whitewood, kara redwood, white pine, western hemlock, and birch. (Desch 148). Balsa, the "lightest" commercial wood, is used primarily in models. However it has been used in full-scale aircraft. Since it's soft, it's ideally sandwiched in-between hardwoods. (Lienhard)

The biggest problem with wooden aircraft is rot. Not just of the wood itself, but also of the glues used.

Toothpicks. Pike (32) says that the toothpick was, "next to the spittoon, . . . the greatest social invention of the [nineteenth] century."

Telegraph and Telephone Poles. Telegraph companies erected 300,000 poles in 1882. (Lillard 147).

"Balloon Frame" and "Platform Frame" Houses. Houses can be built using just light, dimensional lumber, nailed together. These "balloon frame" houses were popular in nineteenth century America, once machine-made nails were available, since the houses could be assembled cheaply and quickly, without the assistance of carpenters. No dovetailed joints, no mortise and tenon. (Cox, 72-3)

In the late twentieth century, the predominant light form construction system is platform framing. This, too uses dimensional lumber. However, in balloon framing, the uprights (studs) run all the way from the base of the first floor to the top of the highest floor. In contrast, in platform framing, the uprights are one floor tall; that is, each floor is built on the platform formed by the floor beneath it.

The framing can be strengthened either by diagonal braces or by panels.

New Wood Products

Let me begin with a caveat: some of the products mentioned here, such as latex and maple sap, are new to the Europeans, but not to native peoples.

Paper. During the seventeenth century, paper was made from fiber crops, such as cotton and flax (linen).

Wood wasn't pulped to make paper until the nineteenth century, and this substantially reduced the cost of paper (and hence of books).

Wood can be pulped by purely mechanical means, or alternatively the wood is chipped and then digested chemically (with sulfite, caustic soda, or sulfate). It took one cord of pulpwood to make one ton of pulp. (Pike 269).

Activated charcoal. The highly porous form of charcoal known as "activated charcoal" is able to absorb gases and liquids, and therefore has been used in water purification plants, gas mask filters, and in the emergency treatment of certain poisons.

Plywood. Plywood (a re-invention; legionairies carried plywood shields) is the result of gluing together three or more thin sheets of wood, cris-crossing the direction of the grain. The wood sheets can come from different trees; the plywood of the De Havilland Mosquito combined balsa and birch.

For maximum strength, the glue should be applied so it penetrates deeply into the lumens of the wood. In general, that means the wood must be sanded, preferably mechanically.

The choice of glue is also important. Hide glue (which is gelatine based) is water-sensitive, and also attacked by bacteria and fungi. Casein glue is moisture resistant, but still subject to rot. Nonetheless, it was the glue of choice in the aircraft of the Thirties. Synthetic resin glues, such as phenol-formaledehyde, urea-formaldehyde, resorcinol formaldehyde, and epoxy, will eventually be available in the 1632 Universe.

Fiberboard and Particle Board. In fiberboard, wood is separated into fibers, which are rejoined with a resin. In particle board, wood particles (sawdust, wood shavings or wood chips) are glued together to make a composite wood.

Sawdust or "wood wool" (loose wood fibers) have been incorporated into cement to form composites, usually to form panels. (Farmer, 58). The cement serves, like a resin or glue, as the binding agent.

Wood pyrolysis products. When wood is pyrolyzed to make charcoal, a number of other chemicals are produced. These include acetic acid, methyl alchohol ("wood alcohol"), and acetone.

Cellulosic polymers. The wood pulp can be used in the production of rayon, cellophane, cellulose acetate, cellulose butyrate, carboxymethylcellulose, and so forth.

Latex and Rubber. Certain trees can be tapped to collect latex, a milky sap. The latex of the Brazilian rubber tree, *Hevea brasiliensis*, can be used as is (e.g., disposable gloves) or coagulated to make rubber. Other latex products include chicle (from *Manikara chicle*), balata (from *Manikara bidentata*), and gutta percha (from *Palaquium gutta*).

Maple syrup. The American Indians were quite familiar with tree sugar. By the mid-1600s, the sweet (2-6% sugar) sap of the sugar maple (Acer saccharum) was bartered to European settlers by Indians of the Great Lakes and St. Lawrence River regions. The sugar maple tree can be tapped once it is forty years old, and a single tree will produce 10-70 gallons of sap each year. It takes over forty gallons of sap to make one gallon of maple syrup. (GSFC)

Indirect Utility of Forests

Forests have uses other than as a source of products. At least one of them is well known to the down-

timers; they provide cover for animals. Others are mentioned in the 1911 Encyclopedia Britannica (EB11). They moderate the climate, help prevent soil erosion and consequent flooding, and act as windbreaks which protect crops from storm damage. (see also Baker, 74-5). Chances are that the down-timers are aware of these utilities, too. However, they don't have a clearly articulated concept of trees as nodes in an ecological web.

Transport Methods

A forest does you no good, as a source of timber, if you can't economically transport the logs to where the wood is needed. In the seventeenth century, the only economical long-distance shipping method was by water. Even "in [late eighteenth century] England it was reckoned that any tree more than 40 miles from water transport was of no use for the navy," and in France there then were legal restrictions on private felling of oak trees within fifteen leagues of the sea or six leagues of any navigable river (Cordingly 19). Shipping coal, another bulk commodity, by water (down the Tyne and up the Thames to London) caused the price of Newcastle coal to increase 6-9 fold (Unger 8-9, Allen 8).

Unger's response to historians who said that there was a timber or energy crisis in early modern Europe was that a large part of the delivered cost of wood (or coal) was its transport cost, and hence it would be more apt to speak of a "transport crisis."

Short-haul transportation. Logs can be dragged (hauled while lying on the ground; "snaked"), skidded (hauled with one end up), or carried (both ends up) to a collection point of some kind. For dragging or skidding, they are attached to a chain or cable which is pulled by animals (oxen, horses or mules), a vehicle (steam or gasoline powered), or a stationary engine. The logs can be carried on an animal-pulled sled (on snow) or logging cart (a cart with a single pair of very large diameter wheels)(Wood , 111-18), on a logging truck, or even on an aerial cable (skyline)(Raphael 138-43). Or they can be floated, on a stream or even a log flume. There is even the possibility of ballooning or helicoptering logs from the woods to the collection point. (Pike 271; Raphael 143-54)

Clarkson Fig. 217 shows the details of a skidding harness, and Fig. 226, the arrangement of an aerial cable for skidding logs.

In the seventeenth century, short-haul transportation was limited to animal and water power. The likely uptime innovations will involve the use of enginery and perhaps also the aerial cable. (Brown 125, 190).

An example of a nineteenth-century machine is the Lombard steam log-hauler. It looked like an ordinary locomotive except that it had crawler treads. It could haul a couple of hundred tons at a speed of 4-5 mph. (Pike, 170-4; Patten). It ultimately was replaced by gasoline-powered tractors.

We turn now to long-haul transport methods, using roads, railroads and rivers.

Logging Railroads. While logging railroads occasionally used animal power, locomotives were preferred. (Brown 329) The issue of logging locomotives was touched upon in Carsten Edelberger's "Railroading in 1632" and my "Saddling the Iron Horse" (both *Grantville Gazette*, Volume 7). In essence, because logging railroads were temporary, and had to cope with sharp curves and steep grades, it was advantageous to use geared locomotives (Shay, Climax, Heisler, Baldwin, Dunkirk) instead of the conventional rod type.

Clarkson provides a lot of information about logging locomotives. For example, he gives these

specifications for the Northeast Lumber Company's Shay No. 3 engine: running on 36" track, driving wheel diameter 39", three cylinders (diameter 10", stroke 10"), boiler (39 3/8" diameter, 180 p.s.i.), firebox (54 3/4" long and 38 5/8" wide), wheelbase (truck 4'2", engine 26'5"), 104 tubes (2" diameter, 8'11" long), grate area 14.7 square feet, heating surface (482 square feet in tubes, 67 in firebox), wheelbase (4'2" truck, 26'5" engine), factor of adhesion 4.55, weight 80,300 pounds, maximum tractive power 17,660 pounds, water capacity 1200 gallons, fuel capacity 1.75 tons soft coal. (Fig. 111; see also Figs. 112, 128, and pp. 55-61.

The rails themselves could also be unconventional. On occasion, they were wood (e.g., peeled spruce logs) instead of iron or steel. (Pike 162-3, Brown 322, 329). If so, the wheels of the engine and log trucks were likely to be double-flanged, so they could hold on better. (Clarkson, 57).

Portable plank roads. These can be used for short distances, and are most useful in marshy areas. (Brown 323).

River drives. This refers to simply floating the logs downstream. This clearly is most suitable if the wood has good floatability. Such woods include spruce, white pine, Norway pine, yellow poplar, aspen and willow. On the other hand, oak, birch, elm and ash are all of a density unsuitable for river driving. (Brown 348-9).

Log driving was practiced in the seventeenth century, at least in Sweden ("Klaralven," Wikipedia). And the down-timers are familiar with the trick of holding water back in splash dams, and then releasing it all at once, so that boats can navigate a relatively shallow stream. The same can be done with logs. However, there were some interesting later innovations.

For example, in nineteenth-century America, booms were used both to store logs upriver and capture them downriver, but there were frequent legal disputes with other river users . Clarkson describes the flexible pocket boom and the crib boom (53). Levi Pond invented the sheer (fin) boom in 1862; it had a moveable fin hinged to a fixed boom. The presence of the fin meant that the boom could be opened to allow river traffic to pass. (Cox, 84-5, 121).

In America, rafting was more popular than log driving until the early nineteenth century, possibly because of the logistical problems of sorting out the logs and paying for the drive (Williams, 98-99).

River rafts and barges. Wood which can't float well can be carried downstream on rafts or barges. If the current is slow, these can be towed by animals on towpaths. The principal up-time improvement would be to replace the animal teams with machinery, most likely a steam-powered tug. Rafts, of course, were disassembled and sawn. Indeed, even barges didn't have to be returned upstream; flimsily constructed "arks" took a one-way trip to the sawmill.

Clarkson (48-9) says that an average American log raft could carry about 70 logs (25,000 board feet). Clarkson describes how the logs were fastened together, and how the rafts were steered.

Rafts and barges couldn't be used on the smallest waterways. So if the wood couldn't float, and wasn't near a large enough stream, it would have to be transported overland or left standing.

After 1691, Rhinelanders made use of giant log rafts—up to 320 meters long, 50 meters wide, 2.2 meters thick, each comprising up to 28,000 cubic meters of wood. A single raft might have a crew of over 500 men. Obviously, you needed a wide, clear waterway to ship this way. (De Vries, 424).

Ocean rafts. The rafting of timbers from America to England was first proposed in the eighteenth century. However, it was easier said than done; both storms and teredos were troublesome. There has been more success with rafting logs along the Pacific Coast of North America. (Brown, 382-6).

Transport costs can be reduced by peeling off bark (Pike 263), or sawing the logs near the point of origin (it is cheaper to ship timber)(Halstead), or by seasoning the wood (reducing its moisture content) before shipping (Gordon?).

* * *

The purpose of transport methods is to get the timber to the sawmill. The alternative is to bring the sawmill to the timber. Portable sawmills have existed since the Seventies; they are used mostly for 'salvage logging', that is, recovering logs left behind by earlier loggers. (Raphael 154-6)

Other New or Improved Wood Handling Equipment and Methods

Ax. Robert Pike says that it was the ax which conquered the American wilderness. During the eighteenth and nineteenth centuries, the European ax was modified to make it more suitable for American wilderness life. According to EA, "Ax," the blade was made thinner, broader, and sharper, and the handle was set forward in the blade." The preferred handle wood was hickory. As to the ax head, this was ultimately made of steel. (Lillard, 20-21; Cox 64; Pike 15-9)

Ideally, the handle was inserted into the ax head (hung) at just the right angle to suit its user. Even when machine-made handles became available (1853), they were sold separately from the ax heads, so the customer could hang his ax.

The curved ax handle was an American innovation, which reduced the shock of the stroke.

The ax evolved into several specialised forms: the single-bitted pole-axe, the double-bitted axe, and the broad ax. (Pike, 15-20).

The Peavey. You've seen this if you ever seen a movie in which lumberjacks were trying to break up a logjam. It's a staff with a spike at one end and a side hook on the other. It was invented in 1858. (Lillard, 151, Cox 131; Pike 106)

Chain Saw. In the twentieth century, the powered chain saw replaced hand tools as the preferred means for felling and bucking (sectioning) trees. With a power saw, one man can cut twice as much wood.

There are certainly a number of chain saws in Grantville. However, there are a lot more trunks in Thuringia than there are chain saws! So the existing ones will be most useful, in the long run, as models for would-be reconstructors.

Sawmills. Before there were sawmills, wood was sawn in a pit by a two man team. They used a long saw with two handles. A grating was placed over the saw pit, and the "top sawyer" stood atop it, and pulled the saw up. The other, the "pitman", was underneath the grating, and pulled the saw down. (Pike 39). Pit saw productivity was 100-200 board feet per day. (Williams, 96, 247; Clarkson 14)

The first reference to a sawmill is from 1204 (Halstead). Sawmills replaced human power with animal, water, wind and, ultimately, steam power. Animal power had the disadvantage that the animals had to be fed. Water power was available only in certain locations (near streams which provided a sufficient "head" to turn the water wheel), and was subject to interruption by droughts, floods, and freezes.

Wind power, harnessed by windmills, could only be used where there were steady winds. The first wind-powered sawmill was patented and built by Cornelis Corneliszoon in the 1590s. ("Sawmill," Wikipedia).

In America, at least, communities strongly encouraged sawmill construction. "[T]owns made grants to

and townsfolk held share in what was ... a cooperative enterprise." The grants were of the privilege of using a particular river site, and sometimes also of cash, land, or lumber. In 1650-99 New York, two sawmills were constructed before settlement of the site in question, three within only 5-9 years after (Williams 94-5).

Sawmills were improved, over the last few centuries, in two major aspects. First, with respect to the motive power. Steam engines were first used to drive American sawmills in 1803, and the typical 1838 engine was twenty horsepower. That was still five to ten times as powerful as the water wheel, and more dependable to boot. At least when it didn't explode. (Cox 67-8). Steam engines, burning wood or coal, could be located anywhere.

That didn't mean that water power became completely obsolete. Even in the twentieth century, there are water-powered mills. However, the old wooden wheel has been replaced with one made of iron. (Pike 178-9)

Another major area of improvement was in the saw design (Pike, 175-82). In a sawmill, the saw is held stationary, and the log is moved against it. A reciprocating sash saw moves back and forth across the log. A circular saw has its teeth on the edge of a disk, and it cuts as it spins about its axis. A band saw has a flexible blade which rides, belt-like, around two wheels.

There are several considerations in choosing a sawing mechanism. These include speed, durability, log size capacity, and the size of the kerf. The kerf of a saw is the width of the saw cut. This is usually wider than the saw blade itself because the teeth are usually formed so that they curve, alternately, to one side or the other. This helps prevent the blade from binding (getting caught in the wood). The greater the kerf, the more wood is wasted as sawdust.

The sash saw is the only kind seen in down-time sawmills. A sawmill using a water-powered sash saw could produce 500-3,000 board feet a day. The speed was of course dependent on the rapidity of the reciprocation; even early nineteenth century mills achieved fewer than eighty strokes per minute. Somewhat unfairly, they received the nickname "up today and down tomorrow" saws. (Clarkson 16; Williams 96, 247)

The earliest improvements retained the reciprocating action. First of all, several blades could be ganged together (connected to a single frame driven by the water wheel) so that a log could be completely cut in a single pass. Secondly, the heavy frame of the sash saw could be dispensed if the saw was made a bit thicker, resulting in a "muley saw." Being lighter, it could move faster, doubling the output (Cox, 66).

The circular saw (buzz saw) was invented in the late eighteenth century, but wasn't used in sawmills until the nineteenth century. Its great advantage was speed; the sash and muley saws only cut on one stroke, while the circular saw's cutting action was continuous. However, it could only saw a log whose diameter was less than half that of the saw itself. The size of the saw, in turn, was limited by the quality of the metal. Early circular saws also had a tendency to wobble, and hence a very large kerf. They also tended to overheat, warp and jam. (Clarkson 19-22; Pike 179, Cox 66-7)

The log diameter problem was ameliorated by the use of two circular saws, one above and the other below the log. (Pursell 157) And the kerf was somewhat reduced when suitable steels became available. But the circular saw nonetheless was clearly not a final solution.

The band saw became practical in the late nineteenth century, when metallurgy had advanced sufficiently that the long, flexible blade could survive the rigors of sawing. The band saw's first advantage over the circular saw was its narrow blade (and hence narrow kerf). In a nineteenth century

American sawmill, about 31% of the wood cut with a circular saw was converted into sawdust. A contemporary band saw would have wasted only 8%. (Hawke, Nuts and Bolts of the Past, 204-5; Cox 41, 66). The second advantage of the band saw was that it could cut even the thickest logs.

Like the circular saw, the band saw was fast. Steam powered circular or band saws of the late nineteenth century could produce over 100,000 board feet per day. (Pursell 157). The world record is 221,319 board feet (714 logs) sawed, with a band saw, in eleven hours (Pike 180).There is a "Band saw" article in *Encyclopedia Americana*, and it gives recommendations as to the thickness of the blade, and its speed of movement. Unfortunately, it doesn't provide any metallurgical specifications. The band sawmills of West Virginia are also described by Clarkson (23-33), which is in the Grantville (Mannington) Public Library. So far as the saw is concerned, it just says, "high grade steel."

After the band saw became the principal sawing mechanism, circular saws remained useful for edging work. (Pike 175).

Besides the saw itself, and the motive power, one must also consider how the log is delivered to the saw. This was originally done by hand. Later, a mechanical device was used to turn logs over as needed. Also, steam power was used to drive "live" rollers, which in turn drove the logs onward. (Pike 179)

Planing Machinery. In 1632, planing (the smoothing of the surface of the lumber) was done by hand. Planing machinery was developed in the nineteenth century.

Stoves and Fireplaces. Even in the mid-twentieth century, over 50% of world wood consumption was for fuel. If wood must be burnt, it is better that it be burnt efficiently. Some American fireplaces used ten to fifteen cords of firewood annually, but wasted four-fifths of the heat generated. (Cox 62) Desch (183-4) says that open fires, and primitive stove and ovens, waste over 90% of the fuel value of the wood. Benjamin Franklin's stove (1714) was specifically intended to conserve wood. (Cox 63)

Accelerated Seasoning. Wood will warp if its moisture content is too high, relative to ambient conditions. Seasoning dries out the wood. However, if the drying is too rapid, the outside of the wood will shrink so much faster than the inside that the wood will split.

In the seventeenth century, wood was seasoned by leaving it out in the air. (Sometimes trees were killed by girdling, but not cut down, so that the wood seasoned in the dead trunk.) The thicker the timbers, the longer it took; as much as seven years to season the "hearts of oak" for a sailing ship. Shipyards had to keep "large stocks of valuable timber seasoned and seasoning."

EB11/Timber says that one can place the timber in "well-ventilated rooms kept at a temperature of from 80° to 150° F," reducing the seasoning time to one-tenth of that required for natural seasoning. It also mentions a pretreatment in which water is used to force out sap.

According to Gordon (144), "by carefully controlling the drying rates in large kilns the time for seasoning can be reduced to a matter of days or weeks."

Moreover, the use of laminated woods (see plywoods, above) reduces seasoning time. The thinner the wood, the faster it can be seasoned (the moisture gradient in the wood isn't as steep).

Preservatives. Wood is subject to attack by fungi and various invertebrates (insects, marine borers), Tar (itself a wood product) has been used as a preservative since ancient times. Another early preservative, creosote, was originally a wood tar derivative, but was later made from coal tar.

Modern wood preservatives can extend the life of lumber by five to ten fold. One group of preservatives are copper salts, which include copper naphthenate, alkaline copper quarternary (ACQ), chromated copper arsenate (CCA), copper azole (CA), and ammoniacal copper zinc arsenate (ASCA).

Unfortunately they are all toxic to humans. That is also true of pentachlorophenol. One non-toxic alternative is borate, but borate can be washed out of the wood and so it unsuitable for outdoor use.

Preservatives can be applied by non-pressure methods such as brushing, spraying, dipping or steeping. Pressure processes can achieve a deeper penetration, but require a greater investment in equipment.

Fire retardants. Wood-eating lifeforms aren't the only danger wood faces; fire is another. Wood can be impregnated with fire retardant. (EA).

Indirect Effects of Up-Time Technology

The development of the coal industry will reduce the demand for wood (and wood charcoal) as a fuel, while steel smelters and concrete mixers will partially replace wood construction in ships and buildings, respectively.

Potassium carbonate can be made by electrolyzing potassium chloride in water, producing potassium hydroxide, and then carbonating with carbon dioxide. This process will ultimately doom the "potash" industry.

Barbed wire fences are a substitute for wood fences, and allow the co-existence of farmers and cattle ranchers.

Better transportation networks (asphalt roads, and railroads) will make it easier to log timber in areas which were previously considered inaccessible, and will also reduce the costs of shipping timber and lumber to communities remote from both the coast and navigable rivers. Water transportation will also be improved by the introduction of steamships.

Steam and electricity will make it possible for trees to be hewn and sawn much more rapidly than before.

Improvements in medicine and sanitation will result in population growth, and thus in increased demand for all products.

Down-Time Forest Law and Practice

The modern agroscientist defines a forest as an "area of land on which forest trees are the dominant vegetation." A "tree,", in turn, is a "woody plant ten or more feet high at maturity," while a "forest tree" is one which normally grow so close to other trees "that their crowns do not have room to expand to their full width... and [which] lose their lower branches. . . ." (Chapman 3). Lay folk think of a forest as a large area which is heavily wooded.

The word "foresta" first appears in the laws of the Lombards, where it referred to woods which had been placed off limits (Latin forestare, to exclude) to all save the king and his favorites. The purpose of this "afforestation" was to protect game so it was preserved for the royal hunt. The forest wasn't necessarily densely wooded; it merely needed to be land which supported suitable wildlife (especially deer) and marked as under royal protection.

Under English forest law, which was established by William the Conqueror, one class of offenses was

that of trespass against the vert (vegetation). These crimes included felling trees, especially if the land was entirely cleared (assarted) for farming; fencing off any part of the land (purpresture), or erecting buildings upon it. Forest law was moderated (for a price) by granting the right to take firewood (estover), or to pasture animals (pannage; agistment). (Harrison, 69-75; Wikipedia).

As in England, in the medieval period, forest management in Germany was primarily limited to the protection of the hunting rights of the nobility. (Fernow 35) When Grantville arrived in Thuringia, most of the forest land was owned by the aristocracy, and a license was needed to hunt there. A law blissfully ignored by the up-timers. (*1632*, Chap. 43).

Beginning in the twelfth century, we can find local ordinances which limited deforestation, and in the late fourteenth century, the first efforts at actively promoting reforestation.

Chronology of Forest Conservation Efforts in Germany Prior to 1631	
1165	clearing of forest for farming prohibited at Lorsch (Fernow 36)
1237	likewise at Salzburg, to protect salt mining interests
1359	first division of forest into felling areas, at Erfurt (286 acres in seven felling areas) (Fernow 38)
1368	first conifer plantation (the City of Nuremberg planted pine, spruce and fir to replace fire losses, see Toumey 1)
1454	use of seed trees in the Harz mountains (Fernow 38)
Mid-15C	foresters marked trees to designate that they could be cut for firewood (Fernow 48)
1480	first use of the "coppice" and "coppice with standards" silvicultural systems
1488	diameter limit of 12 inches in Brunswick (Fernow 38)
1491	first broadleaf tree plantation (the Seligenstadt monastery, in Hesse, agreed to "plant 20 to 30 acres annually with acorns." See Toumey, 1)
1524	retention of "seed trees" (10-30/acre) to quicken regeneration (but this was unsuccessful, as it was applied to the spruce which, being shallow-rooted, was vulnerable to wind damage—Fernow 54)
1530/1	use of thinning to increase yield (Sands 33, Fernow 62)(in 17C, some thought thinning was bad, and the practice was sometimes prohibited)
1560	houses in Saxony required to be built entirely of stone (Fernow 47)
1562	use of oak as firewood restricted (Fernow 48)

	(Fernow 47)
1562	use of oak as firewood restricted (Fernow 48)
1565	seed trees sheltered from wind by other trees in checkerboard or strip patterns; seed soaked before use, and sowed mixed with sawdust or sand, in the Palatine (Fernow 54, 59)
1579	acorns kept over winter for sowing in spring in Hohenlohe (Fernow 59)
1580	coppices in planned rotations (probably a short rotation of twelve years or less, see Fernow 56)
end of 16C	"ordinances against forest fires" (Fernow 45)
~1600	burning of wood to make fertilizer prohibited (Fernow 47)
1603	oak nurseries in use (Fernow 59)
(Sands, 33, unless otherwise cited)	

There were also ordinances which prohibited pasturing in recently logged areas (as the animals would eat the sprouts and thus hinder reforestation), required preservation of certain trees (e.g., oak, beech, larch or pine), allowed only the use of dry wood as fuel, prohibited or restricted the sale of wood to foreigners.

The 1598 Brunswick forest law said that "every farmer shall every year at the proper time set out ten young oaks, every half farmer five, every farm laborer three, well taken up with roots (wildlings), and plant them in the commons or openings at Martini (November) or Mitfasten (Easter) and cover them with thorn brush." (Fernow 58)

* * *

In the early seventeenth century, the Finns cleared land for farming by burning the timber. When Sweden, with the aid of the Dutch industrialist Louis de Geer, sought to mine and smelt copper, it prohibited such waste—the wood was needed as fuel for the smelter. Finnish scofflaws were forced to migrate to New Sweden, the colony founded in Delaware in 1637. (Voyages of David de Vries, 133).

* * *

Even without up-timer intervention, comprehensive forestry management was an idea whose time had almost come in the 1630s. John Evelyn wrote *Silva: or a Discourse of Forest Trees, and the Propagation of Timber* in 1664, and Colbert, minister to Louis XIV, persuaded the Sun King to sign off on the French Forest Ordinance of 1669. Forest management began in Russia under Tsar Aleksei Mikhailovitch; 67 of the articles in the 1649 Council Code regulated the use of forests. (Teplyakov 2)

* * *

Enforcement of forestry laws is notoriously difficult. (Lillard, 122-32; Cox, 25, 30, 99-100, 139-42, 177-9; Pike 44-51; Wood 18, 58-9, 62) The forest lands are difficult to traverse, and the thicker the stands, the shorter the range of visibility. If sufficient foresters are deployed to police the woods, then there are that many more individuals who can be bribed to overlook tree poaching.

Forest Practice in Wurttemberg

Warde's *Ecology, Economy and State Formation in Early Modern Germany* has a detailed analysis of the forest district (*Forstamt*) of Leonberg in the sixteenth and seventeenth centuries. I hope it is reasonably representative of conditions elsewhere in central Europe.

Forstamt Leonberg was part of the Duchy of Wurttemberg, and was bordered on the west by the Black Forest. The *Forstamt* was one-third wooded in the west, and only one-fifth in the east. (Warde 52). It contained five small towns and fifty-three villages, and ran up to the walls of Stuttgart. (43). I don't know what fraction of the Duchy it occupied. The arboreal riches of the *Forstamt* included oak, birch, beech, hazel, alder, aspen, Scots pine, silver fir, ash, hornbeam, willow, and fruit trees (apple and pear) (231-5). The yield of stacked wood in 1713 was 1.6-5.4 cubic meters/hectare (248).

Warde provides this breakdown of forest ownership in 1682:

Owner	Share
"Communes" (villages, towns)	58%
Duke (directly)	17%
Monasteries	9%
Nobility	6%
Private (mostly ducal tenants)	5%
Miscellaneous	2%

(3% unaccounted for) (106-7)

Warde's "communal" forests are best thought of as owned by a corporate-like legal entity, the "mark association," which in Wurttemberg corresponded to a village or town, but elsewhere in Germany (perhaps in a mountain valley) could be a looser association of dispersed farms (Huebner, Vol. I, Sec. 17).

Ducal forests (2300 hectares in 1682; 257) were organized into forest districts (*Forstamter*) administered by a forester. The foresters of Leonberg included members of the minor nobility (Gall von Sachsenheim; Friedrich Jacob von Reischach), but more often were professional foresters who had held similar positions in connection with lesser woodlands (Ulrich Bauder, 1589-1613?, Hans Ulrich Bauder, 1613?-1648?).

Forester pay was a pittance in cash, together with free use of a house, clothing, and various payments in kind. The latter exceeded what the forester would use himself, and the excess could be traded or sold to others, depending on the acumen of the forester. (Warde 185). Foresters also had some kind of expense account; they filed claims for food and lodging when away from the town of Leonberg. In the fiscal year 1585-6, Philip Rossach filed 186 claims. Ulrich Bauder had 129 in 1609-10. (188-9).

Figure that a forester might spend one-third of his time facilitating ducal hunts (locating "trophy" stags, getting hunting dogs in place, and chasing poachers), one-third dealing directly with the wood (surveying, and overseeing the cutting and transport of the timber), and one-third on miscellaneous administrative tasks (riding the bounds, supervising subordinates, attending court, preparing reports, etc.) (189)

Each *forstamt* was further divided into wards, and each ward (Hut) was monitored by a forest warden (Forstknechten. There were thirteen wardens in 1585 (186). The precise size of a ward isn't mentioned, but Warde says that by 1523, wardens were "within a day's walk of all of the district."

We don't know too much about the specific duties of the wardens, but it is safe to assume that they carried out the "detail work" for the forester. The forester might lead a group of wardens against a gang of poachers, but the less exciting work of the ward (e.g., counting the number of stags in June and of wild boar in October) was probably done individually.

Wardens tended to be chosen from the locality, which meant that they had a good knowledge of their ward. It also meant that they could have overly cozy relationships with the farmers and townsmen that they sometimes had to guard the forest against. The corruption of the wardens wasn't surprising, because the pay was poor. In the tax returns of 1544-5, none had an assessment over 160 florins. (The mean for the 4,000 inhabitants of Amt Leonberg was 246, Warde 124.)

The ducal forest income came both from the sale of wood, and of privileges, e.g., gathering acorns, or hunting rights (215). Forest income was usually 8-10% of the total ducal income, but in 1629-31, it reached 14% (216). In 1600, firewood was about 90% of the wood sold from ducal woodlands (264). Beyond that (I think), in 1604-5, ducal woodlands sold 163 trees (export?), and another 137 oaks and 203 firs were put to use within the duchy (e.g., repairing millworks)(254-5).

The ducal foresters and wardens concerned themselves with the non-ducal woodlands only if the latter were grossly mismanaged (191).

The communal administrative system could be complex. First, there were the "ordained in the wood" (*Verordnete im Wald*), who were in charge of certain major activities, e.g., marking and felling of trees. These were usually leading citizens, often members of families with a vested interest in the forest (e.g., coopers), who held the position for an average of eight years. Sometimes they provided deputies to do the actual work.

Then there was the mayor (*Burgermeister*); in Leonberg, you needed his say-so in order "to remove tree stumps, remove lying or dead woods . . . to cut rods, and to drive the pigs into the woods for pannage" (grazing on acorns).

Finally, there were the town's wood wardens, who actually policed the property. Trespassers could be brought before the bailiff (*Schultheiss*) of the village court.

A balance had to be struck by each community with respect to the use of land: as farmland (supplying vegetables and grains), as pasture (supplying meat and milk, as well as manure to restore the fertility of the farmland), and as forest (supplying fuel, and the raw material for making buildings and wooden goods)(Warde 53). The latter uses weren't mutually exclusive; pasture use of woodland was extensive. The woodland of a community was usually on its outskirts (since the forest didn't require constant care) or on steep slopes unsuitable for plowing. (Warde 75).

About 70% of the wood was harvested from forest managed as "coppice with standards" (*Mittelwald*). To control harvesting, some forests were divided into compartments, harvested cyclically. The most common cycle was sixteen years, but the range was 8-40. The village of Renningen, in the 1560s, had 23 compartments, each 17 morgens (one morgen=0.3316 hectares). Compartmentalization was most common for commune forests, less so for ducal ones. Nonetheless, over 80% of woodland would be earmarked to be cut at a particular time. (Warde 76-7, 235-7).

The forest had a traditional schedule. December and January were the months in which the foresters

marked wood as suitable for special uses. The trees were chopped down in February, March and perhaps April (in Munklingen and Leonberg, the cutting season ended on St. George's Day, April 23). This was late enough so that the wood wasn't frozen, but before the sap rose, weakening the wood. The wood sales were done by May. During the summer, the forest officials inspected the forest and chased poachers, handing in their reports in August. There could be a second cutting season in the fall, after St. Edigius' Day (September 1) and before the winter freeze. There was also more surveying, and selling of shipment of wood, in the autumn. (Warde, 78-9).

In general, cutting was frequent enough so that mature stands were relatively rare. Bauholz (building wood) occupied only 14% of the woodland (238). A 1495 ducal ordinance complains of "the great shortage of wood for fuel and building." (175). It may have been the first such official complaint, but it was definitely not the last. Over time, exports of wood declined, and residents who once were allotted free firewood found they had to pay for it (244). Wood sales dropped from about 425 klafter (1 klafter=3.386 cu. m. = 144 cu. ft.) in 1580 to less than 25 in 1630 (244-5). It is rather likely that the wood extracted from the forest exceeded the "mean annual increment."

The town of Gebersheim, with 100 hectares of woodland, sold 18 trees a year in 1630-1, 108 in 1632, 45 in 1633 and 115 in 1634. It seems pretty clear that they were selling off mature trees for ready cash, at a non-sustainable level. (260-1)

Up-Time Forestry Methods

There are two key points to remember about the economic role of forests:

—they are a renewable resource

—for most tree species, the renewal is *very slow*.

The average age of a live oak (*Quercus virginiana*) when cut was 75-100 years old. In nature, there are two to three large trees per acre. (Wood, 55). Of course, there are trees which mature quickly. Willow, which can be used in basket-making, provides a return in ten to twelve years. Some poplars take only twenty to thirty years to mature. (Baker 83). Birch, aspen, alder and larch are also rapid growers (Fernow 61-2).

Modern forestry emphasizes "sustained yield" management—that is, the average annual harvest is equal to the average annual growth. Bear in mind that in the short-term, we will be asking the citizens of the USE to harvest less timber. If we haven't educated the people as to why this is important—and if they aren't willing to take a long-term view—then either they will flout the new forestry law, or, if we enforce it, show their disagreement in other ways.

I am not very satisfied with the encyclopedia descriptions of forestry methods. However, I think it reasonable to expect that Gordon Alexander would be familiar with the very basic silviculture principles which I set forth below.

Mensuration. It was recognized as early as the fourteenth century that the forest was a renewable resource, but that it needed time to recover from extensive logging. The question was how best to accomplish this. The logical expedient was one which was somewhat analogous to rotation of crops. That is, the forest would be partitioned into lots, which would be successively logged and reforested. This progressive movement of logging operations is called "rotation."

In the French Forest Ordinance of 1669, "la methode a tire et aire" was adopted. In essence, the forest was divided into lots of equal area. However, in modern forestry practice, the division is into lots of equal wood volume. Naturally, the period of rotation (the average time between harvests of the same lot) must be sufficient for the lot to recover. The longer it takes for the given tree species to mature, the longer the cycle must be. Moreover, to implement a longer period of rotation, the forest must be divided into a larger number of (smaller) lots.

The EA provides some basic guidance as to how to develop a forestry plan. The first step is to prepare a field map and a timber inventory by species. To obtain a timber inventory, first you determine the area of each forest species as shown on the field map. Then, for each species area, you determine the total merchantable timber volume. That is done by actually measuring the diameter and height of all the trees in several sample plots of known area, multiply the nominal wood volume by the average cordwood content of the trees of that forest species, and extrapolating to the total area of the forest species. This can be a bit tricky because the density of the species can vary from one part of the forest to another.

Silviculture Systems. A number of different silviculture systems exist; these combine a cutting method with a regeneration method. (Hawley)

Three different cutting methods are used with even-aged stands. The first, clearcutting, removes the entire stand at one time. EA says that this is typically used with stands of conifers, such as southern pines and Douglas fir, which are intolerant of shade.

Clearcutting is usually less expensive than other methods (but see Raphael 164). You only need to bring the logging crews in once per rotation, and likewise, you don't need to maintain access roads for as long a period. Some logging methods (e.g., skylining) work best with clearcutting. You don't need to worry about protecting some trees while you harvest others, and you harvest more wood for immediate sale. After harvesting, you have an even-aged stand (even if you didn't originally) and that means that subsequent management is easier (e.g., you can administer pesticides just during the period when the entire stand is most vulnerable). If the newly planted trees are of a species that is intolerant of shade, then clearcutting guarantees them plenty of sun in their early years. (Berger 86-8, Raphael 158-9)

Modern environmental groups tend to oppose clearcutting on the ground that it is unnatural; fires and insect infestations usually don't remove all the trees in a large section of the forest. It is more difficult for the forest to regenerate itself (natural seeding is more difficult; seedlings are in the open), and habitat diversity is reduced, which adversely effects wildlife. Clearcutting is most problematic if practiced on mountain slopes (where the trees help prevent avalanches), and in harsh climates (where the forest moderates the temperature and the forest cover facilitates regeneration). But even environmentalists may applaud clearcutting when it is used to remove invasive species. (Berger, 88-94).

The seed tree method, leaves behind a small number of seed trees. Naturally, the most valuable and healthy trees should be reserved for seed, especially if it is possible to harvest them at a later stage, when reforestation is well along.

The shelterwood method can be characterized as featuring at least two heavy thinnings of the stand. After the first cut, the remainder of the old stand provides seeds, and shelters the resulting seedlings. Then the second cut completes the removal of the old stand, freeing the established seedlings to develop fully. Thus, the "shelterwood" system is really a clear cut performed over several cutting cycles. EA says that the "shelterwood" system "is appropriate for conifers that are semi-tolerant of shade (such as ponderosa or white pine)," and that "the taller trees are removed in two or three stages at intervals of 8 to

10 years."

If the stand is of uneven age, then the usual method is the selection method. An uneven-aged stand is defined as one consisting of at least three age classes, so the selection method, to perpetuate such a stand, must feature at least three cuttings during a single rotation. EA says that the selective logging of hardwood of uneven age is "at five or ten year intervals, with the largest and most poorly formed trees being removed and the other trees left to grow."

Selection usually results in removal of the tallest trees. According to a nineteenth century commentator, "a Maine forest after a lumber campaign is like France after a coup d'etat; the bourgeoisie are as prosperous as ever, but the great men are all gone." (Cox, 81) A poorly timed selection cut, by eliminating the most commercially desirable trees, becomes a reverse genetic selection, in which only the undesirable trees get to reproduce. (Berger 72, Raphael 162)

Selection may be used to convert a mixed stand into a pure one (a monoculture), by culling out the trees which (in the eyes of the forester) "don't belong." It also can convert an uneven aged stand into an even one, or vice versa (if seeds are sown).

Regeneration. There are two basic regeneration methods. The "high forest" method produces new stands from seed. It can be combined with any of the cutting methods described above. The "low forest" ("coppice") method regenerates the trees vegetatively, that is, by sprouting from stumps or root suckers. In its pure form, it is applied after clear cutting.

High and low methods are combined in what is called coppice-with-standards. The "standards" are seed trees, and regeneration is both from the seed provided by the standards, and from the stumps and roots of the logged trees.

In the case of the live oak of the southeastern United States, a tree grown from acorns takes 50-60 years to reach maturity, while one grown from stumps is mature in just one-third that time. (Wood 51)

* * *

The term "rotation" has its original physical meaning often in the management of even-aged stands which are clear cut. Modern foresters define the period of rotation as being "the period of years required to establish and grow timber crops to a specified condition of maturity." (Chapman 252). If all you need is firewood, five years might be good enough. If you need building materials, you might have to wait fifty, even one hundred, years. (Logan 94).

With, for example, the shelterwood system, there might actually be several "cutting cycles" within a single rotation. (Chapman 289)

The U.S. Forestry Service nominally seeks to defer logging until the trees reach "productive maturity," which is when the "mean annual increment" has started to drop (that is, when the trees no longer have a current annual growth which is greater than their average annual growth). However, the problem is that if a timber company buys forest land, it is paying interest on that purchase every year (or at least, its money is tied up in the standing timber and can't be used for something else, and so an economist would say that it has to consider the time value of the money). Likewise, it has costs for maintaining the forest, that is, protecting it against fire and disease. For every year that harvest is delayed, it has to garner that much more revenue in order to make a profit. On the other hand, as the trees grows-, their wood may increase in value; greater bole diameter, fewer branches, less sapwood. Thus, the timber company wants to harvest at "economic maturity," when its return on investment is maximized. (Raphael 185-8)

Intermediate cuttings. Besides the silviculture systems, which implement the rotation scheme, certain

intermediate cuttings (thinning and pruning) may be used on any lot at any time.

Trees compete with each other for light, and those which lose the race for the heights will wither and die. A thinning is a selective cutting made so as to increase the total yield from the stand. Low thinning removes overtopped trees that won't grow well anyway. Crown thinning is the reverse; it removes the higher trees to give the others a better chance. Selection thinning removes dominants which are poorly formed. (Note that a tree may be healthy but not good for lumbering because of defects in the trunk.)

While thinning removes entire trees, pruning merely removes branches which would otherwise produce undesirable knots in the wood. It also encourages the trees to grow straight trunks suitable for masts. (Wood, 51)

Monoculture versus Polyculture: A "monoculture" forest is one dominated by a single tree species. It can arise either naturally ("new growth" after a forest fire, or species which normally occur in pure stands) or through human intervention (planting a single species of tree while culling others). The latter can be called a "tree plantation."

The advantages of monoculture are higher yield (less competition from other plants, standardized planting, pruning, thinning, and pest control) and reduced waste (by standardized harvesting methods tailored to the dominant species). Monoculture also makes it easier to estimate wood volumes for management purposes. On the other hand, the reduced diversity may lead to reduced levels of game, and if a pest or disease gains a foothold, it may spread more rapidly than it would in a more diverse forest.

Logging methods. This is probably as good a place as any to mention that all logging methods have environmental consequences above and beyond the removal of the desired timber. Roads and even some cable systems require additional cutting. The movement of tractors, animal teams, and logs (if skidded) compacts the soil they travel over. The power equipment used to cut trees and lift logs consumes fuel, which had to be extracted from the earth in some way. (Berger, 94-5)

Wastage. In the process of converting standing timber into lumber, some of the wood is wasted. I don't have figures for the seventeenth century, but these are valid for American forests in the mid-twentieth century. For each category, I give the percentage of the total wood volume (not of the wood wasted) attributable to the particular problem:

stumps 2-3%:

The stump is left in the ground so, the higher the stump, the more wood is wasted. If the tree is felled when the land is covered with deep snow, or where the ground is irregular, the stump height may be as high as ten feet. Wood can be saved by requiring short stumps. In the American National Forests, the maximum stump height is typically 6-24 inches. Better yet, the trees are cut just above the root swell. Ideally, the trees are cut at ground level. (This is common in twentieth century Europe.)

tops, limbs, branches 10-12.5%:

Wood is also wasted at the top of the tree. Trees are cut up to a particular top diameter. In the American National Forests, the specified minimum top diameter is typically 4-12 inches, depending on the species.

defective and decayed trunks; boles shattered in felling 4-5.5%:

Care must be taken in choosing the direction in which a tree is felled. If, coming down, it strikes obstacles (other standing timber, stumps, logs, rocks), breakage may occur. (Depending on the species, the loss may be as high as 15%.)

miscellaneous woods losses (e.g., improper log lengths, transportation losses; decay in storage) 1-1.5%

When logs are inaccurately measured, or cut only to even lengths, wood is unnecessarily discarded. Logs can be lost in transport; they go astray, or they are jammed and then damaged when the logjam is freed with explosives. If logs are left outside too long, they may rot.

bark 7-8%

The bark must be removed for the wood to be used as lumber. However, this isn't waste if the bark can be profitably put to some use.

saw kerf 8-10%

Kerf was discussed in the section on sawmills.

slabs 8-9%

edgings and trimmings 6-8%

seasoning 3-4%

remanufacture 2-3%

miscellaneous manufacturing losses 1%

(Brown, 9-11, 115-17, 122-3).

It is evident that something like 53-66% of the wood in the standing timber is wasted in one way or another.

Fire Prevention and Control. Any society which relies heavily on wood construction will experience destructive fires. Just in the early seventeenth century there were ruinous municipal fires in Tiverton (1612), Oslo (1624), and Rajmahal (1631).

North America, with its combination of extensive forests and a hot, dry summer, is especially prone to forest fires. But they aren't unheard of in Europe; 1911EB mentions that in 1811 forest fires in Tyrol destroyed 64 villages.

Grantville has a fire department, and its personnel should have some knowledge of how to prevent and fight wildfires, even though they aren't as frequent a problem in Marion County (Fire District 1) as they are elsewhere in West Virginia, let alone the Far West.

Disease and Pest Control. There are a number of references to particular diseases and pests which afflict trees in the 1911EB (articles on Larch, Lemon, Pear, Plum, Apple, Olive, Orange, etc.)

The "Timber" article warns that to protect it from fungal decay (dry rot), wood used in construction should be well seasoned first, and used in such a way that it is well ventilated. It also discussed preservation by impregnation with creosote, "corrosive sublimate," carbolic acid, or zinc chloride, or by charring, tarring, painting or oiling.

If a fungal infection appears on a living tree, it may be combated by removing diseased material, grafting (e.g., lemon on bitter orange), or spraying with a fungicide (e.g., with "Bordeaux mixture" on the pear, or ammonium copper carbonate on the orange).

Pests can be blocked physically (e.g., a tarry cloth girding the tree), removed by hand, or killed with a pesticide.

In general, grazing animals aren't a serious enemy for mature trees. However, because they eat seedlings, and the foliage and bark of saplings, they do pose a potential threat to the regeneration of the forest. If overgrazed, the forest becomes overmature (ceases to produce new seed), and dies off. This forest-to-grassland devolution has occurred in Spain, Italy, Greece, North Africa, and parts of the Western United States. (Chapman, 11).

Genetic Improvement. Because of the long maturation period for most trees, the breeding of trees to improve their traits takes time.

One of the first trees known to have been improved as a result of human intervention is the plane tree (Platanus). The Tradescants, who were British court gardeners, were growing the oriental plane tree (Platanus orientalis) in their South Lambeth garden by 1633. In 1637, John Tradescant the younger returned home from Virginia with seeds or cuttings of the American sycamore (Platanus occidentalis). The two species, normally separated by the Atlantic Ocean, hybridized, producing the London plane tree (Platanus x acerifolia). The Tradescants were not trying to create a new species, but they recognized that the London plane tree was something novel and useful. (Spongberg 12-13).

A modern genetics program will involve collecting seeds or other reproductive material from the "star" trees, those whose traits are considered especially desirable. One trick is to cut off the top of the tree (in conifers, that's the part which produces the most cones), and then take cuttings from the tips of the branches. The cuttings, in turn, are grafted onto a compatible root stock, thus facilitating the rapid reproduction of the trees. So the generation time is reduced from, say, sixty years, to just a couple. (Raphael, 40-1).

With a suitably spaced orchard of "star" trees, natural crossing occurs. But of course the tree scientists make deliberate, artificial crosses, too. The seedlings may go straight to the forest, or first be cosseted in a greenhouse nursery.

Conclusion

For the downtime Europeans, wood is a preeminent material: a source of heat and shelter, and a medium of expression for artisans. Yet the forests from which they derive their wood are not managed in a way which will preserve them in perpetuity.

Caecilius Statius (220-168 BC) wrote, "He plants trees to benefit another generation."

The up-timers bring with them knowledge both of how to cut trees far more efficiently, and of the deleterious consequences of deforestation. They know of valuable trees never seen by down-time European eyes, and of familiar trees lost or endangered as a result of environmental change, natural or manmade.

It remains to be seen whether the overall effect of the Ring of Fire on the human relationship with the forests is a positive or negative one.

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Guilds 101

Written by Karen Bergstralh

Guilds had a long history. Depending upon your exact definition, a form of guilds can be traced back over 4,000 years. By the twentieth century all but a few guilds had disappeared and the handful that remain had altered greatly. A major factor in their disappearance was industrialization.

The following is a very basic outline applicable to most European guilds. It is intended as a starting point only. Anyone intending to write about guilds in a particular city will need to do research into those specific guilds and cities. Guild rules and practices varied by region, country, city, and time.

The Steps to Becoming a Guild Master

Step One:

Apprenticeship—a boy between 12 to 16 years old goes into a master's household for training. The family pays the master to train their son. Depending upon distances, the apprentice might go home to his family Saturday afternoon and return to the master Sunday evening. If the master is in a smaller village the apprentice might stay at home, reporting to the master every morning. The apprentice is not paid for the work he does.

Apprenticeship is a legal contract between the boy's family and the master. Basically, apprenticeship lasted until the master agreed that the apprentice was ready to be a journeyman. This might be anywhere from one year to ten. On the other hand, a master might declare that an apprentice was unfit to ever become a journeyman, in which case the young man was dismissed. A dismissed apprentice's family was unlikely to find another master willing to take him on.

The master is charged with training the apprentice in the craft and seeing that he has schooling in general education and business education (such as basic bookkeeping) so that the boy will be prepared to run his own shop. If the boy lives with the master, then the master is responsible for feeding and clothing him during the apprenticeship. The master may hire the apprentice out to another master or to a farmer with the boy's wages coming to the master. Hiring out to non-guild members was generally frowned on if not actually against most guilds' rules, but appears to have happened with fair regularity.

The only rules that appeared to be universal among almost all guilds were that for a child to be acceptable for apprenticeship the child had to be of legitimate birth and male.

Step Two:

Journeyman—a young man of 16 to 25 + years old who has been determined to have reached a certain level of training and leaves the master who trained him. At this time he may "journey" around from town to town, working for different masters, learning different techniques. More importantly, he looks for a town that has room for another master. Journeymen work for wages and to learn new techniques from different masters. Journeymen were not allowed to marry.

The usual time from being apprenticed to being a journeyman ready to apply for mastership was considered to be seven years regardless of the craft. The minimum time was considered to be three years. It rarely mattered.

Some guilds required a journeyman to "tramp," that is, move around for a minimum time, usually three years, before trying for his mastership. Again, there were many exceptions. A journeyman who was the son of a master in a large city might "tramp" no further than to a couple of other masters within the same city before coming back to his father's shop. Less well-connected journeymen did move around and some went far from home.

Step Three:

Master—a man of 22 to ?. The journeyman has been working for a master and has produced a "masterwork" that showcases his abilities. In a town or city with multiple masters of a single trade, several of the masters needed to agree that the work was of masterwork level. They also had to agree that there was room for one more master to set up shop. A master sets up his own shop, takes on apprentices, hires, and promotes or fires journeymen.

New masters had to set up their own shops as no master was allowed to work for another master. In some cases, the new master might be able to partner with an older master who had no son to take over the established shop rather than set up on his own. Upon becoming a master, a man also had to marry at once. Often the ceremony granting his master's license was immediately followed by a marriage ceremony. So, add into the requirements for becoming a master the requirement for enough money to both set up a shop and marry.

A journeyman might also marry the widow of the master he was working for, take over the business and, defacto, be accepted as a master. If the town had no room for another master of his trade, the journeyman must travel on, seeking a place where he can become a master.

There were no set ages or set tests to determine any level. If a journeyman produced what he considered a masterwork, there was no guarantee that the master would accept it. In that case, all the journeyman could do was move on to another master and try again.

A journeyman didn't really "train" for his mastery. He tried to find a master that A) would hire him, B) had a technique that the journeyman didn't know, C) would accept the journeyman's work as being master level, or D) was sick and/or elderly and without heirs, and had a wife the journeyman can marry upon the master's death, or any combination of these. If a journeyman hadn't become a master by the time he was in his thirties, the chance that he would achieve that level dropped to nearly zero. Option D was about all that was open to him.

One last hurdle to becoming a master was that the journeyman had to be acceptable for citizenship of the city he was seeking his mastership in. If he wasn't, he didn't become a master and had to find another city that would accept him as a citizen and another master who would hire him.

Should the journeyman be the master's son, his progress from journeyman to master was assured. He would still be expected to go out for a while and work for other masters but the rules on this varied. Guild rules were not always applied equally nor did guild practices always match guild rules.

The Power of the Guilds

Were the guilds powerful or weak? The guilds could and did have the power to regulate who became an apprentice, journeyman, and master. They could fine masters and journeymen for violating guild rules and regulations. Disputes between members of a guild were mediated by that guild. Guilds could dictate what goods carried the guild stamp. They could set prices for their own goods and, often, the prices paid for raw materials used to make their goods. In many places they could prevent goods made outside their city from being sold within the city.

Most of the guilds' rights and powers varied from chapter to chapter. Each guild chapter had to be chartered by the city it existed in and that guild chapter's powers only applied within that city. The charter spelled out exactly what the guild had the power to do and what it did not. The exact wording of these charters depended upon what the masters of the town's guild chapter considered important and what they were able to negotiate with the city council. Thus the glove makers' guild chapter in City A might have the power to exclude the sale of all gloves made elsewhere while the chapter in City B could only limit the number of outside gloves that could be sold. City C's chapter might be able to control the number of outside gloves being sold and force them to be sold for a set price.

Chapter charters were renegotiated from time to time and the powers granted that guild chapter would be changed. A city could revoke a guild charter. A local noble could declare piece of land he owned outside the city to be a "guild-free" zone and the guild chapters within the city were legally powerless to do anything about it.

Each guild chapter could control only what happened within the city it was chartered in. The glove makers' guild in City C had no say in what the glove makers' guild in City A did. No city-chartered guild could control what went on in the rural regions around it. The best that they could do would be to forbid or limit any goods not made by themselves from being sold within their own city—if their charter allowed that. One problem that the guilds were already facing in the seventeenth century was that their charters did not extend into the suburbs growing up around cities.

A few guild chapters had regional charters that did allow them control of guild-related things in all the state. These regional charters only existed as long as the state ruler(s) decided that they could. As with city charters, those regional guild chapters only had those powers that they could negotiate with the state's ruler.

Guild chapters from several cities in a region could and did work together to lobby the region's ruler for a wide range of things pertaining to their guild. Different craft guilds also might form alliances within a city or region and lobby. What did they lobby for? In some cases it was to force all raw material producers to sell only to them and at set prices and quotas.

The guilds lobbied city and state councils, offered bribes and loans to officials and princes. Cooperation amongst guilds was not the rule. Just as often the various craft guilds were busily lobbying against each other and against the merchant guilds.

The guild masters were socially, religiously, and politically active. They had money. They had influence. They were prominent citizens of their cities. Guild masters were found on church and city councils. In some cities you had to be a guild master to be on the city council. As prominent, wealthy, and influential citizens, they did have considerable say in what happened within their cities. They were not, however, all-powerful. At any time a non-Imperial city or town council could alter their charters and remove the rights of any and all guilds within the town.

In the sixteenth century Charles V stripped the guilds of their charters in Imperial cities. It can be argued

that his move broke the guilds' political power. There is absolutely no reason that the USE cannot and will not do the same thing. In fact, there is every reason to believe that the USE will strip the rights of guilds in Imperial cities.

The guilds sponsored feasts, dances, entertainments, and all manner of social and church functions. Events might be limited to members of a particular guild, or to all of city's guild members, or be open to the public.

Guilds and Women

Women were not allowed to become members of guilds. Period. Fini. No way. Yeah, really. However, there is much evidence that women did do guild work and even ran shops as masters. How can this be when the rules absolutely forbade it? The widow of a master was allowed to continue to run his shop and they often did. The guilds might encourage the widows to remarry a likely journeyman or widowed master but it appears that they rarely attempted to force them.

Unofficially, women produced guild products. At some times certain products such as woven woolen goods appear to have been made more by women and other "non-guild" workers than by guild workers. The practice was frowned on, fined, grumbled over, but continued with a wink and a nod.

Many illustrations and paintings from the sixteenth and seventeenth century show a guild master's wife working along side him, doing the same work. In these and other illustrations, daughters as well as sons can be found toiling away at their father's craft.

Despite these proofs that women did do guild work, almost all guild rules banned females from guild membership.

There were, however, a very few guilds that did allow a form of limited mastership to women. As seen above, widows of guild masters were allowed to run their husband's shop. There is evidence that a painter's guild in Holland allowed female masters but closely regulated what materials and methods they could use.

As stated before, anyone intending to write about guilds in a particular city will need to do research into those specific guilds and cities—especially when it comes to their attitudes toward women working in the guild.

Industrialization vs. Guilds

Developing industries wanted workers and most of the industrial jobs required little training. Under the guilds a boy underwent anything from three to seven years of training before he began earning any money. His family had to pay a master to take the boy on as an apprentice. Poor families could send a boy into industry and, instead of having to pay for his training, that boy would be earning wages from the start.

The growth of industrialization rang the final death knell for the guilds as they had been. As a note, what is known as "proto-industrialization" had been putting pressure on the guilds before the advent of the

Ring of Fire. For this and various other reasons the guilds were already in decline throughout most of Europe.

Guilds vs. Unions

Some confusion may occur because the unions adopted the terms apprentice, journeyman, and master to indicate levels of abilities. However, under unions, there are standard tests that determine who gets what title. A member of the UMWA in Kentucky faces the same tests as a member in West Virginia or Pennsylvania.

Most unions use a combination of on the job training and classes to determine which apprentices can take the test for journeyman. Under most union rules, apprentices cannot work alone but may work under either a journeyman or master of their trade.

Similarly, for most unions, a journeyman has to spend a certain amount of time working as a journeyman as well as attending classes before he can sit the test for master.

Once more, the above is in no way complete. It is intended only as a basic outline to help authors. The guild system had as many exceptions as it had rules. How the guilds were run in England varied from the way they were run in France and both differed from what happened in Germany, Holland, Spain, Italy, Poland, etc. Anyone intending to write about guilds in a particular city will need to do research into those specific guilds and cities.

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The Doodlebugger

Written by Iver P. Cooper

Wietze Oil Field, near Celle, in the Duchy of Calenberg
Early, 1634

"Hans, dammit! Where's the report on the new mine cars?"

"In a moment, sir." Hans started rummaging through the files, at first calmly, then more frantically. "I am sure it's here somewhere."

"Perhaps it'll be faster for me to just open the window and yell. There's got to be someone down there who knows his ass from his elbow." Quentin Underwood, the Manager of Oil Operations, and former USE Secretary of the Interior, turned and walked over to the window. Looking out, he realized that several of the men were gathered around a stranger. "Who the hell is that? Some fucking labor organizer?" Forgetting, for the moment, that his political bosses were union men. Quentin grabbed his coat and stormed out the door.

***

"Yes, yes, it's working, can you see?" Martin Schmiedechen smiled broadly. His big hands quivered. The long end of the forked stick he held seemed to take on a life of its own. He appeared to be fighting it, as it swerved down and to the left. The oil field workers gaped.

"There's oil there, isn't there?" Martin added.

"Oh, yes," said one of the workers. "How'd you know?"

"Well, as I am sure you realize, petroleum is the oil of rock, and thus partakes of the elemental character of both Water and Earth. Consequently, I have modified a traditional dowsing rod. As you can see, I have wrapped copper wire about it. Copper is a metal, and thus is of Earth, but it is also the metal of Venus, and thus also represents Water, which is a female principle.

"The wires lead to the Harmonium on my back."

They looked with admiration at the black box with silvery alchemical signals painted upon it.

"So what's in the box?" one asked.

"I am sorry, I can't tell you that. It is one of the great philosophical secrets of this age. One possible only by my combining the great Magnetic Science of the uptimers with the secret, almost forgotten alchemical knowledge of the Pharaohs of Egypt." They looked at him blankly.

Martin took pity on them. "But I can tell you that it contains certain objects which have . . . affinities . . . with both the magnetics of the Earth and the alchemical principles of the petroleum."

"You have a bottle of oil inside?"

Martin looked offended. "Nature does not yield its secrets so readily. One must proceed indirectly, and take it by surprise."

Quentin arrived. "What's going on here?"

"This fellow showed us how to find oil," said the foreman. "Isn't that amazing?"

"Can you find your ass in the dark? Of course he can find oil here. You're standing next to a goddamn oil field, remember? And the oil is so close to the surface that half the time we just *dig* for it!

"This jackass is just a doodlebugger, a dowsing fool with delusions of grandeur. Get back to work!"

Quentin glared at Martin. "What's your name?"

Martin started to answer but Quentin didn't wait. "Never mind, I don't care. You don't work here, you don't have permission to be here, you're out. Security! Where the hell's security when you need it?"

A somewhat red-faced guard answered his call. "Sir?"

"Escort this man out of here. Now. And don't let him back." Underwood stomped back to his office, secure in the knowledge that he had once again triumphed in his never-ending battle against human frailty.

* * *

"This Underwood was really most impolite, Cousin Ilse. He wouldn't even allow me to introduce myself. And he completely disregarded the evidence of his own eyes, my definitive demonstration of the Oleic Harmonization to his own workers.

"You, Ilse, are the only other living soul to see the contents of my Harmonium. The fossil plant. The bottle of oil. And the Prime Catalyst—" He lowered his voice, even though he knew they were alone. "—the Sparkplug."

"I feel for you, Martin. I will talk to August, he will make sure you get a proper hearing."

A few weeks later

Quentin finished reading a letter, crumpled it, and tossed it into the wastebasket. "For crissake! The screwball's got connections."

"Sir?"

"The doodlebugger. One of his relatives is Ilse Schmiedechen."

"Ah." His secretary still was new to petroleum technology. But he had the genealogies of the noble families down pat. Ilse was the morganatic wife of August von Calenberg, Bishop of Minden. Who was the older brother of Georg, Duke of Calenberg. Who, not so incidentally, owned the Wietze oilfield.

"So he wants a test, eh? Boy, he'll get a test."

* * *

"So, Herr Schmuckechen—"

"Schmiedechen. Martin Schmiedechen."

"You think you can find oil?"

"If the harmonic conditions are appropriate."

"Yeah, right. Okay, here's the deal, I have ten identical boxes here. And if you think it was easy to get ten identical boxes in this screwed-up world, well, you're crazy. Every box is filled with sand. However, in one of the boxes, I have buried a bottle of oil. Your job is to do your voodoo dance, or whatever is you do, and pick out the right box."

Martin nodded.

"Oh. My secretary will record whether you got it right or wrong. And after your first pick, we blindfold you, open the boxes, and pick at random which box to put the bottle into for the second time around. And then again for the third time. Ten trials in all."

"Sir, this is hardly a fair test. The amount of oil is small, and you have taken it out of the ground, which means that you have severed the harmonic lines—"

"If you don't like the test, the door is over that way."

"Very well, but I do this under protest. Make sure your secretary writes that down."

Martin picked the correct box two times out of ten.

"That's better than I expected," said Underwood.

"So I am hired?"

"Are you kidding? It's still well within chance variation."

"We'll see whether the Duke's advisers agree."

"His buck, his grief. Out."

On a hillside near Hannover

"Here?" The crew chief looked skeptical.

Martin closed his eyes, opened them again. "Yes, here. The vibrations were most pronounced, they indicated the presence of a veritable lake beneath our feet."

The crew chief looked at the Duke's representative, who gave him a quick nod. "Alright, lads, let's start assembling the derrick."

He turned to Martin. "This isn't going to be easy. We're on a hillside; we're going to have a devil of a time drilling a straight hole."

"I must go where the lines of magnetic harmony lead me," said Martin loftily.

* * *

They looked at the sand that had just been brought up. The crew chief ran his fingers through it. "It feels wet."

"Oil?" asked Martin hopefully.

"More likely water. In which case the hole may be a little off. Water's usually under oil. If we strike water first, that's a bad sign. But we'll give it another ten or twenty feet to be sure." The drilling crew put the drill bit back on the cable, and continued their work.

Some minutes later, the hole started gushing a brown fluid. Not black or clear.

"What's that?" asked Martin.

A crewman reached out a hand, took a taste. "It's beer! We've struck beer." He quickly stood under the fountaining beverage, mouth agape.

"Hey!" He had been pushed aside by one of his fellows.

"So where's the oil?"

"Who's complaining? "I'll take beer over oil any day!"

The duke's representative came over to Martin. "Do you have any idea what has happened here?"

"Beer is made from fermented grain, which is, of course, of the Kingdom Vegetalia," mused Martin. "And the oil, according to the uptimers, that is the result of a natural alchemical change in the character of ancient vegetable remains. The beer and oil both being liquid, as well as vegetable, they exhibit the same magnetic harmonics—"

"No, I meant, where did all the beer come from?"

It was only later that they went downhill, and found the brewery which had been using a cave in the same hillside as an inexpensive storage tank. But by then even the duke's representative was too drunk to care.

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Supply and Demand

Written by Rick Boatright

Tink tink tink... The little yellow screwdriver rang against the side of the Cora's mug as Father Nicholas Smithson sat silently in the rectory kitchen.

"Why so glum, Nick?"

Father Nicholas Smithson looked up from staring into his coffee mug to see his good friend walking in. "I was hearing confession, Gus."

"Well, it was your turn."

"I know, and I'm happy to provide the service. I still miss my parishioners in London, and this is a small way to be a part of the life of this community. But I'm afraid I may have to stop."

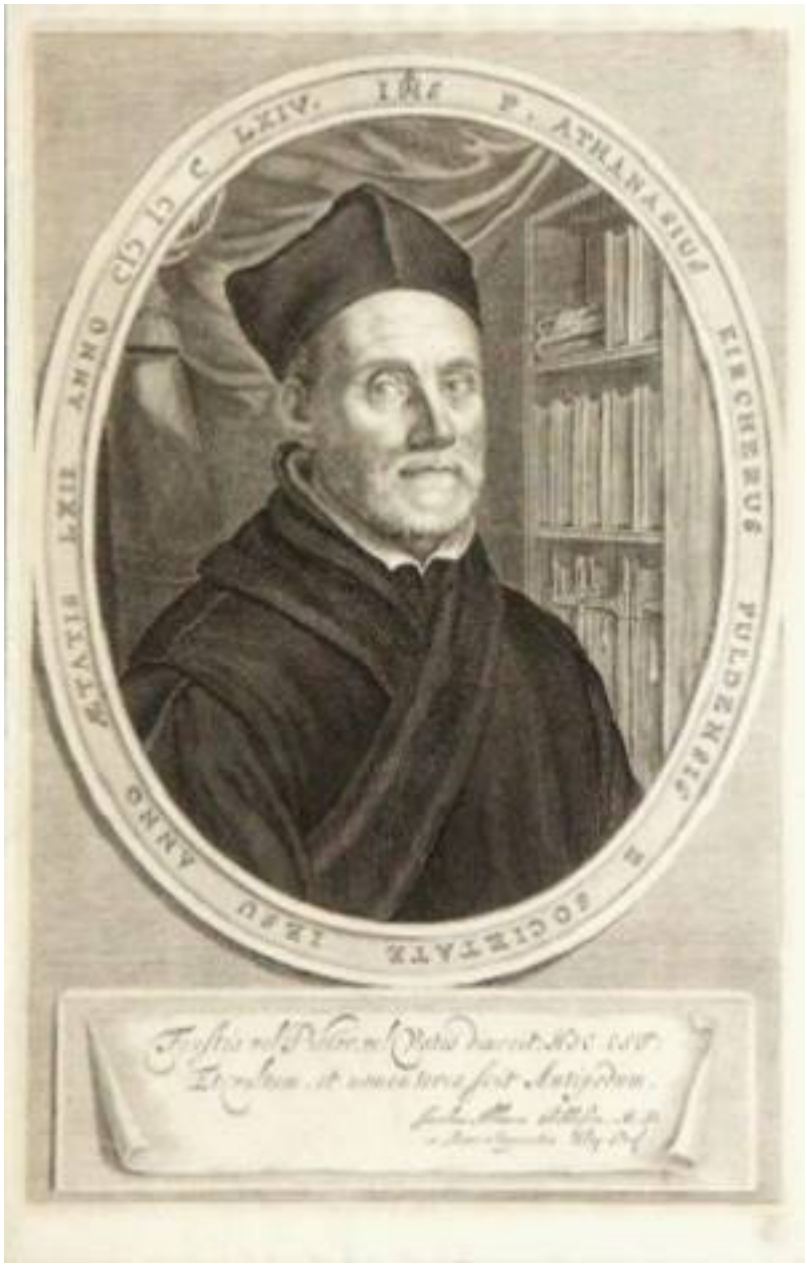
"Why?"

"Because it happened again today. Someone didn't want the sacrament; they had a job offer for Nicholas Smithson, expert on up-timers. "

"Again? I am so sorry Nick. It's so *sad* that people want to throw money at you. It's not like you were a Benedictine or something."

"They were demeaning the sacrament and the sanctuary of the church. Did not Christ himself overturn the money changers?"

"He did." Gus nodded, grinning.



"And when I do attempt to do research, I am pummeled with requests beyond what any man can do. It is not as though I am the only researcher in the library."

"Yes, Nick. But you are the only author of *How Not to Think Like a Redneck*. That may be the best selling book in Europe."

"I know. But it's silly. Brother Johann is as good a researcher, and the others just as good."

"Nick, they are good researchers, but you have found your place. You have a gift for putting the bits and pieces together into a whole that no one has yet quite matched. Then, there is your reputation. I see only one way to control this. You must rely on the invisible hand."

"Gus, I've already doubled my prices over what everyone else charges!"

"Then double them again. Eventually, you will drive the crowds away. Then, you can pick and choose the projects you want to work on."

"Double them again! I would be charging one hundred dollars an hour!"

"And if that's not enough, then you double them again. Eventually, the market will respond."

"Am I to be a prisoner of the Dark Science then?"

"Yes, Nick. A prisoner with an income which makes you able to do the things you want done. Oh that more of us would have such a burden."

Nick stared into his coffee cup: "Let's go get a beer."

Gus smiled. "Your treat."

* * *

"Excuse me, Father Smithson?"

Nick looked up. The library table was covered with 3x5 cards, stacked in complex patterns like a tarot design, some with colorful ink staining the corners. There were pencils and strings linking the cards into an odd network. Nick set the card in his hand back onto his stack. "How can I help you?"

"My name is Johann Rademacher. I am with O'Keefe's Septic Tank Maintenance Company."

"Yes?" Father Nick looked at him questioningly. "How can I help you?" He gestured at the chair beside him.

Johann sat down. "We have been looking to open additional markets for porcelain. We have been working with potters and designing mostly sanitary pottery, sinks and toilets. Now, we are wanting to move into 'higher tech.' Specifically, spark plugs. When we realized we needed help, we thought of you."

"Why me, Herr Rademacher? There are many researchers, and the library is open to all."

Johann pointed to the table. "This is why. Anyone can look things up in books, if they take the time. But few can do *that*." He made a sweeping gesture. "Your reputation is that you do not just research what the books say, you combine the bits and pieces into a whole which would not otherwise exist. We need your expertise. We have tried to make spark plugs. And we failed. We need you."

Nick sat for a moment. "You understand that I am busy? Your project is interesting, but I have work."

Johann smiled "We can pay. We are prepared to pay. Further, we will pay extra for you to agree to keep the resulting research private for a period of time. A year perhaps?"

Nick thought about Gus' recommendation. "One hundred dollars an hour, and a six month agreement of privacy."

"Done!"

* * *

Gus walked into the rectory kitchen. "I hear you turned in the spark plug report today."

Nick smiled and laid the check on the table. "I did."

"What was it then?"

"It?"

Gus smiled. "It. There's always an it for you, the critical bit that everyone had overlooked. What is it?"

"It's the seals, of course. It is simple enough to make the bolt, to drill it out, to slide the porcelain into it and glue it in place. But with the pressure and heat of the engine,the gases leak out and burn the steel away."

Gus sat silently.

"Oh, very well. You need to use three different materials. One is braised onto the ceramic and is a substance that wets the ceramic, another is braised onto the bolt and wets the steel, and then a third braising welds them together in a flexible manner so that the differences in expansion don't crack the ceramic. Anyone trying to do it in one or two steps is doomed to fail."

Gus smiled hugely. "Well, then. Another success for the great Smithson, and hope for another new business."

Nick sputtered.

"So, let's go get a beer." Gus nudged the check. "And you're buying."

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Plugging Along

Written by Kerryn Offord

The Saale Industrial Zone, winter 1633-34

Larry Karickhoff turned the key of the pickup. The engine fired a few times, backfired, and stopped.

"What's the hold up, Larry? Day's over, everyone wants to get home," Johann Rademacher said.

Larry tried the engine again, with the same result. "I dunno, Johann." He flicked the fuel gauge. It remained steady. "Fuel's okay. I'll pop the hood and take a look."

Johann waited while Larry climbed out and opened the hood. There was a tapping on the glass behind him.

"Johann, what's the hold up?"

The workers in the back wanted to know what was happening. He climbed out of the cab to explain. "The engine won't start. Herr Karickoff is having a look."

"The same thing happened last week in this truck. Herr Straley said it was the spark plugs. He took them out and cleaned them and he was able to get the truck running again," Heinrich Bischoff offered.

"Thank you. I'll tell him. Hopefully the problem isn't serious and we can get home before dark."

Johann hated to disturb a man working on an engine, but it had to be done. He walked around to stand beside Larry. "Heinrich says there was trouble with the spark plugs last week."

Larry wiped his hands on his pants, then reached into the cab for the vehicle log book and flipped pages, checking the entries. "Shit! Typical bloody Norton. Has a problem and doesn't record it in the log." Larry made a note in the logbook, then put it back where it belonged before grabbing the tool box and returning to the engine.

* * *

"Damn it!" Larry waved the spark plug toward Johann and the others. "If any of you have to be anywhere soon, I suggest you start walking. This truck ain't going nowhere without a tow."

"What is the problem? If Norton could get the engine going by just cleaning the spark plugs, why can't you?" Johann asked.

"Because not only are they dirty, but this one's ground electrode is broken." Larry passed Johann the spark plug.

Johann held the spark plug up to see what the problem was. It was obviously very dirty, but . . . "What is a ground electrode?"

Larry handed him another spark plug. "See that little bit of metal hanging off the bottom? That's the ground electrode."

Johann could easily see the difference. "But why do you need to tow the vehicle? Can't it run on just seven cylinders?"

Larry shook his head. "It could run on just the seven cylinders. Not well, but well enough to get us home. But what's happened to that bit of metal? I hope it just fell off onto the ground. Because there's no telling what damage it could do floating around in a running engine."

"Ouch. Yes, I see. So you won't be running this truck until you find the missing piece of metal?"

"Or at least prove it isn't in the engine. Then we have to weld on a new ground electrode."

"Why don't you just get another spark plug? "

Larry stifled a laugh. "Where from? Nobody's making new plugs and nobody's selling their stock. We've still got a few left, but we're trying to put off using them as long as possible."

"They don't look as if they'd be too hard to make. Why hasn't anybody tried?"

"No idea, Johann. You're the guy with all the fancy letters after his name. Why don't you try it?"

December 1633

Johann Rademacher B.A., M.A. (Leiden) slammed his fists down on the workbench and screamed to the heavens. "What am I doing wrong?"

Aurene O'Keefe, who had been attracted to the work room by a continuous stream of swearing in no fewer than four languages, poked her head around the door. "Having a bit of trouble?"

Johann spun around at Aurene's voice. "My apologies for my intemperate language, Frau O'Keefe."

"Accepted. So what's all the fuss?"

"My latest attempt to make a spark plug failed. I'm at a loss what to do next."

"Um . . . How much do you know about spark plugs?"

"Not a lot personally, but Larry has been a considerable help."

Aurene snorted. "You can probably write what Larry knows about the things on a postage stamp. Have you thought about checking out the library?"

"No, Frau O'Keefe."

"Then maybe it's about time you did, don't you think?"

Embarrassed, Johann could only nod in silence.

O'Keefe's, Two weeks later

Larry shook his head in disbelief. "You paid five grand for someone to go to the library and look in a few books. Hell, I'd have done it for free if you'd asked."

Johann pulled three sheets of paper off the top of the bundle of pages. "No. I paid five thousand dollars for these three pieces of paper."

"Three pieces of paper are worth five grand? Pull the other one; it's got bells on it."

Johann grinned. "I will happily pull your other leg. When those three pages represent the considered analysis of all the available information by none other than Father Nicholas Smithson, then they are definitely well worth the "five grand," as you call it. These three pages are a cheat sheet for making spark plugs."

"What? Let me see. Hey, I can't read this. What language is it?"

"Latin, of course. Now to see about making us some spark plugs."

O'Keefe's, a month later

Johann ripped open the package from Melba Sue Freeman's ceramics and porcelain company. Inside, in individual wrappings, were a dozen porcelain insulators. Carefully he unwrapped one. The shiny white insulator was beautiful. He reached over for one of the damaged up-time spark plugs and compared them. The insulators looked identical, except for the markings. Ever hopeful, Johann had already decided on the name he wanted.

Then he started to assemble the Grantville-Zuendkerze-Kompanie's very first Series One spark plug.

* * *

With a dozen finished spark plugs in his basket, Johann went looking for Larry. He needed to prove they worked.

With Larry in tow, Johann headed for the workshop. First they tested them in the lawn mower. All of them worked.

"Well, Larry, what do you think?"

"I think you're going to be revoltingly rich. Let's try them in one of the trucks and see how well they work and how long they last."

A month later

Johann sighed. It didn't look like he was going to get revoltingly rich manufacturing spark plugs. At least not any time soon. He'd invested heavily into producing a standard size plug, as that should have been where most of the demand was. However, it looked like that might have been a mistake.

There were just too many of the standard-size plugs in Grantville, many of them still in vehicles that had been up on blocks since the Ring of Fire.

One problem was performance. Even reconditioned up-time spark plugs performed better than his. If they had been noticeably cheaper than reconditioning up-time spark plugs, he might have had better sales. But at the price he had to charge to make a profit, sales so far had been worse than disappointing.

He looked the expensive equipment sitting idle on the workbench, and at the boxes of finished product stacked against the wall. Sure, there was some demand as up-time spark plugs failed beyond repair, but there was no driving need for lots of his new spark plugs. Not yet. What he needed was something to generate demand. Like someone making new engines. Because new engines would need new spark plugs.

Until then, it was back to designing plumbing installations.

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The Spark of Inspiration

Written by Gorg Huff and Paula Goodlett

Neil O'Connor looked over at Johan. "Say what ever you like, man, that girl is fine." He continued to turn the spark plug wrench as he talked.

"She may be pretty but she is too forward, I think," Albrecht Knopf said. "She is becoming too American in her attitudes."

Neil pulled the plug and glanced at it. Whatever he was planning to say about the girl was forgotten. "Damn! This thing is burned clear through. You guys have been running the mix too lean again, haven't you?"

Neil and Al were doing thousand hour maintenance on the *Jupiter*, which was known far and wide as the *Monster*. Neil didn't know why Georg Markgraf didn't just give up and change the name, but he wasn't the designer, so what the heck.

Al poked his head around the cowling. "How's our stock?"

"All down-time made," Neil said. "Change them every hundred flight hours. Frankly I'm a bit surprised that we can make them at all."

"Too complicated?" Al Knopf asked with a bit of a glint in his eye.

"No. Incompatible expansion rates." Neil held up his hand in surrender, or at least partial surrender. "More a chemistry problem then craftsmanship." He had lost a number of bets with Al over the last couple of years. They'd been bets having to do with what down-time craftsmen could do with just a file and a chunk of metal.

Neil looked back at the plug and then at Johan. "You know, I wonder how long it's going to be till we start building aircraft engines."

"Start?" Al asked. "We have already started! How much of that engine we're working on was made here? The plugs, the gaskets, three tappet valves. . . ."

Neil held up his hands, interrupting the list before Al got good and started. Al could talk for hours about the parts of the engines that were now hand made. "That's not what I meant, Al. How long till we start from the design and make engines that are really for airplanes, not just auto engines pushed into service?"

"I don't know, Neil," Johan said. "But if we don't do it soon, we'll be buying our engines from someone who has." He shrugged and grinned. "Anyway, that's a management problem. I'm just a pilot. I just point the plane where they tell me to go." Johan made a great deal of money pointing the plane where he was told. Not to mention the stock options. Still, in spite of being unwilling to bet with Al on what down-time craftsmen could do, Neil didn't believe it. A whole engine was just too complicated for the down-time tech base to handle.

* * *

Magdalena van de Passe set down the phone with a sigh. If it wasn't the fuel, it was the engines. She had just had to turn down another job. Because they had just one airplane. Well, three, if you stretched it to

include two two-seat small planes that ran with a pilot and a sack of mail. And they couldn't keep the *Monster* in the air all the time. She had had it all explained to her in great boring detail. In normal use, an automobile engine might reasonably be expected to do thirty thousand miles a year. Perhaps fifty thousand, on rare occasion even one hundred thousand miles a year. But the stress on that engine during most of the time was not that great. The engine would spend time idling, and providing only enough push to maintain the automobile's speed. Not so in an aircraft. For all practical purposes, an airplane spent almost all of its time going uphill, even in level flight. The engines were forced to work as hard as a normal engine going up a grade.

TransEuropean Airlines was making money hand over fist. That was true enough. But they were turning down more jobs than they were taking because and if one of their engines broke in a way they couldn't fix, they were out of business.

"Georg, we need more engines. We need more engines because we need more airplanes. And we need them soon."

"And I have the airplanes for you. Two more *Jupiter One* air frames sitting in the hanger, ready to go, if I could buy the engines for them. Find me eight one-hundred-plus horsepower engines and I'll have two new *Jupiters* for you in a month," Georg said.

He stopped talking when Neil burst through the door.Neil always burst through doors, generally without knocking first. Neil had apparently heard him, because he said, "Al and Johan figure you should build your own." He shook his head.

"I've been thinking the same thing."

"Maggy, you don't know how complex internal combustion engines are," Neil insisted.

Magdalena and Georg shared a look. It figured that it would be the up-timer in the room that brought that up. Sometimes the up-timer's constant harping on the great and amazing complexity of the up-timer technology got more than a little old. In point of fact, Magdalena, in the past year, had twice been involved in the complete disassembly and reassembly of one of the *Monster*'s engines. And she probably knew—well, almost—as much about them as Neil did. But Neil failed to grasp the degree of precision that fine craftsman of the seventeenth century were capable of. Even Magdalena hid a grin after all the bets he had lost with Albrecht Knopf.

* * *

At first they were going to go with a V8 or perhaps a radial engine Then a research project at the National Library suggested that the Wankel rotary engine made popular by Mazda was the way to go. This was because if it over-heated you lost some power, but the engine didn't seize up, as well as the fact that it was lighter per horse power. They also considered turboshaft and turboprop engines, but all three fell victim to the materials problem. They would be better airplanes if they had the materials to make them . . . but they didn't. After much debate and several library research projects, they had been forced back to either a radial or a V engine. Then to a radial design, because the radial design was simpler to manufacture and cooler than the inline cylinders.

Magdalena looked around the room like a nervous conspirator. Well, actually more like a twelve-year-old pretending to be a nervous conspirator. "Can any up-timers hear us?" she whispered, rather loudly.

Georg Markgraf rolled his eyes and Farrell Smith stuck his fingers in his ears. He was, after all, an up-timer.

Arnold Swartz snorted. Arnold, it had to be admitted, had something of a love/hate relationship with

Grantville and its machines. He was a master blacksmith whose shop in Suhl now had several production machines running. His senior journeyman could run those, so Arnold felt a bit unnecessary there. It wasn't an especially comfortable feeling for him, either.

"It's not that bad." Georg insisted, looking apologetically at Farrell.

Farrell grinned "You couldn't prove it by me." The issue was, of course, tolerances. Up-timers—some up-timers—were still insisting that down-time craftsmen weren't capable of the tight tolerances modern machinery needed. "Look, Dad is a good guy and a good engineer. But most of his work has been in the office and not that much on the factory floor. Mostly he's adapted well enough. I know he can be a bit of a by-the-book guy, but he is right about the fact that a lot of people died to write the words in FAA manuals."

"That is not what I object to," Arnold said. "I can deliver the tolerances and the material strength needed. But not if he insists on testing half the parts to destruction. The up-time engineers have told me that the usual percentage for critical components is 10%. Granted, machines, at least well-made machines, produce more consistent results but his attitude is both expensive and insulting."

Farrell just nodded. "How long will it take your shops per engine?

"Less than you might think." Arnold smiled. "The cylinder casings can be cast to their basic shape, cooling fins and all, then finished by hand. We'll use crucible steel, not as light as aluminum but quite strong enough for what we need. By being extra careful with the molds, we will save finishing time on the parts themselves. I have craftsmen working for me, not what you call 'hacks.'

"But it will be expensive. Craftsmanship takes time and craftsmen need to eat. It's not the precision of your machines that we can't compete with—it's the speed."

"And that brings up another issue," Magdalena said. "To the extent possible, we want to use off-the-shelf parts, and adjust the design to fit them. That will save us money and save your craftsmen's time for where it's needed."

"How much can we get from the auto companies?" Arnold asked.

"Not that much. They still haven't fully finalized their designs," Georg complained.

"It's not that bad. They do have some of the parts in limited production," Farrell corrected him, gently."Someone over there has been at least a bit clever and realized that some of the parts they would need for their automobiles would also be useable for other products. They prioritized those for production. They are building their heads to take the plugs Grantville-Zuendkerze-Kompanie makes. They've settled on a cylinder size, even if they aren't making them yet."

As a whole, the auto people were working in the red and probably would continue doing so till the assembly line got up and running a few years down the road. But by making parts that could be used in other devices as well as automobiles first, they were managing to keep the red ink from getting quite as deep as it would otherwise be. Standard-sized nuts and bolts, ball bearings, brake pads, hydraulic brake systems—even, oddly enough, rotors. But they were still years away from a mass-produced automobile or a mass-produced engine. "On the up side, the parts of an engine that wear out fastest are coming into production pretty fast now. The biggest problem is going to be the engine-specific parts, especially parts specific to the radial engines. Things like the finned cylinders Arnold mentioned."

Arnold Swartz didn't seem at all put out by that. In fact, he grinned widely. With dollar signs flashing in his eyes, near as Magdalena could tell.

* * *

Six months later Swartz Aviation engines delivered four seven-cylinder 120 horsepower air-cooled radial engines. They weighed 220 pounds each. By then Arnold wasn't smiling quite so wide. Word had recently arrived that another firm was also making aviation engines.

Georg Markgraf, on the other hand, was ecstatic. And Magdalena was pretty pleased herself.

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Sunday Driver

Written by Laura Runkle

Grantville
July, 1634

Father Nicholas Smithson stood by the side door and shook hands after early mass at Saint Mary's Catholic Church. Father Athanasius Kircher was greeting parishioners coming out of the main door, but some always left by the quicker route.

He smiled as he saw three faces that had been missing for a month. "Lolly Aossey! Welcome back! How did the twins take to the field session?"

"It's good to see you, Father Nick." Lolly Aossey sent a tired look back at her older children. "Mimi and Larry are both teething." Cathy and Matt were each holding a plump baby. Behind them beamed Jim McNally, the proud paterfamilias, a hand on the shoulder of each teenager. If Nick knew anything about the older McNally children, it was to keep them from bolting.

Lolly brightened. "Since I'm back, come to dinner after the last mass? Jim's apprentices should be back from Countess Kate's by then. It'll just be the usual summer fare, but I'd love to tell you what all happened."

"I'm sorry, but there are a couple of out of town visitors I want to see. Otherwise, I'd very much like to." Nick's regret was real. The conversation and the cooking at the McNally house were usually both lively.

Jim McNally smiled. "Bring them along. The more the merrier. That's what the Sunday usual is for."

Matt rolled his eyes. "The usual has got to be better than Cathy heating up one of Aunt Dina's casseroles."

"Ha! As if we'd want to eat your scrambled eggshells again!" Cathy's tone was sharp enough to cause the baby in her arms to stir.

"Let's go home, kids. I doubt Father Nick is interested in your unsupervised culinary attempts. If you want the usual, y'all have a bit of chopping to do." Jim pushed the kids out onto the sidewalk. "We'll see you and your visitors at two, Father."

Nick sighed as he waved farewell. Jim was right. After his visit last month, he'd had no further interest in the culinary attempts of either Matt or Cathy. Fortunately, today's dinner promised to be more interesting.

* * *

Nick regretfully decided that eating another bowl of the berries and cream would be gluttonous. There were still the remains of the wheaten salad and mutton pastries on the table. Across from him, Lion Gardiner and Henry Gage were enjoying the delights of fresh tomatoes with salt. Several conversations buzzed around.

"*Ja*, Mrs. Aossey. He says that when I've helped finish up this circular divider, and written the paper on it, I'll probably only have a year or so left until journeyman."

"Amsterdam? Really? If you could send on a letter for me, I'd be most grateful. Jake Koch has set up a correspondence back and forth from Augsburg, but I'd like to correspond with the Netherlands also. I've expanded from just optics to instruments, as well, but they have mighty fine opticians."

"No. Steel like this requires both nickel and chromium. Mom's graduates have found nickel in tailings from more than one mine, but no chromium yet. When? Any year, now."

"About half girls, again, Marie. And at the ceremony on Wednesday, Ron Koch told me that the instrument maker that Jake is visiting has started training his own daughter. You won't be alone when it comes time to do your journeying."

"No, sir. The ballet company has moved to Magdeburg, so there aren't any performances here this week. But I hope to go to school there this fall, if Dad thinks we have enough money."

Everyone focused on Jim. He said, "Honey, there's no question that we've got money. We've been putting aside your mother's fees for the field camp into a couple different funds, and they've done very well. The problem is that the twins' early arrival tapped us out for this year, as far as liquid cash goes."

"Daaaad! I've got enough money of my own from dancing to pay those fees!" Cathy wailed as only a fourteen-year-old girl could.

"But it's not liquid, and won't be for another couple of years," Jim said.

Young Cathy had a gift, and gifts were to be cultivated. Nick spoke up. "Don't spend so much time worrying about the future that you ignore what you have. Cathy should be studying with Mrs. Matowski."

Lolly sighed. "We're trying. But the only thing that would give us enough cash for the fees would be to sell the Subaru. No way are we selling the SUV. And you know that selling something as expensive as a car usually takes a month or so to get a buyer okayed by the bank."

"Subaru? That would be the car engine that makes a good airplane?" Lion Gardiner asked. "How much were you going to ask for it?"

"More than I'd feel comfortable talking about over a family dinner," said Jim. "Part of it depends on how much they cost now, compared to how much it would cost to make one. Marie, how long do you think it

would take until your father can make an airplane engine at his foundry?"

Marie Schmidt, Jim's older apprentice, looked up. "Papa's foundry couldn't any time soon. He's too committed to making the sewing machines. But someone could make one by hand, if they had the right materials. Right, Thomas?"

Thomas Swartz gave a wry smile. "That's why I'm here. I'm learning how to make all kinds of small instruments, and glasses and other things, so that my father and people like him can inspect small work. But the materials—?"

"—Any year, now." The chorus came from around the table.

Henry Gage leaned forward, tomatoes forgotten. "Mr. McNally. We've come on behalf of a client who's not interested in waiting for 'any year now' to come. When would you be interested in discussing whether you think we could be approved by your banker? We have a letter of credit from the Wisselbank."

"You can worry about that tomorrow. Today, come look at the car." Jim stood up and beckoned to both visitors.

Nick winced. He'd learned what the visitors were doing in Grantville. Now he just needed to know who they were representing, before the banker cleared the letter. It was easier to worry about tomorrow than he would like.

* * *

As Henry Gage and Lionel Gardiner left the McNally home, they were talking quickly, and waving their hands at each other. Nick was certain he caught a "vroom" coming out of Gage, but that could have been a trick of the breeze. They had certainly enjoyed their spin in the Subaru, "to make sure that the engine is in working condition."

Nick waited until the visitors were a block away. "Jim, aren't you wondering who the eventual buyer of this car is? For all you know, it could be someone who wants to destroy everything you stand for."

"And you're the one who says not to worry, Father." Jim sounded strangely smug. "I've just helped ensure tomorrow."

"What?"

"Think! What's the first thing that Father Larry—oops, Cardinal Mazzare—does when he has a spare moment?"

"He fixes cars."

"Yep. He fixes cars. And airplanes take a lot more maintenance than cars do," Jim said.

"So? Someone could still try to destroy Grantville."

"They can try."

"By all accounts, those Croats came too close."

"To make the airplane work well, they'll have to develop a whole support system. They'll need technicians, and measuring instruments, and eventually, they'll need materials."

"So you're just helping to develop someone else's economy," Nick replied.

"There's no "just helping" about it. Lolly's driven home to me that the only way we'll get what we want for things like medical supplies is for everyone to be growing and changing. Everyone. Everywhere. Any year now."

Nick nodded. He knew just how close a call the twins had had. The night when he'd christened the early

babies at Leahy Medical Center was still etched in his brain. "So by selling the car, you're removing worries from tomorrow?"

"There've been other interested buyers. They just didn't sound like they were able to follow through. Those two, though? Wherever they go, they'll help build the world my children need."

Jim turned around, and clapped Nick on the shoulder. "C'mon into the house, Father Nick. If I know Lolly, she's put together a basket of food for the rectory for tomorrow. Worry not."

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Turn, Turn, Turn

Written by Virginia DeMarce

July 1634

Father Nicholas Smithson, S.J., cleared his throat for the third time. Crossing his arms over his chest, he leaned back against the wall of St. Mary's rectory. After a pause, he cleared his throat for the fourth time.

With obvious reluctance, Father Athanasius Kircher, S.J., lifted his head from looking at the top sheet in a large pile of papers. "Yes, Nick?"

"I know you've been saving this evening for catching up on letters from your correspondence circle. I wouldn't interrupt if . . . ."

". . . it weren't important."

"Right." Nick moved over toward Kircher's desk. "Henry Gage is in town."

"This is important why?" Kircher, naturally, did not have the familiarity with England that a native son of the island did.

"He's from an old English Catholic family with strong ties in the Spanish Netherlands. His grandmother's family were merchants at Liege; his wife's mother is Flemish. Through his mother, he's a grandson of the late Sir Thomas Copley, the exile who was knighted in France and made a baron by Philip II of Spain, much to the displeasure of the late queen. He went back to England for a while in 1627, but returned in 1630. He's been commanding an English regiment in the Spanish service, under Don Fernando, now."

"Is it bad that he is in Grantville?"

"Normally, I'd be delighted to see him. His Aunt Helen, Copley's daughter, was the mother of the two Stanihursts. Given that we really need more English-speaking priests here at St. Mary's, I'd normally recommend that you approach him about trying to interest either Peter or William. They're both in their

thirties, so they'll have the energy to keep up with the pace of things here. But they entered the order in their teens, so they're seasoned. It would make a nice balance."

"What is not normal?"

"Henry didn't drop by to catch up on old times. We had scarcely blown the foam off our beers when he asked to purchase a copy of that old report I did on spark plugs."

"You did say that he's an army officer." Kircher pursed his lips. "Is he working for Don Fernando? The cardinal-infante withheld his troops from active participation against the USE this spring, under various pretexts, some colorable and some . . ."

"Not so plausible. Yes. There's a truce, but not a treaty." Nick moved back and leaned against the wall again. "And then there's the man he's traveling with. An English engineer. He's describing himself as 'Master of Fortifications to the Prince of Orange.'"

"Is he?"

"He's definitely been working in the Netherlands for Frederik Hendrik. That much is true. He was born in London and the family is armigerous, I think. Or, at least, he's claiming connection to a gentry family. So there's no obvious reason for him to be working with Gage other than that, perhaps, someone has paid him a great deal of money."

"Or perhaps the rumors that Don Fernando and the stadhalter have come to some detente are true."

"Possibly more interesting is a book that Ms. Mailey loaned on deposit to the state library." Nick reached into the pocket of his soutane and read out, "*History of the Pequot War: The Contemporary Accounts of Mason, Underhill, Vincent and Gardener. Reprinted from the Collections of the Massachusetts Historical Society. With additional notes and an Introduction by Charles Orr, Librarian of Case Library*." He paused. "1980. Reprint of the 1897 edition, published by Helman-Taylor Co., Cleveland. One of the relations in it, described as 'among the most reliable' by the editor, was written by Henry Gage's traveling companion. Gardiner seems to have trained under Thomas Fairfax—the old man."

"Puritan, then?"

"If it pays, probably. In the world in which he wrote his 'Narrative,' he worked for Lord Saye and Sele's company. He's married to a Dutch woman from Woerden. They went to New England next year, and eventually managed to get a manorial grant for an entire island off the coast of New Amsterdam. Which, by then, was New York, I believe. Or soon would be."

"Talk to them." Kircher turned back to his reading, unwilling to give up one of his rare chances to maintain his scientific interests.

Nick turned to leave the room.

Kircher's voice followed him. "Talk to them long enough that you find out who else they are talking to. And sell them a copy of the spark plug report. It's old news and the parish can use the money."

* * *

"Engines," Lion Gardiner said. "All the information about engines that you can provide. Especially airplane engines. Not that anyone involved with aviation wants to talk to us about engines."

Shelby Carpenter cocked her head. "Jesse the Mighty Colonel Wood damned well won't, nor any of his people. The Kitts won't either. And little as I like the Kellys, especially Madam Kay who treats me like the dirt under her feet, they won't." She twirled her stein around in the puddle of water that had

condensed under it on the table. "But I think I've met someone who will."

* * *

"What exactly did I do up-time? I was a mechanical engineer, that's what. With a bachelor's degree. Over twenty years of experience. I worked for GE in Baltimore, Maryland, that's what I did. And if I hadn't let my wife talk me into coming to her aunt and uncle's damned wedding anniversary party, that's where I still would be. Not here, slaving in a back room for Dave Marcantonio, because we were caught here with hardly a cent to our names and nothing but the clothes on our backs and I damned well wasn't going to take charity from her family. Marina didn't want to, either. None of the others who are doing aviation now could pay a living wage, at first, so we went with Marcantonio, who could—me as an engineer and Marina as a drafter. And that's where we're still stuck, working for wages while people around us are making fortunes, like those damned Sewing Circle kids."

He slammed a piece of paper on the table. "Look at the job description. That's the job I was applying for when the Ring of Fire happened."

Lion Gardiner craned his neck and saw magic words.

. . . responsible for the design, development and test of aircraft engines or engine components. They are accountable to ensure that the product meets performance criteria, weight, and fit and function specifications . . .

"Why haven't you begun your own firm, as others have done?" he asked.

"For the same reason I likely wouldn't have gotten the promotion," Peter Barclay admitted a little ruefully. "People skills. It was that '*good interpersonal and leadership skills highly desirable*' line in the job descriptions that always shafted me. How the hell am I going to go out and schmooze the money guys to raise capital? But all the rest of it, I could have done. And done it well. Since when do you need to talk nice to components? Design them, test them, and be done with it. Now, what do you want to know about aircraft engines and how much will you pay me for it?"

* * *

"Therefore," Henry Gage wrote, "I respectfully suggest that you modify your hopes to some degree. I believe that it would be possible to obtain, not only an exemplar of one of the engines in question, but also, if a sufficient financial inducement were to be offered, at least one trained engineer and several technicians. It is true that the great majority of the inhabitants of this Grantville are most zealous supporters of their Michael Stearns and through him of the Protestant Swede. However, they are human. Additionally, this Barclay is Catholic. Although this will probably be of little matter to him, since Grantville is a far less hostile world for Catholics than is England. To the best of my knowledge, he has not even noticed that I am of the same faith as himself, whereas Gardiner is not."

Grantville, August 1634

Kircher looked at the pile of money on his table. Nick Smithson had dropped it into a small clearing produced by pushing a few stacks of paper closer together. "That's better than I was expecting we would do."

"Gage and Gardiner are definitely collecting technological information. I sold them several old reports and wrote three new ones, as well. Nor am I the only one. The Grantville Research Institute has done well by their visit." Nick resumed his favorite position against the wall. "But they are not collecting the

material for Don Fernando."

"For whom, then?" Kircher raised his eyebrows.

"Their contact is Istvan Janoszi. He has been in Grantville, or at least back and forth between Grantville and Prague, for a year or so, now. I thought perhaps Wallenstein?"

"Very unlikely. Wallenstein has plenty of contacts here already. What is Janoszi like? I don't believe I've met him."

"A middle-aged man. Calvinist." Nick grinned. "That's probably why you haven't met him. He goes to the Reverend Wiley's church when he's in town. He serves as a man of business for Count Pal Nadasdy, who up until how has resisted all of the emperor's . . . incentives . . . for his return to the mother church."

"Austria, then?"

Kircher meditated a few minutes. "Nadasdy's children are still young, but he has a nephew, his sister's orphan—a Catholic, to boot, and therefore welcome at the imperial court—who is only a year or so younger than the emperor's son. The two have been companions, so he may be closer to the king of Hungary than he is to Ferdinand II. And the younger Ferdinand speaks for the peace party in Austria in this world, just as he did in the other."

"An arc across the Germanies, then? Fernando in the Netherlands providing access to resources for the voices of reason in Austria?" Nick nodded. "The emperor isn't well. Don Fernando and his advisers have to be thinking about what will happen when Ferdinand II dies. Or, if they aren't, they should be. But why technology? And would private citizens have the kind of money that Gage and Gardiner have been spending?"

"The younger Ferdinand will need some sort of a counterweight against his father's zealots. Technology would give it to him, in a way. A demonstration that he has the resources to defend Austria and Hungary, both in the Balkans and against Gustav. . . He has to be looking around, especially since he is spending the summer inspecting fortifications on the Turkish frontier. And, yes. Nadasdy is a magnate. He can afford to spend a lot of money. If he is drawing on his nephew's resources as well, he can afford to spend more than just 'a lot.'"

"And the man who brought that technology to him . . . a patriot, obviously, displaying zeal for the welfare of Austria . . . A Catholic friend . . . with a Protestant uncle who assisted . . . an argument for toleration . . ." Nick frowned. "I'm not sure where this is going."

Kircher stood up. "We cannot solve all the continent's problems in one evening, my friend. Yet, occasionally, we do solve one. Gage did write to his young cousins. One of them was interested. And Father Mazzare . . ." Kircher smiled. "*Cardinal* Mazzare, I should say, has written from Rome that the Father-General is looking favorably upon our request to have William Stanihurst assigned here. So, even

aside from the money they paid for your research, St. Mary's, like the Grantville Research Institute, has done well from Gage's visit. Let us give thanks for God's providential ways."

* * *

THE END

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