Grantville Gazette Volume 22

Table of Contents

Jim Baen's Universe
Grantville Gazette, Volume 22

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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 was published late in 2007. Another, *Ring of Fire III* , is forthcoming. 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, even 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, Three and Four.

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

The Anaconda Project—Next Episode

Written by Eric Flint

Eric Flint prefers to write two chapters at a time, so we'll be offering that in every other issue, starting with *Grantville Gazette* , Volume 23. Unless something changes, of course.

Arsenic and Old Italians

Written by Iver P. Cooper

The liquid in the shallow dish ignited, releasing a burst of yellow-green fire. The audience, a curious mix of Tuscan scholars and glitterati, applauded.

Lewis Philip Bartolli acknowledged the applause with a briefly lifted hand. "This lovely green reveals the presence of the element boron, which was not known to the ancients. The liquid is distilled spirits, which burn nicely. To the spirits, I added what chemists call boric acid. This boric acid contains one atom of boron, three of oxygen, and three of hydrogen, and it was obtained from the volcanic emissions of the Maremma of southern Tuscany."

A servant in the livery of the reigning Grand Duke of Tuscany, Ferdinand de Medici, silently glided down the aisle, and whispered into the ear of Andrea di Giovanni Battista Cioli, the Tuscan Secretary of State.

Cioli flinched, then muttered something to his companion, the teenaged Prince Leopold.

"The green color of the flame is the result of the excitation of the electrons of boron. Next, I would like to show you—"

Cioli rose abruptly. "On behalf of the Serenissime Grand Duke, of His Highness don Leopoldo, the learned fellows of the Academy, our guests, and myself, I would like to thank Dottore Bartolli for a fascinating presentation on chemistry. Unfortunately, we must excuse him, as he has a pressing engagement."

*I do?*But Lewis kept this thought to himself, and bowed.

The crowd filed out. The increased hubbub woke up Galileo Galilei, who was snoring away in a front seat. Like Lewis, the great man was expected to entertain the court. Lewis gave chemistry demonstrations during the day, and Galileo set up his telescope and explained the wonders of the night sky. Since he was up half the night, and was more than twice Lewis' age, it was perhaps understandable that he couldn't always stay awake for Lewis' lecture.

"Um, what. Oh. Wonderful presentation, Lewis. Another nail in the coffin of the Aristotelians."

Cioli put his arm around Lewis. "Walk with me, dear chemist. You can take my coach to your pressing engagement." He turned to Leopold. "Your Highness, you are welcome to join us, I think you will find the matter of interest." Leopold was the grand duke's youngest brother.

In the privacy of the coach, Lewis finally could speak his mind. "For Christ's sake, what is this all about?"

"Grand Duke Ferdinando was dining with one of his leading noblemen. The man suddenly showed signs of severe gastric distress."

"I am not a physician—"

"You don't need to be; he is already dead."

"And you suspect—"

"Murder. Yes. By poison, we think. So we need your expertise."

Prince Leopold chimed in. "Surely your mentor, the great Sherlock Holmes, would expect you to assist us."

The grand duke and his brothers had not initially grasped the concept that the Sherlock Holmes Lewis had told them about was a fictional character, and Lewis' business associate in Tuscany, Niccolo Cavriani, had warned Lewis not to correct them. "In general, it is not a good idea to tell a ruler that he is wrong. Especially when the error is a harmless one" were his words. Hence, earlier that year, Lewis had not protested when Grand Duke Ferdinand proclaimed the young up-timer to be "Consulting Detective to the Grand Duchy of Tuscany."

They rode in silence for a few minutes.

Cioli cleared his throat. "During your investigation, Lewis, please keep in mind that the deceased lord might not have been the real target of the poisoner. The grand duke is not popular in all circles of power in Tuscany. Or beyond. Especially since he has shown favor to you, and thus, however obliquely, to your United States of Europe."

"So you think it was an assassination attempt gone amiss?"

Cioli shrugged. "Who can say? But you see that the investigation is of the greatest importance. You doubtless will be rewarded appropriately for proving the identity the poisoner." Cioli was too polite to mention the consequences of failure.

Or perhaps he thought it more effective to leave them to Lewis' imagination.

* * *

The coach stopped in front of a villa. The footman stepped down and open the door. Lewis was about to step out when he was stopped by a soldier. He aimed a lantern into the compartment. "Excuse me, Your Highness, Your Lordship, Dottore. I have my orders. Would you wait just a moment, please?" He closed the door.

"This is exciting, isn't it, Dottore?" asked Leopold.

Lewis reminded himself that Leopold was only sixteen. With the *gravitas* that came from being fully two years older, Lewis acknowledged that the case might have its interesting aspects.

When the door was opened once more, it was to reveal the familiar visage of the ruler of Tuscany. "A curious turn of events, eh, Lewis?".

"Yes, Your Grace."

"But with you here, the game is now afoot."

Lewis fought back a groan. "Indeed."

"Thank you for your assistance, Lord Cioli. Oh, and hi, Leopoldo. Try not to bother Lewis with too

many questions."

Ferdinand beckoned to a tall fellow in an officer's uniform. "This is Lieutenant Cosimo Capponi. He and his men will help you conduct searches, question suspects, and so forth. I want to make sure that you encounter no difficulties on account of your being a foreigner."

Cosimo bowed. "I look forward to working with you, Dottore. I will make sure that you can go where you need to go, and that people answer your questions. And of course I can question witnesses on your behalf."

Cosimo pointed out two soldiers. "Carlo and Rocco. If you need a suspect watched, or a door broken in, they're your men.

"Also permit me to introduce Giovanni di Niccolo Ronconi, who is one of our family physicians. A Padua man."

"I'm a West Virginia man, myself," said Lewis. The Tuscans all nodded sagely.

"But please proceed with your investigations, Lewis."

"Your Grace, who was at the table besides yourself?"

"Pietro, the deceased. His wife Silvia, and their children Domenico and Olimpia. The Senator Francesco di Alessandro Arrighi, and his wife Lucrezia. The banker Alberto Spinelli, and his sister Isabella. *La Cecchina* —"

"I beg your pardon? *La Cecchina* ? 'The Songbird,' who's that?"

"I perceive you are not a musician, Lewis," Ferdinand said. "Why not? Didn't Sherlock Holmes play the violin?"

Cioli intervened. " *La Cecchina*is the composer and singer Francesca Caccini. She sang for our court for at least two decades. Maria of Tuscany, the Queen of France, tried to steal her from us but her uncle, Ferdinando the First, forbade Francesca to leave."

"A wise move. She was, I think, the first woman to write an opera. Do you remember it, Cioli? It was 'La liberazione di Ruggiero dall'isola d'Alcina'; it was performed at my villa in 1625."

"It was exquisite. She married a Luccan nobleman, he died, and she returned to Ferdinando's service last year."

"That's right. And then there was Lorenzo Pippi, the poet. Or perhaps I should say *Perlone Zipoli* , since that's his pen name."

"Would-be poet," muttered Cioli. "Wise of him to use a pen name. Should have stuck to painting."

Ferdinand laughed. "Perhaps a half-dozen others whose names slip my mind. Silvia can tell you who they were."

"So describe the dinner," Lewis prompted. "What was served, who ate what, that sort of thing. And when did Pietro show the first signs of distress?"

"Hmm . . . first course was prosciutto cooked in wine and Neapolitan spice cakes. Those were served off the sideboard, 'help yourself.' I did."

"No spit-roasted songbirds, this time?" asked Leopold.

Cioli shook his head minutely. "Now that wouldn't have been very polite, with Francesca Caccini in attendance."

Ferdinand chuckled. "Second course, several different roasts. I had the goat and the rabbit, I am not sure what else there was.

"For the third course, there was a stuffed goose, smothered with almonds, with cheese, sugar and cinnamon on the side. Also Turkish-style rice, in milk, with more sugar and cinnamon sprinkled over it. Cabbage soup with sausages half-submerged, like those submarines you once told me about, Lewis. And boiled calves' feet. How could I forget that?

"We saw, but never got to taste, the fourth course, the desserts. They were arranged on the sideboard. Quince pastries. Pear tarts. Leopoldo, do you remember the time—"

"Please, brother, don't tell them."

"Oh, very well. More cheese. More almonds. Roast chestnuts. My, it's making me hungry just thinking about them. And it's barely an hour past sunset.

"Anyway, *La Cecchina* sang between the first and second courses."

"Paying for her supper," Leopold said.

Better than listening to restaurant muzak. Or worse, karaoke, thought Lewis.

"Lorenzo recited a few of his poems between the second and third courses. That's when Pietro started seeming out of sorts."

"And no wonder," grumbled Cioli.

"The remains of the third course had just been carried off and we were heading toward the sideboard, when Pietro clutched his stomach and claimed he was nauseous. We urged him to lie down, but he refused. Then he vomited.

"Silvia ordered the servants to carry him to the nearest couch and lie him down there. At that point of course, none of us were thinking about poison."

"Or dessert," Leopold said.

Ferdinand gave his brother a quelling look. "We assumed it was just a case of indigestion. At worst, that he ate something that was spoiled. Pietro complained that he was thirsty, and we brought him some wine. He seemed to have difficulty in swallowing, and he complained that his throat was sore. He soon vomited again.

"When Pietro was still in great distress an hour later, I sent a messenger to fetch Dottore Ronconi. Since

the incident happened in my presence, I was insistent that Pietro be seen by the best doctor in Florence." Ronconi bowed.

"Ronconi will have to tell you what happened next."

Ronconi took a deep breath. "I came and questioned Pietro. He told me that he was of the opinion that there were people 'out to get him.'"

Lewis raised his eyebrows. "So he thought he was poisoned. Did he name any names?"

"He did not. He said that they must be in league with the Devil to get through his defenses."

"Defenses?"

"He has an armed guard at the door," Cioli said. "And I have heard that he has detailed servants to spy on each other, and that it is rare for a servant to stay more than a year or two before being dismissed on suspicion of wrongdoing. It is not a happy household."

"In any event, I examined him," said Ronconi. "Besides the obvious problem of the nausea and repeated vomiting, his stomach was very sensitive to pressure. He found even a light touch to be painful. I prescribed some medications, and departed.

"The following morning, I received a message from Silvia, urging my return. He had had an attack of diarrhea. Several in fact. By the time I arrived, he was in an advanced state of tenesmus."

"No medical gobbledygook, please," ordered Ferdinand.

"You feel you have to poop, and you can't. And it hurts." Ronconi shrugged. "It was at that point that I began to wonder whether there was some truth to Pietro's speculations, and I asked that the leftovers be gathered together for testing."

"I am surprised that the servants hadn't eaten them all by then," Leopold said. Since he was a sixteen year old boy, the concept of failing to eat any available food was no doubt alien to him.

"They had, indeed, eaten most of what had been left from the first and second courses, but naturally that tended to suggest that those courses were free of any taint. The servants had not disturbed the third course; no doubt Pietro's sufferings discouraged them from doing so.

"Hence, I was able to feed the remains of the third course to the family dog, and he seemed none the worse for the experience."

Clearly, thought Lewis, *animal rights have yet too make much headway in early modern Italy*.

"That quieted my concerns for a time. But the next day, Pietro's skin became cold and clammy, his pulse weakened, and at last he died."

"Were his wife and children present? How did they react to his death?" asked Ferdinand sharply.

"The wife and children seemed properly remorseful." He spread his hands. "There is not much left to say. He passed from my care to that of Our Lord and Savior."

Ferdinand gripped Lewis' shoulder, then released it. "In view of the allegations of poisoning, I thought it appropriate to call upon my 'Consulting Detective.' Don't disappoint me."

"Don't forget what I said about keeping your mind open as to whom the target might have been," Cioli added, softly.

"Well, there are a few options. I can do a Marsh test for arsenic on the remaining food."

"I am sorry, Ispettore Bartolli," the doctor said, "but none remain. The dog ate it all."

"Well, then—I don't suppose you saved any of the vomit?"

"No, I'm sorry. The servants cleaned it up. There might be a little staining his clothing, but I can't make any promises."

"Doesn't matter. I will just have to ask you, in the Grand Duke's name, to perform an autopsy. You can examine the stomach lining for signs of damage, and I can test the contents for arsenic and anything else I can think of.

"I will need to interview the family. One by one, if you please. I'll need one of your men, Cosimo, to act as a witness."

"I'll give you Rocco, he has some letters."

"Good. And Cosimo, if you would interview all the servants. Again, one by one, so they can't influence each other."

"Right, but I can assure you that the servants are probably hoarse from all the gabbing they've done already."

* * *

"I am sorry for your loss," Lewis offered.

The widow, Silvia, dabbed at the corner of her eye with a small handkerchief. Suddenly Lewis was reminded of a scene in a *film noir* movie. He couldn't remember the name. He was pretty sure that the widow in that movie turned out to be guilty, though.

"Thank you."

"I regret that I must ask you some questions."

"I understand . . . the Grand Duke told me. . . ."

"Perhaps he also told you that I am a stranger to this city, even to this time. You can trust me to seek the truth."

"At least as long as that truth isn't politically inconvenient for the grand duke."

"Even then, I might surprise you." Lewis hoped so, at least.

"Ask your questions."

Lewis asked her everything a mystery reader or crime TV fan might expect him to ask. The poisonous substances which were kept in the house or its grounds, and whether they had shown signs of recent use. The names and duties of the servants, their term of service, their past employers, and their whereabouts on the day that Pietro was stricken. The medications which Pietro had taken over the past month or so. The names and business of any visitors within the same period, and the dates of their visits. Who might be expected to benefit from or take pleasure in Pietro's death.

"Is it true that he thought someone wanted to kill him?"

"Yes."

"When did he first form this belief?"

"Several years ago. First he was attacked by ruffians at night, and was saved by the chance appearance of a couple of young noblemen. And then he was standing by a building, and was grazed by a falling brick."

"He saw someone drop the brick on him?"

"No, he said it happened too quickly."

"And do you think he was right, that he was in danger?"

Silvia shrugged. "This is Florence, who can say? Politics can be vicious. And commerce, even more vicious."

You aren't being paranoid if people really are out to get you, Lewis mused.

Domenico was a sullen twenty-something of no clear occupation. Other, perhaps, than his former occupation of "Waiting for Pop to Die So I Can Make a Real Dent in the Family Fortune." He disavowed any knowledge of poisons or medicines, not that in the seventeenth century there was a big difference between the two.

Olimpia was equally irritating, in her own special way. While Domenico tried to answer every questions with a single word—and then, only after a long pause, Olimpia was obviously in training for the Run-On Sentence Olympic event.

Before leaving, Lewis took samples of Domenico's tonic, and Silvia and Olimpia's cosmetics. He also borrowed the household accounts book.

* * *

Lewis and Cosimo compared notes.

"I spoke to Pietro's manservant, Taddeo. He told me something peculiar. Seems that Pietro was in the habit of making trips by himself, perhaps once every other month. Went in disguise."

"That's interesting. Sounds like a Clue with a capital C."

"Frustrating, is what I'd call it. If he were alive, I could have him tailed. With him dead, I can't follow up on it."

"If he weren't dead, we wouldn't be talking about it in the first place."

"It's too bad. I would have looked forward to tailing him. Probably lead me through three or four taverns a night. Perhaps even a brothel or two. And I would have to buy drinks, and so forth, all at Medici expense. So I didn't look suspicious, you see."

"I do indeed."

"I feel cheated, I must say."

"Pietro ever say anything about why he made the trips?"

"Apparently not. As you heard, Pietro was secretive. Didn't trust his own servants. Might have been going to see a girl, but I rather think it was something political. If it was directed against the Medicis, perhaps it's just as well he's dead."

Cosimo cocked his head. "Any great insights? Has Sherlock Holmes spoken to you from beyond the Great Unknown?"

"Well, a detective looks for who has means, motive and opportunity. The family members, and the servants, of course have opportunity. And often motive, too. As to means—by God Almighty, there's arsenic everywhere! In Domenico's tonic, in Silvia and Olimpia's face-powder, in the servant's storeroom. They use it to kill rats, they say.

"If my chemical tests show that Pietro was poisoned, it won't be a surprise to me. The surprise is that everyone else in the damn household is still alive!"

* * *

"Signorina Bartolli is waiting for you in the courtyard," the butler said.

Lewis nearly dropped the instruments he was carrying. "Who?"

"Your sister, Marina Bartolli." The servant gave him a reproving look. "You really should have warned us, sir."

Lewis ran down the hall. It was Marina all right, sitting on a stone bench, her back to him. "What the hell are you doing here?" he sputtered.

She turned her head. "It's good to see you, too, brother. The roses here are lovely, don't you think? Not a variety we have in Grantville."

"I mean, how could you come without sending me word, giving me the chance to tell you whether conditions were safe?"

"I did send you word, a few weeks ago. But then I had the chance, thanks to Duchess Claudia, to snag a seat on the Monster." That was the world's first commercial airplane. "You can't begrudge me having chosen to cross the Alps in just a few hours, rather than a month by land, can you? And then it was just a

coach ride from Venice to Florence." She added impishly, "I'm sure my letter will get here eventually."

"Claudia de Medici? The *arch* duchess and regent of Austria-Tyrol? How do you know her?"

"Why, she came into the store."

"Claudia de Medici visited Bartolli's Surplus and Outdoors Supplies?"

"No, she just pressed her face against the window glass, idiot. Yes, she came in. It was refreshing to have a visitor who asked questions about things that didn't go boom. We hit it off."

Lewis stared at the ceiling. "I don't suppose she asked about our family, too?"

"Oh, yes, I bragged a bit about our brother-in-law." Greg Ferrara, once Grantville's high school chemistry teacher, and now the USE's Grand Poo-Bah of Military R&D. "And I might have mentioned Toni Adducci, Senior." He was their first cousin, once removed, and the Secretary of the Treasury for the State of Thuringia-Franconia.

"Good God, Marina, you were talking to a Medici. For them, there is no boundary between family life and political life. I wouldn't be a bit surprised if she knew about Greg before you opened your mouth. She flew you to Venice—"

"And arranged for me to be escorted here. And I have a letter to her nephew Ferdinand, asking that he see to it that I am safely returned to her townhouse in Venice when I am done here."

"How nice. Given that 'nephew Ferdinand' is the grand duke of Tuscany, I am sure you'll travel in style. But what sort of favor do you think Claudia will expect from you? And what will she do if you can't deliver?"

"Oh, pooh," said Marina. "I can deliver. I already had cousin Greg and *Arch* duchess Claudia over for dinner, for example. It went fine, even if Mother nearly had a nervous breakdown. And I can ask my brother Lewis—" She winked. "—whether there might be any 'investment opportunities' in his boric acid operation. So, are there?"

"Given that the operation is backed by Medici money, and Claudia is a Medici, I think that's a safe assumption."

"Good. I also have a list of chemistry questions for you. Mind you, I think Claudia already put the same questions to cousin Greg, and just wants to see if your answers are the same. She's a smart cookie."

"I'm sure."

"She kinda hinted that she might be able to take me on as one of her ladies-in-waiting."

"You want to be a glorified servant to a noblewoman?"

"Oh, that's right. I could stay in Grantville and be a sales clerk in a sporting goods store. What was I thinking?"

"Still—"

"Okay." She held up her left hand, palm up. "Sales clerk in Grantville." She held up her right hand the same way, at the same height. "Lady-in-waiting and ornamental up-timer in Tyrolia." She jiggled the hands up and down, as if they were the pans of a balance, then suddenly raised the left and lowered the right, sharply. "Tyrol wins!

"Anyway, you're one to talk. Isn't 'nephew Ferdinand' your patron now?"

"Technically speaking, he, and his brother Leopold, are patrons of the Academy, not my personal patron. I am still an officer in the USE Army."

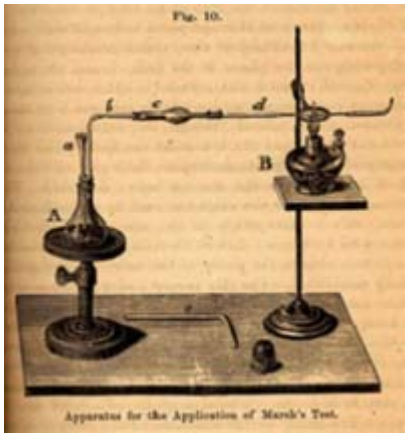
"Technically speaking, 'Mister Consulting Detective,' if he tells you to piss, you say, 'yes sir, how far, sir?' Because we want Tuscany to be a friendly neutral. At least, that's what the Ambassadress told me when I passed through Venice."

Lewis winced. "As a matter of fact, he has given me a little assignment. A murder investigation."

"Ooh, tell me more."

* * *

"Well, the gruesome part is done," Lewis said. After the grand duke's physician had clucked-clucked over the corrosion of the stomach lining—typical of arsenic, antimony or mercury poisoning—Lewis had divided the stomach contents into two parts. One part he preserved intact, for study under the microscope, and the other part he homogenized, acidified, and heated. He let it cool back down, and ran it through a filter.



"Your Grace, if there is any arsenic in the filtrate, it is now sodium arsenate. We can now perform the Marsh test." Lewis pointed at a bottle. "That contains arsenic-free sulfuric acid." Lewis pulled some small rods of metal out of a chest. "And these are arsenic-free rods of zinc metal; what the alchemists call 'Malabar lead.'"

The World's Most Blue-Blooded Lab Assistant, otherwise known as Grand Duke Ferdinand, put the rods into a flask and poured the acid over the metal.

"Take it easy, Your Grace," warned Lewis. "We want to keep the temperature low, and the evolution of hydrogen slow." Lewis stuck his precious up-time thermometer into the flask. "Hmm . . . you were perhaps a little too enthusiastic. Let's cool things down a bit." He put the flask into a dish of cold water for a few minutes, then removed it.

"All right, next step." Lewis stoppered the flask, and inserted two tubes into it, one for adding the sample at the proper time, and the other to a U-shaped drying tube. This in turn he connected to an L-shaped tube with a long arm passing over a candle.

"Now we wait for all the air to be expelled."

The minutes passed.

Leopold fidgeted. Finally, he asked, "Why is it called the 'Marsh test'? That is your English word for a 'swamp,' *si* ?"

"It's named after the English chemist, James Marsh. Marsh was called upon in a case in which a young man was accused of poisoning his grandfather with arsenic trioxide . . . that's what your apothecaries call 'arsenic.' He detected it by its reaction with hydrogen sulfide, but by the time of the trial, the yellow precipitate had deteriorated, and the jury refused to convict. Marsh was apoplectic over this miscarriage of justice, and worked long hours in his laboratory until he devised this test."

"Why the zinc?"

"The zinc reacts with the sulfuric acid to generate hydrogen, and the hydrogen reacts with the arsenic to form arsine gas."

"A gas? Like air?" Leopold, clearly, had attended Lewis' lecture on how air was a substance. "How will we see it?"

"When the gas is brought to a red heat here"—Lewis pointed to the part of the tube right above the alcohol burner—"it will decompose into metallic arsenic and hydrogen, and a shiny black deposit of arsenic will be deposited on the inside of the tube, just beyond. That's what we call the . . ." He paused for effect ". . . 'arsenic mirror.'

"It is time. Leopold, would you like to do the honors?" The World's Second Most Blue-Blooded Lab Assistant dropped the filtrate down the sample tube into the flask. And his older brother lit the burner.

"I can't believe you're letting them do everything," Marina complained.

"I thought you hated lab work when you took chemistry last year."

"I did. But you still should have *asked* me."

"I don't see anything yet," said Ferdinand.

"Let me see if this helps." Lewis held a white paper behind the tube.

"No. . . . Wait . . . yes! I see a brown stain."

"It's getting blacker," said Leopold.

"Black as sin," pronounced Ferdinand. "We have a poisoning, don't we, Lewis?"

"It looks that way, Your Grace. But let me confirm." Lewis brought the burner to the free end of the

tube, and ignited the escaping gas. It produced a bluish white flame, with white fumes.

"So far so good. Or bad, depending on your point of view."

Lewis held a cold porcelain dish to the flame, then brought it away. There was a brownish black spot upon it. "And that, my friends, is the 'arsenic spot.'"

* * *

Marina walked into Lewis' house, followed by a servant trying to balance a large pile of goods.

Lewis eyed the pile warily. "I hope Archduchess Claudia gave you an expense account."

"Nothing to worry about, brother. These are gifts from relatives."

"Relatives?"

"You didn't think that the Bartollis climbed out of the trees in West Virginia, did'ya? There are Bartollis right here in Florence. Cosimo, Lorenzo, Giovanni, Matteo, Niccolo, Piero. . . ."

"And you think we're related, just because of the last name?"

"Well, they thought it was reasonable. Of course, they weren't sure of the blood connection until I mentioned that I had been in Ferdinand and Leopold's private laboratory, and flew to Venice with Archduchess Claudia."

"You impudent namedropper, you. Even if it's true, let me think . . . 370 years . . . twenty years a generation . . . you might be their cousin eighteenth removed, if I've got the terminology straight. You're probably more closely related to John F. Kennedy than you are to them."

"Whatever. So, who d'you think knocked off Pietro?" Marina said.

Lewis laughed. "Suspects? They are as common as mosquitoes in the Maremma. Silvia is sure it's some business or political rival. She gave me a list. Pietro was recently appointed to a salt magistracy, and she thinks that perhaps he discovered that one of his colleagues was embezzling funds, and threatened to inform the authorities if he didn't turn himself in."

"More likely asked for a cut in return for his silence, and got too greedy," said Cosimo.

"But were those rivals at the dinner?" asked Marina.

"Even if they weren't there, they could have suborned a servant," said Cosimo. "But actually, I think it's the wife. Wives have poisoned inconvenient husbands since time immemorial. A half-century ago, Bianca Cappello, the most beautiful woman in Tuscany, poisoned Pietro Bonaventuri, so she could marry her lover, Francesco de Medici."

"Yep, Silvia's a suspect, all right. Silvia would have much more financial independence as a widow, and she's still good looking. For that matter, perhaps there's some young fellow she already has her eyes on."

"We'll look into it," said Cosimo.

"Then there are the heirs," Lewis continued. " Domenico and Olimpia . You do know what they call arsenic in this day and age? 'Inheritance powder.' It can be added to food or drink without imparting a suspicious color or taste, and seventeenth century alchemy is quite incapable of identifying it. That made it the ideal poison until chemistry caught up with the poisoners in the nineteenth century."

"Rocco got chummy with Taddeo, found out that Pietro's got a mistress. Had a mistress, I should say. Her name's Stella. Lives at a nice address, dresses well. Sin pays."

"Ah," said Lewis, "the plot thickens. Or, more precisely, the list of suspects increases."

Marina looked unconvinced. "Why would she kill the goose that lays the golden eggs? Surely she would be left with nothing if he died."

"Right," said Cosimo. "Usually the mistress gets rid of the wife, and marries the husband. Bianca Capello did that, too. Remember her? She poisoned Giovanna, the Austrian princess, and married Francesco de Medici."

Lewis shrugged. "A mistress might murder a patron. Perhaps she found a fatter 'goose,' and Pietro wouldn't let her move on. Or perhaps he beats her, and she wanted revenge. Or he refused to divorce his wife, and she decided to poison Pietro and hope that the death would be blamed on Silvia."

Marina had a different idea. "Or perhaps some young fellow is madly in love with Stella and killed Pietro out of jealousy."

"You're quite a romantic," said Lewis.

"No, no, your sister's right," said Cosimo. "That sort of thing happens. I'll ask around."

"Perhaps I should interview this Stella myself."

"How very conscientious of you, dear brother."

* * *

Cosimo found Stella's boy toy. "His name's Fabio," Cosimo reported.

"Occupation?"

"Artist."

"Great, all I need," said Lewis.

"What's wrong with artists? Even artists named 'Fabio'?" asked Marina.

"The pigments they use. Which include realgar red and orpiment yellow. Realgar is arsenic (II) sulfide, and orpiment is arsenic (III) sulfide."

"While those are poisonous, you can't put them in food without anyone noticing," said Cosimo.

"But you can react them with natron, sodium carbonate, to get arsenic trioxide. And heat that in vegetable oil if you want pure arsenic. As I said, all I need."

Lewis started pacing, then stopped abruptly. "Although while this Fabio may have had the means, and the motive, I am not so sure he'd have the opportunity. When would he come into contact with Pietro?"

"Perhaps he gave the stuff to Stella to administer to Pietro. He might not even have told her it was poison. Perhaps that it was an aphrodisiac."

Lewis snorted. "We're making quite a mountain of accusations out of a molehill of evidence."

* * *

Lewis knew that Pietro's body contained a large dose of arsenic, the Marsh test on his stomach contents was ample proof of that. If the arsenic had been administered on the day of the infamous dinner, then the list of suspects could be trimmed down, to just the family, the guests and the servants present that day. Still a long list, of course.

But Pietro and Silvia thought that there had been a series of attempts on his life. And if that were the case, and they were all by the same party, then knowing when the attempts were made could help narrow down the list of suspects.

Unfortunately, the Marsh test didn't provide a timeline. The statements collected by the investigators, and even the household account book, hadn't been of much help, either. There were payments for medicines, but the responsible doctors and apothecaries swore that these didn't contain significant amounts of arsenic, and Lewis' testing of the remaining vials, ointments and whatnot confirmed that. In fact, it seemed that Pietro had the least chronic exposure to arsenic of anyone in the household.

Lewis had one last resort. Back in 1997, the high school had been the recipient of an extraordinary gift, a $300,000 atomic absorption spectrophotometer. The gift had come about because one of the high school teachers had led a statewide high school science club trip to Carnegie Science Center in Pittsburgh, and had run into some LaFarge executives there.

As the name suggested, the AAS atomized a sample and then analyzed its ability to absorb light of different wavelengths. It should be able to detect arsenic at a level of just one part per million. Perhaps less.

"It's been a month since Pietro died, Dottore," Ferdinand said. He and Lewis were sitting in Ferdinand's laboratory, a corner of which had been appropriated by Lewis. "Can this wondrous AAS of yours still find the poison?"

"That's the good thing about an elemental poison, like arsenic, or thallium, your Grace. The body can kick it out, but it can't decompose as it can, oh, snake venom. Within an hour or two of ingestion, the arsenic is distributed all over the body, even in the hair roots. Within a few days, it can be detected in the hair above the skin. And if the victim died with arsenic there, it will be still be there a month, a year, a decade, even a century later. The arsenic atoms stick very well to the sulfur atoms in the hair."

"A century, are you sure?".

"That's right. In the nineteenth century of the old time line, there was an emperor of France named Napoleon. He got defeated by the Brits and sent into exile on an island. He died there, and some people thought he had been poisoned. Over a century after his death, someone took a lock of hair that Napoleon had given to one of his aides, and had it tested with modern equipment for arsenic.

"Sure enough, he had way more than normal levels of arsenic."

"Wow!" said Marina, who had been invited to look at Ferdinand's chamber of curiosities. "Napoleon was poisoned!"

"Well, not necessarily deliberately," Lewis admitted. "There was a green wallpaper used at that time, which contained an arsenical dye. They didn't know that it could be decomposed by bacteria to release arsine gas, which is really nasty stuff."

"A hundred years . . ." muttered Ferdinand.

"I beg your pardon, Your Grace. What did you say?"

"Never mind that for now. You already know that he was poisoned, from the contents of his stomach, so why look at his hair?"

"Because the hair would chronicle his arsenic exposure. Hair grows from the root outward, at a rate of a centimeter a month. So if his hair were twelve centimeters long, we could cut into sections and know when he ingested arsenic over the past year or so."

"Marvelous. And so you could eliminate any suspects who were absent when he had an arsenic peak," said Ferdinand.

"Exactly."

"Would you know the very days of each poisoning attempt?"

"I wish. To narrow down the time, you need to test shorter segments of hair, and there is more of a chance of contamination of the segment with arsenic from other sources. And that one centimeter a

month is an average, it varies from person to person, and even from one part of the head to another. But we should be able to pin it down to a particular month, maybe even a particular fortnight.

"While I'm at it, Your Grace, I would like to send Grantville some additional hair samples for testing. My hair, Marina's, Cosimo's and your own, perhaps. We'll make sure that no one is putting arsenic in your soup, that way, and the rest of us will act as controls."

"See to it. Tomorrow morning I will have a courier take it to Venice. It can be there in two days, and then catch the next flight to Grantville. And your colleagues can radio the results to Venice to save time. All I ask is that the communications not reveal anyone's names."

"I wouldn't want them to. I will number the hair samples, so the testers won't be influenced in any way."

* * *

"These results . . . are very strange."

"How so?" asked Marina.

"Okay. Look at the report. Sample 1 is your hair, that was the main control."

"Why not your hair?"

"Well, since I've been in Italy for a few months, and I have made few enemies, I couldn't be sure that no one was poisoning *me* ."

"Oh."

"Anyway, your levels are low. About one part per million. So are mine, and Cosimo's, and even the grand duke's, for that matter. All under five parts per million. But now look at Sample 5."

Marina stared at the graph. "That's weird. They're up and down, on a regular basis. But . . . the peaks get higher and higher. And then the last peak is way up. So what does it mean?"

"First of all, these peaks are way above what a seventeenth-century Italian would naturally be exposed to. So Pietro was being poisoned all right."

"Which I thought we knew already, from the Marsh test on his tummy-wummy."

"Yes, Marina, but it was nice to get that confirmed by a more sensitive test.

"Second, Pietro suffered both chronic and acute arsenic poisoning. Which means that either our poisoner kept notching up the dose, and finally got impatient for some reason and hit him with the chemical equivalent of a two by four . . ."

Marina finished his thought. "Or we have two poisoners, working independently."

* * *

"Cosimo, I need to construct a plan of the house," Lewis said.

"What good will that do?"

"When a general is planning a battle, he consults a map of the terrain, does he not? When a detective investigates a crime in a house, he needs a house plan."

Cosimo shrugged. "All right, that makes sense. Perhaps I can borrow an assistant from one of the grand duke's architects; he'll do a better job than we could."

"Fine, Cosimo, but I need exact dimensions, not just a general layout. I want the length and height of every wall measured, and every corner checked to make sure that it's a right angle. I want to know the apparent thickness of every wall, beginning to end."

"You're looking for secret rooms?"

"Yes, like the priest's holes the Catholics in England have. Or even just a little hiding place."

* * *

"There, Cosimo, just as I thought. The dimensions of the study aren't right. This wall should be a foot further away from the windows, to match the next room over."

"So what does that mean?"

"A false wall, and something behind it." Lewis put his ear against the wall, and tapped it.

He then did the same for one of the other walls.

"I believe the far wall is hollow. You try it."

Cosimo did just that. "I guess we need to go get some axes," he said cheerfully. The thought of a little authorized mayhem, even directed against the inanimate, was apparently pleasing to his martial spirit.

Lewis rubbed his chin. "Let's not be hasty. If the secret compartment, or whatever, was accessed frequently, his lordship certainly wasn't bashing in the wall each time. Start feeling around for a hidden panel."

They found it eventually, just below the ceiling. It had been superbly designed; it was no wonder they hadn't found it the first time they searched the house. The compartment it concealed wasn't that big, but it was big enough to hold some oddly marked vials, and a journal. Lewis handed them down to Cosimo, then stepped off the chair.

One of the vials contained a white powder. Lewis pointed to it, and Cosimo handed it over. Lewis pulled out the cork, and waved his hand over the top, wafting the released air toward him. "I'll have to test it, but I think it's arsenic. I wonder what the book says."

Cosimo had already started leafing through it. "Makes no sense to me."

"Here, let me. After reading the Latin mumbo-jumbo the alchemists write, I am pretty good at understanding esoterica. Not to mention reading really bad handwriting."

Cosimo handed the book over, with a slight smile.

"Why are you smirking, Captain? Oh." The text was clearly encyrypted. "I guess I'll save that for later."

* * *

Lewis had taken the first steps to solving the secret text. First, he tabulated all the symbols used on the first few pages. There were 26 different ones, which implied that each stood for a letter of the Renaissance Latin alphabet. It was just what Sherlock Holmes had done in "The Adventure of the Dancing Men."

However, Lewis couldn't be sure whether the cipher was in Latin or Italian, and in any event, Lewis didn't have frequency tables for either language. That problem was easy enough to solve; he gave Cosimo and Marina a few texts in each language, and had them compile tables for him.

In the meantime, he made a frequency table for the cipher. He was relieved to discover that it seemed to have the characteristic look, in terms of variation in frequency among the letters, of a monoalphabetic substitution cipher. That is, one in which each letter of the plaintext was replaced with a single cipher letter, and always that letter. Lewis had read that polyalphabetics had been invented in the fifteenth century, and wasn't at all sure that his deciphering skills were up to tackling one.

"Here you go," said Marina. "I hope this is based on enough data. I'll go blind if I look at any more Latin gobbledegook today."

Lewis looked it over. From most to least, it ran E A I T U . . . English would be E T A O N . . . Fortunately, with so much cipher text to work from, it would be easier to solve than even a newspaper cryptogram. Assuming that Lewis hadn't made any mistakes in converting the symbols into letters, and that Pietro, or whoever, hadn't thrown in too many nulls, abbreviations, code names or mistakes.

Marina looked over her shoulder. "I can tell you what it says. 'Dear Diary'. . . ."

"You're right, Maria, it *is* a diary. Although each entry begins with a date. So I will decipher the first few entries, and then switch to the last ones."

"Fine. I am going out."

"Okay, you know the drill. Summon the coach, have them wait for you, don't go off with any strange men. Actually, with any men."

"Yeah, yeah." She gave him a vague wave and went looking for a footman.

Lewis went back to work. He was still working when she returned, late in the evening. But he was able to tell her something important. The text wasn't a diary, exactly. It was a journal. An experimental journal.

The next morning, when Cosimo arrived at the door, Lewis was waiting for him. "Cosimo, we need to visit a few apothecaries," said Lewis. "Oh, tell Carlo and Rocco I would like them to dress as servants, not soldiers. We are going to collect information, not to make arrests. I'll explain along the way."

* * *

"I understand you have solved the mystery," the grand duke declared.

"I think so, Your Grace. Pietro poisoned himself."

"Suicide? That is a serious charge—"

Lewis held up his hand. "Forgive the interruption, but while the poisoning was deliberate, the result was accidental."

"Explain."

"You will recall the testimony of the Lady Silvia that Pietro thought that someone was poisoning him. He questioned and fired a few servants, but of course he then had to hire new ones, who he soon suspected in turn. In desperation, he began his experiments."

"Oho," said Leopold, "he emulated Mithradates."

"Who's Mithradates?" asked Marina. "The name sounds Greek, not Italian."

Leopold smiled at her. "Mithradates of Pontus. He fought three wars with Rome. He was afraid of assassination, and he protected himself from poisoners by taking tiny doses of many different poisons. Then when he was about to be captured by the Romans, he tried to poison himself, without success. Had to ask a friend to run him through with a sword. See, brother, I wasn't sleeping during my history lessons."

Ferdinand pretended to yawn. "That's what you did at least once a lesson, and you sure looked like you were sleeping. I guess you came awake if you heard the words 'poison' or 'sword.'"

"The infamous 'auditory echo,'" Marina muttered.

Lewis coughed, and Ferdinand motioned for him to continue. "Pietro took arsenic in small doses. Probably every other month, which is why the arsenic level in his hair fluctuated the same way. And he kept increasing the dose, as his tolerance increased, which is why the peaks got higher and higher."

"But the big peak at the end—surely that was something different? A poisoner got through his defenses?"

"That's what I thought, at first. And I suppose I can't rule it out, completely. But his secret journal records where he bought his arsenic. On those mysterious solitary trips in disguise that Cosimo told us, I believe. Pietro usually went to Cinelli's. But this last bottle, he got it from Rossi. I'm not sure why; perhaps Cinelli was out of town."

"What difference would that have made?"

"A crime was committed all right, but it wasn't murder. I made tests on the arsenic in the secret compartment, and also bought arsenic from both Cinelli and Rossi directly.

"Rossi's arsenic was fine. Cinelli's, on the other hand, was, excuse my French, crap. I think Cinelli was adulterating his arsenic all these years, and Pietro never realized it. Rossi, on the other hand, was an honest man. When Pietro bought arsenic from him, it was pure stuff. Consequently, Pietro received a much greater dose than he was expecting."

"Deliberate, yet accidental," murmured Ferdinand.

"Exactly."

"Captain Cosimo, see to it that Cinelli is arrested for criminal adulteration. I will tell Silvia that she and her son are now free of suspicion, and there will be no interference with the disposition of the estate."

Cosimo saluted, and left the room.

"Oh, Dottore Bartolli. I am most gratified with your work on this matter. But please, while you are welcome to mention your Marsh test in your lectures, please say nothing about the ability of this atomic absorption spectrophotometer in Grantville to detect arsenic in even a hundred-year-old corpse. At least, not to anyone other than a member of my family."

"Yes, Your Grace."

"There is going to be a party at the palace, I hope you and your sister can come," said Ferdinand.

"Yes, please come, Marina," said Leopold. "You can tell me more about Grantville. Do you know how to dance the *gagliarda* ?"

"No, but I can teach the *macarena* ."

Sometime later, on a flight from Venice to Magdeburg. . . .

"It sounds like you had a most interesting visit to Florence," said Archduchess Claudia de Medici.

"Indeed I did, Your Grace," said Marina. "But, why didn't your nephew Ferdinand want Lewis to talk about the AAS. Wouldn't he want to discourage future would-be poisoners from practicing their art in his realm?"

Claudia laughed. "Oh, yes. But it's the past he was worried about."

Marina looked blank.

The archduchess leaned over, and whispered her explanation. "You haven't heard the story? In 1587, my Uncle Francesco and *Step* -Aunt Bianca"—she carefully enunciated the "step"—"both suffered a sudden illness. Francesco was the grand duke at the time, Papa being his younger brother. Fortunately, Papa had arrived at the villa a few days earlier. He took charge, seeing to it they had the best possible care.

"Alas, they died eleven days later. The grand duke's death was, according to Papa and his physicians, because of Francesco's terrible eating habits. And Bianca's grief was too great for any mortal to bear, so she died the same day. From the stress of watching Francesco's decline, no doubt. The autopsies confirmed that the deaths were completely natural, and Papa bowed to the inevitable and became the next grand duke. Ferdinando the First. His first son was my older brother Cosimo, who fathered Ferdinando the Second.

"Anyway, certain rash and unprincipled people have nonetheless suggested that the deaths came at a too convenient time for Papa, Bianca having been maneuvering to have her bastard Don Antonio declared the heir. The word 'poison' was trotted out. It is really annoying, the way people think 'poison' as soon as you say 'Medici.' We aren't the Borgias, after all.

"It is possible that someone unhappy with my brother's rule might agitate for this AAS test to be performed on the bodies of Francesco and Bianca. If the results were anything but unambiguously negative, then they could be used to question the legitimacy of Ferdinando's rule."

"But wouldn't your nephew want to know whether they were poisoned?"

"God knows already, dear Marina. Just God. And it's better that it stay that way."

The Irish Sitter Sings

Written by Terry Howard

Late January 1635

Near the City of Nijmegen, Netherlands

"Innkeeper, we need a wet nurse."

One of Henrich's company—probably his daughter, the timing was right and she looked just like him—had a fever. The stout lass was down and likely would not be getting up. She had been no help with loading the mules for three days and then, unable to walk, she had to be carried the last half day to the inn. Now she was out of her head with fever and out of milk for her child. When she got pregnant Henrich cursed himself as a soft-headed/soft-hearted fool. He never should have taken her on as hostler help. But she had gone ahead loading and unloading the mules through it all with nary a word of complaint or a hint of expecting things to be different. Indeed, when someone started to help her out when her belly was at its biggest, she cursed the lad roundly. Then she gave birth in the night after having done her full share of the work the evening before and she did her full share the morning after. Her boy was now a toddler and could have been weaned already but the mother thought breast-feeding would keep her from getting pregnant. They tried giving him solid food, but he would not eat and now he would not stop crying.

"Yes, there is a wet nurse." The innkeeper named a price.

"I want milk for a bastard," Henrich said. "I don't need a gold-plated tit." They haggled half-heartedly and settled.

The company sat for two days while Henrich's daughter finished dying.

"Innkeeper, can we leave the child with the nurse?"

"No!" The innkeeper was adamant. "But you can take the nurse with the child!" he added quickly.

"You would have her leave her home?"

"This is not her home. Her man died in that corner . . ." The innkeeper pointed with his chin at a spot in the front room. ". . . over there. We buried him in the churchyard. It is damned good the Irish are all Catholics. The priest was not about to let any but Catholics be buried there."

"Irish, you say?" Henrich's mind began to turn over, counting the cost, assigning probabilities and weighing the long- and short-term benefits against the liabilities. "What of her children?"

"None. She gave birth in that same corner and buried her man and babe on the same day. I need her

gone. She hasn't enough language to wait tables, the regulars are fighting over who gets her, and the other girls are deathly jealous. Here, she's poison. You need a nurse, I need her gone. Take her."

"She will agree?"

The innkeeper snorted. *What an odd question* , he thought. Who did the merchant think he was dealing with? He had no intention of giving the girl a choice. "Oh, yes. She will be quite agreeable."

* * *

Once again Maire was off to where she knew not. That was the story of her life since leaving Dromiskin in County Louth with Tadhg. It was all a grand adventure until Tadhg didn't come back from his last battle. Maire found him on the field with his face blown away. She lost his child when it came too early into the world. Ruairi looked after her in her bereavement, but he failed to come back to camp before everyone fled when a battle became a rout. If he lived, he never did find her.

Alexander was next on hand to see to her needs but he caught the wound fever and wasted away. She stayed with him when he could not keep up and the rest of the band moved on. She was delivered of his child the day before he died. Father and son were laid to rest together in the church yard.

Now a traveling merchant had taken her on. Oddly, he saw to it that she slept alone, except for the babe. The merchant fed her often and well, much better than he needed to just to keep her in milk. He was buying meat daily and watching to see that she ate everything on her plate . . . almost as if he wanted to fatten her up. He also insisted that she learn English and a start on being able to read.

"Come, lass, walk with me," Henrich said the first day on the road.

"What did you say?" Maire asked.

Henrich smiled. "The language was English. You need to learn it. I said come walk with me."

"Why do I need to learn English? We are going southeast. England is west of here." After the band left Alexander and Maire, he decided to make for home so he could at least be buried in Eire. They got as far as Nijmegen in the Netherlands. There weren't enough Englishmen in County Louth to call the language at all common. She had heard it a few times in the inn as a child and young girl, but no more than that.

"We are going to Augsburg. When we arrive, there may be a good job for you there. If there is, you will need to speak English."

"They speak English in Augsburg?"

"No." Henrich laughed. "In Augsburg, they speak mostly German, and a miserable strain of German at that. But there is a man there who speaks English and his wife is due any day now. They will want a nurse. If we are lucky, that will be you. It will help if you speak English."

Maire asked no more questions. It did not matter. She was eating well and sleeping warm and dry, and she had a child to care for and love. What else could one ask for in this life?

One night at an inn there was a west-bound merchant with news.

"Henrich, I see you're importing Irish. You're too late. Dietrich passed me several days ago with two in tow."

"Damn!" Henrich said.

"Caspar," a voice called out, "you're peddling old news. Dietrich's Irish were turned down. Dietrich abandoned them at the first inn he came to when he left Augsburg. They were still there when I came through."

Caspar, annoyed at being upstaged, looked across the room. "You're Nicolas, aren't you? How is the dispatch business going?"

"I'm making a living."

"Join us for a beer," Caspar said. "My friend here is buying."

"Don't mind if I do."

"Do you have any idea why Dietrich's Irish were turned down?" Henrich asked.

"Yes, the tale was all over Augsburg. The American insisted that his wife could only hire an Irish nanny with red hair, but when he saw the two Dietrich brought to town he said to Dietrich, 'they look like they were rode hard and put away wet. What are they, camp followers?' Well, the way Dietrich tells it he was pissed at the man's snotty attitude. He claims he said, 'What did you expect, a virgin wet nurse?' Then he claims he walked out. The other version says the American told him to leave and to take his bedraggled guttersnipes with him."

The next day Henrich resolved to instruct Maire in behaving like a shy maiden, something she never had been. Shy, that is. After all, every girl was a maiden once upon a time. He began by instructing Maire on her back-story. "Your father was a returned mercenary. You were raised on a small farm."

Maire snorted and let off with a string of obscenities. "That is a load of crap. My mother had no idea who my father was. I was raised in the barnyard of an inn with the chickens and the pigs. A boy I knew wanted to follow the wild geese and asked me to go with him, or most likely I'd be there still." By wild geese she meant the many Irish bands who found themselves in the Catholic armies of Europe. The boy was a lad from the same barnyard, not much older than she. He was a gentle lover and a sweet lad As he was reaching a man's height there was no place for him in the staff.

"Lass, that time was free. The next time I hear you using language like that, I will slap you."

Maire paled but said not a word.

"Bite your lip and look down."

Her face stormed red in the way only a redhead can.

"No!" Henrich almost barked. "When you blush or go pale or get angry—especially if you get angry—bite your lip and look down. If you look up, you are ready to fight. Fight with me, girl, and you will lose. The only question is how badly you will hurt when we are done. But that is not the point. A sweet, young, blushing maid will not make eye contact; she will avoid confrontation. I can land you a good job as a sweet, young widow. They will have no use for a loud, harsh wench out of some inn's barnyard with shit between her toes. They will not want a whore raising their child."

Maire blinked and thought about what he said. When the blink was over, her eyes were on her feet and she was pulling her lower lip into her teeth.

"Good. Very good. I almost believe it myself. And another thing, this boy was your husband. He was the only man you ever knew carnally. I doubt you have ever been married, but from now on you refer to any man you laid with as 'my husband.' He was a poor boy from another farm in the village and the two of you got married and ran away to the continent to win a fortune and return home to lease a farm and raise a family. Do you understand? No! Don't look up. Just nod your agreement while counting your toes."

At the next inn there was a troupe of wandering entertainers who had exhausted their welcome and were moving on. Since they were traveling in the same direction, Henrich arranged for someone to instruct Maire in singing as they walked. It turned out the lass had a good ear, as well as a clear, sweet voice, and clever hands.

The instructor convinced Henrich that she had promise as a lute player and just by chance the company had an extra lute they were willing to part with. "An innkeeper had it. Someone died or left it or couldn't pay? Who knows? He couldn't or wouldn't pay us but he offered me the lute instead. The strings were dead but I've restrung it." Thomas, the group's leader, did not mention the shape the wood was in. A little oil and a lot of rubbing made it look good. It would take a professional to know it had suffered from neglect. It had also been left with the strings taut so the neck was warped. Thomas strung it over the backside. After a month of careful adjustment the instrument was playable, at least enough to be passed off on some rank amateur. "I don't need two and I'm tired of carrying the thing around."

When they parted company, Maire had the basics for the lute down. Her teacher's parting words were, "Don't worry about speed. That will come with practice. Work on your chord changes and your rhythm. Play a little everyday you have a warm place, and remember to let the instrument warm and cool slowly."

Henrich saw to it she played every night, after dinner. He even taught her a few songs he remembered from his visit to the theater in the Higgins' Hotel in Grantville.

One night, after he had spent over an hour helping her get the tune and the words to an English song just right, Maire finally asked, "Why are you doing this?"

Henrich smiled. In a voice full of piety he answered, "It is an act of Christian charity, my child."

Marie looked down and counted her toes. She couldn't bite her lip because she was too busy gritting her teeth.

Henrich laughed. "Very good, Maire. If I didn't know better I would indeed believe it.

"Very well, lass, I will tell you why. It might make things go better if you know. There is a man in Augsburg, an American from Grantville. I'm sure you've heard of those. He is doing quite well. He is the merchant's agent in Augsburg for a great many concerns. The business that passes through his hands is worth several fortunes. I want a slice of that trade. If the man owes me a favor then I will turn a profit on it. You are that favor. For some reason, he has told his wife she may only hire a redheaded Irish lass as a nursemaid for his child. There isn't one to be had in all of Augsburg. I know at least three men who are racing to Ireland and back or scouring the army camps for such a lass. By chance, I stumbled over you. If they will take you on as part of the household, then every time I come to Augsburg, your uncle Henrich will look in on you to see how you are doing and he will leave you some small trifle he has found on his journeys that he thinks you will like.

"Of course, while I am about it I will brush past this rich American commercial agent and ask in passing if there is any freight he needs hauled or something he needs fetched. And perhaps they will let you keep . . ." Henrich looked to the toddler on Maire's hip. ". . . him below the stairs. If not then perhaps I can find someone near by to raise him where you can keep an eye on him. I would like it if I knew that someone who loved the boy was watching out for him. If not, then I need to find something else to do with my grandson. Is that enough reason for you?"

Maire counted her toes and nodded.

"Look at me, Maire." He waited for eye contact. "Is that enough of a reason?" he demanded.

Her hard, cold eyes said not a word. Her mouth said only, "Yes."

"Then you will do it?"

"Yes."

"Good."

By and by she found herself in the city of Augsburg, freshly bathed, in new and modest apparel, on her way with Henrich to a meeting with H. A. Burston and his wife Catharina.

* * *

"Horatio Alger Burston," Catharina said, "I don't know why you are wasting your time. This Henrich hasn't had time to go to Ireland and back. So this girl will have been through the wars like the last two you turned down. I do wish you would be sensible and just let me hire a local girl."

H.A. knew his young wife was annoyed with him when she addressed him by his full name. It was by way of being formal. He thought he had her, mostly, trained to his more comfortable, informal, West Virginian ways. "Catharina, Henrich is a man of business, in a small way, with a good reputation. It would be unthinkable to not even look at what he has to offer. Yes, the last two prospects were not what we wanted, but in time, if we are patient, what we want will walk through the door."

"Horatio Alger Burston, you are a most infuriating man. When it comes to business you have all the common sense in the world. Why can't you apply those same principles to a simple family matter?

"What you want does not exist. Any wet nurse, will have a sad tale of misery and woe or she would not be hiring herself out while she is still in milk."

"Perhaps you are right, my dear," H.A. admitted. "Perhaps what I want is just a fantasy." He knew his dreams of how a rich man should live were, after all, a product of the twentieth-century entertainment media. The best cooks were French chefs, so he insisted they hire a Frenchman to cook for them. A rich man got into his car and said, "Home, James," in that upper class almost-British accent, so he wanted an English coachman named James. In the movies, the servants who knew how to have fun were Irish. It was okay to have straitlaced, stern German chambermaids keeping things clean, but his children should have fun growing up. He was rich. He should be able to have what he wanted. What he wanted was an Irish lass to raise his children.

"Horatio Alger, face reality. There is no perhaps about it. You are not being fair with me in this matter. At best, a wet nurse is a tragic woman who recently lost her child or she wouldn't be in milk. She probably just lost her husband as well, or she wouldn't need to be self-supporting. And that is if she ever had a husband. The truth is, most likely, her tale will be a sordid one. Or if she has been a wet nurse for a long time, and she is looking for a job, then you can be sure she has no personality or no skills. If she had either she would have been kept on in the household after the child was weaned and she would no longer be a wet nurse."

"You're probably right. It is just that . . . well . . . oh, never mind." H.A. sighed. "You are completely right about one thing though. Henrich said Maire recently buried her husband and her child."

* * *

Catharina didn't let her smile show. Horatio was on the verge of giving in. She was sure, when the coming interview was over, he would give up and let her hire whomever she wanted. There was no possible way any woman could look good after she got through questioning her. What she said next was carefully calculated to make her seem reasonable, to disarm her spouse and set him up for the next round, which she was now—finally—sure she would win. "Well, Tio Al, let's give this one a fair chance, shall we? After all, maybe she will be what you want." She knew using the shortened form of his first and second names would please him and make him feel like he was gaining ground in their clash of wills over cultural matters.

One of the maids showed Henrich and Maire into the room H. A. called the front parlor. He started to rise to greet his guests but Catharina's hand on his arm kept him in his seat. She had, after all, her own firm ideas on what was and wasn't proper, and she also was working on training her new spouse.

Catharina watched H.A. smile when he saw the lute Maire was carrying. She took one glance at her husband's face and sharpened her questions to be sure the girl came off looking badly lest Horatio should decide to *let* her hire this one.

The girl was young. She was clean and appeared demure or even shy. Her long, dark red hair framed a pretty face. Indeed, if Catharina did not already have someone picked out and waiting she might have wanted this girl as part of the household.

* * *

Horatio addressed the prospective employee and her escort. "Please be seated."

Catharina squeezed his arm. H.A. knew her thoughts on how the help should be treated. He did not agree. Besides, if the lass played the lute she probably needed to be seated to do so. H.A. nodded at the instrument. "Are you any good with that thing?"

Maire looked down and bit her lip to smother a chuckle. She unwrapped the lute, risking the rapid change of temperature just this one time. She quickly tuned the stings and began to sing a slow song in her native Irish tongue in a soft, sweet voice. It was nice but H.A. steeled himself for the employment interview which would follow. Maire started a second song in charmingly accented English without a pause, "Dough is for the rising bread, ray is for the rising sun. Me is a name for my rising self—"

The words and the tune were almost, but not quite, familiar. It nagged H.A., while at the same time it set him at ease. At last he made the connection. The song was almost like one of the signature tunes from the Maria von Trump . . . or von Trap . . . well, von something, anyway . . . story, the one where the failed nun was sent to raise a family of children and ended up marrying the father. H.A. made up his mind with a smile.

When she finished the song H.A. said to Henrich, "She is exactly what we are looking for. We'll take her."

* * *

Catharina's mouth fell open and was as quickly closed. She was not given the chance to ask the new nursemaid a single question. What *could* her husband be thinking? She sighed the most exasperated sigh imaginable and said under her breath, " *Americans*! Who can understand them?" Still it was clear her husband was in a good mood. If she was going to get anything out of this other than the embarrassment of not getting to hire who she wanted, now was the time to get it. "Tio Al, we could use some new clothes for our baby daughter. And with the diapers to be washed the laundress will need some help. I was wondering if we might buy a sewing machine and hire a girl to help out for a bit."

"I don't see why not." H.A. replied.

Catharina smiled. It wasn't the job the girl was expecting but at least she wouldn't have to turn her away after letting her think she would have a place in the household. Horatio was a generous man when he wasn't being stubborn.

* * *

On November second, All Soul's Day, H.A. arrived home, as usual, about five minutes before noon for lunch, which would be on the table, piping hot, promptly at twelve o'clock. Catharina was sitting at the dining table, waiting for him. Her air of intense concentration clearly told H.A. that there was something on her mind and that this was not going to be an ordinary lunch.

"What's the matter?" H.A. asked.

"A doctor called this morning and just left. It seems one of the help brought a sick child into the house." Her tone made it clear. Heads would be rolling just as soon as she found out who did it, who knew about it and didn't say anything or who didn't know about it but should have. To H. A. it was obvious that if his wife had her way, all of the resident staff, and maybe the entire staff, would most likely find themselves in

need of new jobs. Considering the history of plagues and epidemics and the high mortality rate of young children, her wrath was fueled as much or more by fear than anger. But, still, H.A. was glad he had made it plain that while she could hire mostly as she pleased, he would be reviewing the circumstances and making the final decision before anyone was dismissed from service. Catharina was a loving mother and a thoughtful, compassionate wife. Unfortunately, those traits did not seem to apply when she was dealing with servants.

"I know, dear. I quite agree. We can't have the servants bringing sick children into the house. That's why I sent the doctor around to see him."

H.A. could have grown a tail and horns without startling his wife any more than he did with his calm agreement that was not an agreement at all. "You sent the doctor?! You knew about this?"

Briefly H.A. was worried about his own head rolling. Then he remembered that this was the 1600s, that the money was his, and that she really didn't have much of anywhere else to go if she wanted to continue living in the manner to which she was accustomed. "I've known for months that Maire was unhappy with the care Alois was getting."

"Maire?" While Catharina was satisfied with the care her children were receiving, she had to admit the children were clean, happy and well behaved, she had never gotten completely over not being allowed to hire her first choice. "Her child is supposed to be dead!" The implication was they had been lied to and that she should be dismissed.

"Alois is the grandson of the merchant Henrich. He hired Maire to care for the child and then he brought her here. When she took this job he made arrangements with his usual inn to look after the boy for him. That is where Maire goes when she has time off. As I said, I've known for some time that she was unhappy with how the boy was being looked after."

"I don't think I like our nanny being distracted with other children," Catharina said.

H.A.'s voice took on a firmer resonance. "I don't think I would want my children being raised by someone who could turn her back and let a child she once cared for die just because it was no longer convenient. If she cares for the last lot, then she will care for the next. I like knowing she cares."

"Well, she can't keep it here!"

"Why not? Now, I quite agree that we can't be having the help bring sick children to work, but this is the only home Maire has, so she sure couldn't leave the child with its grandmother, now could she? So I sent a doctor. That last girl you hired, Anna, can look after the boy and still get her work done. She's been unhappy and pining away over not having a child to care for since you hired her. That's the job she thought she was getting after all, wasn't it! Well, now she can quit sneaking upstairs to peek at our kids."

"And just how do you know all of this?" Catharina was suddenly very suspicious. Her husband seemed to know a lot more than he should about the nanny and one of the maids.

H.A. had enough sense not to chuckle. "I talk to Fred."

"Fred? Fredrick? You talk to your valet?"

"Yes, I talk to my valet. He is a very interesting character. He has a bottomless supply of dirty jokes. He's been through some rather incredible circumstances, and he keeps me posted on what is going on in

the kitchen, in the stables and in the garrets."

Catharina was mollified on one point but still wound up on the other. "And you think it will be all right to just let the staff raise this merchant's bastard—" She made a correct assumption on the child's linage. "—grandson."

"I don't see why not. We've got way more staff than we need to get the work done. If the child is to hand, then Maire will know he's well and she can quit worrying about him so she will have one less distraction, and she can pay more attention to what she is supposed to be doing. Look, we've got a live-in Irish sitter. Think of Alois as a live-in playmate."

H.A. got that look on his face; the one Catharina was learning to associate with things her husband seemed unable or unwilling to explain, the look he sometimes described as a shit-eating grin. "No. I don't see any reason we can't keep an in-house playmate. But, I will definitely draw the line at keeping bunnies."

Northwest Passage, Part One

Written by Herbert and William Sakalaucks

Part I

November 1633

A bright sun and a cool breeze made Copenhagen the best place in the world as far as Sergeant Karl Andersen was concerned. He strolled with the three members of his city watch patrol through the open air market. They paused occasionally to gossip with the shopkeepers. Karl anticipated stopping for a large stein of beer with his men when their shift ended in an hour. The day had been relatively peaceful, with only the one pickpocket breaking the calm. The thief had literally fallen into their arms. He ran into them as he rounded a corner to escape from his victim. His years on the city watch and the army had taught Karl to enjoy days like today, since they usually meant the other shoe would drop soon.

He was jolted out of his daydream of beer by an unusual noise. A faint commotion could be heard from ahead of them. "Come on, men," he said and headed toward the noise.

"Sounds like a fight!" The most junior member, Jens, nearly squeaked in his excitement. Everything recently had been blissfully quiet and Jens was anxious for action. Muffled cries sounded, coming from the section of the city where the recent influx of refugees had congregated. Trouble had been brewing there for some time.

"Seems like our afternoon's peace is over, boys. Check your gear; it sounds like the refugees have started to riot. Third time this month. They're getting hungry and the council does nothing, as usual." Karl glanced back to check his men. Gunnar and Jakob were ready, but Jens' scabbard threatened to trip him again. "I thought I told you to get a new strap for that scabbard! Serves you right if it trips you and you get stuck."

The sounds of a major riot were now plainly audible. "Jens, be prepared to go for help if I tell you." Karl didn't need a green recruit in a riot. He'd be just as likely to stick one of the patrol with his sword as a rioter. "Now, draw swords and cudgels and follow me. Wait for my signal before you do anything drastic!"

They charged around the corner, boot nails sparking on the cobblestones, only to halt, startled. Men, women, and children were laughing, cheering and dancing in the street. A number of people waved copies of a broadside. Extra copies were posted on the wall of the nearby church.

Karl grabbed a youngster who had a broadside in his hand. "What's going on here? We thought there was a riot!"

The boy grinned and held up the sheet. "Says here the king is giving free land to all able-bodied men; forty acres to each man, and twenty more if he's married. Now we won't have to beg the city council for a meal." He twisted free and raced off into the mob.

Karl shook his head in amazement. "Put 'em away, boys. It looks like we aren't needed here now. I just wonder what will happen when these fools wake up and find out this was a lie."

The watchmen sheathed their swords and cudgels and headed for the local tavern. The run had worked up a powerful thirst and their watch was just about over. Karl picked up a broadside that someone had dropped and jammed it in his tunic.

* * *

The door slammed shut and nearly shook the painting off the wall. The logs in the fireplace settled, giving off a shower of sparks. Sir Thomas stalked into the room, looking like he was ready to spit nails. "What the hell were you thinking, Reuben? We agreed to post broadsides announcing the new company, not tell all of Copenhagen that we're giving away free land." He paused to catch his breath, and then turned to the other of the pair. "Or was this your idea, Saul?"

The Abrabanel brothers started to laugh.

This only set Sir Thomas off again. "Your uncles may have put up the majority of the funds for the expedition to Hudson's Bay, but my friends and I have our fortunes tied up in it, too!" Normally a very mild-mannered English diplomat, Sir Thomas Roe appeared ready to strangle the younger men.

Saul attempted to calm Sir Thomas down. "Yes, Reuben was the one who had the broadsides printed and distributed. According to the discussions you and Captain Foxe had with us, recruiting colonists is

the biggest task facing us if the expedition is going to sail on time." He poured a glass of wine, handed it to Sir Thomas and then continued. "We've already had fifteen families stop by the office to sign up. Another week and we should have all the soldiers, fishermen, and farmers we need. Then all we'll need are the miners and craftsmen you said you would locate."

Sir Thomas stared at the glass and then downed it in one long swallow. "Just how do you plan to pay for their passage? You're giving away thousands of acres."

Reuben said, "Remember, the king said he wants the refugees and all the riffraff cleared out? He agreed that the crown would pay for every refugee family and prisoner we sent. We've made sure that *everyone* we've signed up is a refugee. I've also made arrangements with the city jailer to have all prisoners with craft or military experience turned over to us. We may not have to cover any passage expenses ourselves. The king will cover it all!

"Besides, what are a few thousand acres, compared to the millions that the Company will still own."

His calm manner stopped Sir Thomas as he was working up to another outburst. Slowly, the impact of what the brothers had done dawned on him. "Well, I'll be damned. You boys actually put one over on Christian when you wrote up that charter. And you're right, only settlers will make our lands valuable. It looks like I'll have to get busy and get the miners and craftsmen moved here. Captain Foxe will need to get the ships ready to sail sooner than I thought. I'll notify him that he needs to proceed with his part of the enterprise as soon as possible."

* * *

Captain Luke Foxe reread the note from Sir Thomas. He chuckled when he read the part about Reuben's ploy to recruit colonists. In the flickering lamp light, his features still showed a hint of the experiences from his last discovery voyage to Hudson's Bay and the recent voyage to Greenland. The privations he suffered as he waited for the audience with King Charles that never came, and the poor food the Spaniards had for their sailors on the voyage to Greenland, had aged him. The last month, though, had done wonders for his health. The small inn, where he was currently lodged, had some of the best food he'd eaten since he first went to sea. His stomach no longer bothered him. The only problem was that his trousers were starting to get a little snug .A month back at sea and that problem should take care of itself.

"Svend, I want you to prepare the letter to Sir Thomas that we discussed earlier, on the four captains I met with today. They are all interested in signing on for the expedition and their ships meet our needs. I'll meet at his convenience tomorrow to go over the details."

"I'll get to it immediately, Captain." At fifteen years of age, Svend had all the eagerness of youth for a great adventure. Ever since Captain Foxe had first sought lodging at his mother's inn, Svend had been like a young puppy trying to please its master. Luke had finally surrendered to the inevitable. As his share of the work to prepare the expedition to Hudson's Bay increased, Luke hired Svend as a messenger. Surprisingly, Svend had turned out to be well-educated, with a clear hand for writing. He now served as Luke's temporary clerk.

"As soon as you have a clear copy ready, I'll sign it and you can take it to Sir Thomas' house. Wait for his answer, if he's there. I'll ask Mette to keep a meal warm for you."

* * *

With the signed letter in a leather pouch, Svend set off for Sir Thomas' house. Supper tonight was to be chicken with dumplings. Svend could almost taste his mother's cooking as he raced out the door and rounded the corner. With his mind on dumplings, he barreled right into one of the four watchmen heading toward the inn. Svend knocked the young man over in a tangle of limbs and scabbard.

The older watchman, who was evidently the leader, grabbed Svend by his collar and lifted him clear. He roared at the man on the ground, "I told you Jens, get that strap fixed. If this had been a real brawl, you'd be dead." Then he asked Svend, "And where are you off to in such a hurry, lad? Or are you running from someone?" He set Svend down but still held onto his collar.

Svend opened the flap of his pouch to show the letter. "I'm carrying a letter for Captain Foxe to Sir Thomas Roe. I apologize for my inattentiveness, Sergeant."

Karl grinned. "You're from the inn, aren't you? I thought you looked familiar. Be on your way, but watch where you're going!" He let go of the collar, then gave Svend a smack on the backside that propelled him off. "Let's get that beer before anything else interrupts us."

* * *

As befitted the status of the ambassador from the English court to Denmark, Sir Thomas' house was in the Hovermarken neighborhood and was solidly built of gray, faced stone. Before he climbed the steps to the door, Svend paused to straighten his tunic and run his fingers through his hair. *The Captain would really dress me down if I showed up looking like a street urchin* , he thought as he reached for the bell pull. This was the first time he'd been to Sir Thomas' house since the ambassador's family and staff had joined him here in Denmark. The door opened and Svend was surprised to be greeted by a petite, dark-haired young lady.

"May I help you?"

Tongue-tied, Svend stammered, "I have a letter for Sir Thomas from Captain Foxe."

She opened the door wide and invited him in. "My uncle is in the study. Please have a seat and I'll get him."

As she walked down the hall, Svend noticed that the dress she was wearing was a patched hand-me-down.

A few minutes later, Sir Thomas appeared. "Agnes said you've a message from Captain Foxe?"

"Yes, sir." After he handed over the letter, Svend continued, "Captain Foxe asked me to wait for your

answer, if it was convenient."

Reading the note, Sir Thomas started back down the hall. He motioned for Svend to follow. When they entered the study, Sir Thomas looked up. "Have a seat. I do have an answer and I won't be a moment composing it." He quickly penned a reply. "Take this back to the Captain. You may tell him that a meeting at ten o'clock tomorrow morning will be fine."

Svend placed the note in the pouch and headed for the door. The young lady watched from a door at the end of the hall.

* * *

"I must be getting old," Karl thought, trudging through the gathering dusk to his home. "Only two beers and Magda won't even be surprised. I've been home early every night the past two weeks." He sighed. "Just an old married man." He opened the door to the house he and his wife, Magda, shared with their son, Johann and his family.

" *Farmor*!" He was instantly mobbed by his four oldest grandchildren. Magda looked up from her cooking. "Children, let your grandfather get in the door before you pester him. Dinner will be ready as soon as Johann finishes at the shop." She tasted the stew and then continued to stir the pot. The stew's aroma had Karl's mouth watering. She gave Karl the look every wife had when she knew something was up. "I hear there was some excitement this afternoon among the refugees. Anything important happen?"

"No, just someone posted broadsides on free land. Can you imagine, the fools actually thought someone would give them free land?" He reached into his tunic and pulled out a rumpled paper. "Here's a copy. Some fools will believe anything."

Magda read the broadside and frowned. "Too bad you're too old to start farming and the land is so far away. We could turn the house over to Johann." Karl looked at her like she had lost her mind, but Magda continued with a twinkle in her eye. "Then they would have enough room, especially since Bergitte just found out she's expecting again!"

Karl asked, "Does Johann know yet?"

"No. Bergitte plans to tell him when he got home tonight. And don't you dare let the cat out of the bag beforehand!"

"This calls for a celebration. I'll get the akvavit from the cabinet."

Karl headed to the storage room, and Magda turned to toss the broadside into the fire. She paused, folded the paper and tucked it into her apron, a thoughtful expression on her face.

* * *

The next day dawned cold and cloudy with a hint of precipitation to come. Luke finished the last of his breakfast, then sighed, contented. "Mette McDermott, I can't remember when I've eaten so well!"

"You must be getting old, Captain. You've already forgotten you said the same thing yesterday." Smiling, Mette picked up Luke's dishes and headed toward the kitchen.

While the buxom, blonde widow retreat into the kitchen, Luke realized that he felt better than he had in

years. Ever since his trip to Grantville, where he saw his "obituary" in the history books, his attitude on life had changed. Knowing when and how one was supposed to die tended to change one's focus. Now that he had cheated death, anything seemed possible, even starting a family. *Now where did that idea come from?*

Muttering to himself about crazy old men who should know better, Luke looked up when Svend entered the room. "Are you ready? We have a busy day. We'll head to the ship and get my books and papers for the meeting. I want you and Mr. Barrow to go with me." Luke picked up his boat cape, but the image of Mette McDermott stayed with him.

* * *

The familiar harbor smells set Luke to thinking about the planned voyage. He thought over what was involved with the planned expedition and what he had heard about the Roanoke, Jamestown, and Plymouth expeditions and came to some solid conclusions. Those expeditions had tried to get by on half measures and ended up on half rations. If investors could be convinced to actually start a colony on a firm footing, the long term payoff should justify the cost. Four or five seaworthy vessels of at least eighty tons each should meet the need. They would carry not only settlers, but adequate food supplies, tools and trade goods. His ship, the *Köbenhavn* , would serve as one of two ships to carry colonists. He wanted two ships to carry the soldiers, their equipment and enough food to last until a harvest could be brought in. The fifth ship would carry the livestock, grain and trade goods. They would need to be well armed, too. The *Köbenhavn* 's armament consisted of six cannon and the livestock ship could carry four more cannon. Those four would be unloaded for the defense of the colony. Along with forty arquebuses, powder, and shot, that should deter any but the most determined attackers. Trade goods to acquire the needed land from the natives should make for good relations with the new neighbors. They would also need at least one resupply of food with the second group of settlers, in case there were crop failures the first year.

The short trip to the *Köbenhavn* went quickly. Luke came out of us reverie when they arrived and checked the rigging for any problems. His first officer, John Barrow, was efficient, as usual. All yards were squared off and the running and standing riggings showed no sign of excessive wear or stretching. The *Köbenhavn* was two hundred tons, painted black with a white strake, and was only two years old. Sir Thomas had bought her specifically for the expedition. When Luke and Svend boarded, John met them at the entry port.

"Morning, Captain. I have your papers for the meeting in your cabin, just as you requested."

"Good! You'll be going with us, John. You'll need to know our decisions today first hand. Svend will be

along to help carry the papers and books." Luke gestured to the low, gray clouds. "It looks like it might snow soon, so let's be off."

* * *

Just before they reached their destination, a fine snow started to fall. John looked disgusted. "Hope the meeting goes quickly, Captain. These cobblestones will be slick if we get much snow."

"We're going to be a while today. Sir Thomas' note hinted that things were moving faster than we originally planned. I want you to speak up if you have any ideas or you catch anything that I miss."

John rapped on the door with the pommel of his knife. When the doorman answered, John announced, "Captain Luke Foxe and party to see Sir Thomas."

"You are expected, sirs. The other gentlemen are here already."

They were greeted by a crackling fire in the brick fireplace of the study. Five men arose as they entered.

Sir Thomas made the introductions. "Captain Foxe, thank you for being so prompt. You know Saul and Reuben Abrabanel. And this is Adolphus Bamberg, the local factor for the House of Cavriani." The fifth guest was pointedly ignored.

"Gentlemen, Captain Luke Foxe, his first officer, John Barrow, and their clerk, Svend McDermott." Svend quietly placed the papers he was carrying on the table as Sir Thomas asked Luke, "What can you tell us about the ships you've found?"

Luke paused to pick up a list from the pile of papers. "Based on the number of passengers and amount of equipment you say are needed for the first expedition, I calculate that we will need over five hundred tons of carrying capacity. The *Köbenhavn* , of course, and I've located four other ships that I feel meet our needs. Captain Thomas James, with his *Henriette Marie* , already has experience with Hudson's Bay. We've known each other for a number of years. He would be my recommendation as the second in command of this expedition. His ship and mine would carry most of the colonists. Captain Lars Johannson with his 90-ton *Kristina* , would carry the expedition's livestock and trade goods. Captain Jan de Puyter of the 150-ton *Wilhelm* and Captain Martin Rheinwald of the 120-ton *Hamburg* would carry provisions, weapons, soldiers and equipment. This assumes that we are still looking at the planned numbers and leave in March. Captains Johannson and Rheinwald each have a charter to Luebeck to complete before they are ready to sail, but they'll be back in Copenhagen by mid February."

Reuben and Saul whispered together for a moment, and looked toward Sir Thomas, who nodded agreement. Saul said, "This group is eminently satisfactory, Captain Foxe. We are on track with our plans for recruiting settlers and your recommendation for Captain James as your deputy coincides with our thoughts. March will fit our time frame. Now that we have decided on our ships, we need to discuss the details to make this expedition successful."

A loud rumble sounded from across the room. Svend started to blush. "I'm sorry, Captain. I was so busy this morning, I missed lunch."

Sir Thomas laughed. "A young man needs his meals. Why don't you see my cook? She usually has something to eat. The doorman will take you to the kitchen."

Svend beat an embarrassed retreat.

Luke said, "Thank you for being understanding. I still remember what it was like as a young sailor, hungry all the time. He'll probably be happier there than listening to our boring discussions."

The group settled down to examine the details of the expedition. Three hours later, the discussion started to wind down. Then an involved discussion started between the Abrabanels, Bamberg, and Sir Thomas concerning mineral rights started.

Luke asked John, who was trying desperately to stay awake, "Why don't you see how Svend is doing? I think I can spare you for a while. Hopefully, we should be done here soon. I'll need him to help with the items we'll carry back to the ship."

"Thank you, sir!"

John quietly left the room. He spotted the doorman who had greeted them, walked over and asked, "The young gentleman who came with us, can you show me to him?"

"Certainly, sir. He and Mistress Roe are in the kitchen with the cook."

The reply startled John. "Is she Sir Thomas' daughter?"

"Heavens, no! She's his ward. Her parents were his cousins. They died in the plague and Sir Thomas was her only living relative. He hardly pays her any attention. The cook is really whose raising her. Sir Thomas only took her in out of Christian charity."

They squeezed through a narrow servant's hall that was still packed with some of the recently arrived furniture. The doorman ushered him into the kitchen. "Matilda will see you back when you're done. I have to return to my post."

A cherubic faced, matronly figure in an apron peered out of a cloud of flour. "Come to fetch the young master? He's been very well mannered. Mistress Roe will be disappointed that he's leaving. She doesn't get many visitors her age."

It seemed as though the cloud of flour she'd raised billowed along as she walked through it to fetch the youngsters. A moment later, they returned. The two youngsters were holding an animated conversation in whispers. Svend clutched a small book tightly in his hands and nodded every time the small, dark-haired girl made some point.

"Agnes, this is Captain Foxe's first officer, John Barrow. Mr. Barrow, may I present Agnes Roe, a cousin of Sir Thomas," Svend said.

Agnes made a short curtsey and John bowed deeply. "My pleasure, ma'am. I come as a bearer of sad tidings. Svend's duties call. We will be leaving shortly and he must return to the library." Svend was downcast, but Agnes looked like a lost puppy. "Don't worry; I'm sure Svend will be back soon. The meeting went well and I expect the captain will send him by with messages from time to time."

They visibly perked up. Svend said, "I'll make sure to get your book back next week, even if the captain doesn't have an errand for me."

"Do you think he'll let me visit the ship? I would dearly like to tour your ship!"

John said, "Your ship? I didn't know the Sir Thomas had sold her to you. The captain will be interested to hear this. Does this mean a raise for everyone?"

Svend blushed furiously. The hero worship in Agnes' gaze warned John to go easy on the boy. He recognized the signs of young love. "I'm sure a tour can be arranged."

* * *

Sir Thomas stood by the fireplace, talking to Saul and Reuben. "My other investors have no problem with your proposal for refugees, Saul, but Captain Foxe is not familiar with your proposal. What do you think, Luke?" The visitors stiffened noticeably. John started to clear his throat to announce their return but then stopped, having sensed the tension. He motioned Svend to stay where he was.

"As I understand, from time to time you may have settlers that need to be transported on short notice. They will pay the regular fare but no questions will be asked as to who they might be and why they are traveling. The gentlemen here will be the contact for those groups," Sir Thomas said.

"Before I agree, may I ask who the other member of your party is?" Luke said.

"Let us just say he is a labor member from Southern Germany who is traveling with us. If anyone asks you, he was never here. Rest assured, he supports your efforts and has significant influence in certain 'Swedish' circles. At this time, he is only here to bring news of our negotiations to the appropriate parties," Saul answered.

Once more, Luke was perplexed by the odd statements and then it hit. "You're from Grantville, aren't you?" The gentleman just smiled. "Forgive my interruption. The question was unnecessary." Many things fell into place. It seemed that Sir Thomas had established some contacts with Grantville outside of official channels. While the governments might not support the proposed settlement, people with money and knowledge to help make a go of it were in support. In the long run, that might be even better. Full funding and full rations would go a long way toward a successful settlement. Luke thought for a moment, and then made his decision. "I agree to the proposal. As long as the passengers are not prominent Danish criminals, I should have no problems with transporting them."

Sir Thomas motioned for John and Svend to enter. "I think that settles our last issue. We'll meet again, once the miners arrive."

The Grantville visitor added a last comment. "Don't take too long. Things could get very interesting come spring. If Christian gets too tied up in, oh, some kind of war, you may never get out." No one seemed surprised by the comment.

* * *

On the way back to the ship, John spoke of his visit to the kitchen. When he mentioned that Agnes had loaned Svend a book, Luke inquired about the title.

"It's a book from Grantville that Sir Thomas bought for her. *Peter Pan* . It describes a magical land, pirates, and the adventures of a group of lost boys. I promised Agnes to return it next week."

"Make sure you keep that promise! You're likely to be going there on business frequently and you don't want to ruin your reputation. The young lady has trusted you with an important item. When I spoke with your mother the other day about your assistance, she spoke highly of your trustworthiness. We also spoke of your future. I need a good assistant who can be counted on. The skills your father taught you on navigation may come in very handy when we start exploring the new land. Would you be interested in the job? Think it over carefully because you would be gone for several years."

Svend's smile grew from ear to ear. "Mother and I already discussed this and I've thought and dreamed about it a lot. I don't need any extra time, the answer is yes!"

"Good, I'll sign you on as a member of the expedition, as Captain's Clerk, after breakfast tomorrow.

* * *

After a short, leisurely stroll to help settle breakfast, Luke spoke with Mette for over an hour. He wanted her opinions on the various merchants he would be doing business with over the next few months; securing supplies he needed for the expedition. Her familiarity with most of the merchants in the harbor area was immensely valuable. She also had some pointed comments on the trustworthiness of some. Luke pointedly ignored Svend's squirming during the discussion, but finally broke down.

"Mette, I think your son has something to say. He's been very good for not interrupting, but I think I better let him have his say before he explodes from trying to hold it in."

With a look of mild concern on her face, Mette turned to Svend. "Is there something I need to know?"

"At the meeting yesterday, the departure date for the expedition was set. They plan to leave in March."

Luke was surprised by Mette's reaction to Svend's announcement. She turned toward him with a sad look, not the response that he had expected. For some reason, his heart seemed to flutter.

Oblivious to the byplay, Svend continued. "The captain has asked me to join the expedition as his clerk, with your approval. He says we will probably be gone for a couple of years."

Mette smiled. "Of course you have my permission. You've always been your father's son. I knew someday you would leave, I just never expected you to go so far away." She reached for Luke's hand. "I trust you to take good care of my oldest."

Luke realized Mette had left a lot unsaid. He felt twenty years younger. "Svend has a very bright future. We will need someone who is good with navigating overland and can keep a logbook. His father taught him well. I will make sure that he stays out of trouble." He looked at Svend. "We have a lot to get done. Be ready to leave for the ship in ten minutes."

Luke's heart felt like a ship rising to the top of a rogue wave as he whispered to Mette. "We'll talk some more when we have some privacy and time." Her warm smile sent Luke off with a spring in his step.

December 1633

Luke sighed as he, John Barrow, and Factor Bamberg entered the shop of Dagmar Bundgaard. Three fruitless weeks of excuses and apologies from Copenhagen's ships' chandlers and supply houses had finally convinced him that Mette's comments about who he would have to buy from were true. If he was going to get the cannon, gunpowder and small arms the expedition needed, his only choice would be to buy the needed supplies from Bundgaard. A cousin to the king's Minister of War, Bundgaard had the sole concession to sell military arms in Copenhagen. He used his monopoly to force people who wanted to buy armaments to also purchase their other supplies from him. Since word had gotten out that the expedition wanted to buy weapons, other potential suppliers were suddenly unable to meet Luke's requests or their prices were twice the rate they had been when Luke first started planning. Bundgaard had made a take it or leave it offer to supply all the expedition's needs. He hinted that the other suppliers knew what was good for them and Luke should too. His price was slightly higher than planned, but even Bamberg agreed, "He may be a scoundrel, but if we are going to sail on time, he's your only choice." With no other options and time getting short, it was time to negotiate the best deal they could get with Bundgaard.

"Greetings, Captain Foxe!"

Bundgaard reminded Luke a little of a fictional character Svend had described, except without the hook. There were two unsavory looking toughs lounging near the fire who didn't bother to move when the owner greeted Luke.

Luke quickly got down to business. "We're here to finalize the order for the expedition. I brought Adolphus along because we need to add some additional mining tools to the list." Bamberg handed over a short list. "Can you supply these by the end of February?"

Bundgaard read the paper. "I should have no trouble and the price will be reasonable. Come into my office and we can work out the contract's details."

Luke thought Bundgaard's eyes reflected the stacks of coins he was expecting to count.

An hour later, after some serious haggling over terms and dates, Luke's party emerged. "Very well, half now and the remainder by the first of February. All supplies to be delivered by February fifteenth. My crews will load from your warehouse by the docks."

* * *

Once outside, Bamberg turned to Luke. "I hope we did the right thing. I don't have a very good feeling that we are going to get what we paid for."

"I know what you mean, Adolphus, but as you said before, what choice do we have?"

* * *

A Dutch captain and his bosun headed straight for the shop Luke's party had just left. When they entered, the two toughs immediately stepped over and blocked their way. "We're here to see that swindler, Bundgaard. Those provisions he sold us for our last voyage were mostly barrels filled with stone and sawdust. My men almost starved because of his thievery."

"Fister Bundgaard does not want to see you!" Both men blocked the doorway to the office Bundgaard had retreated into. The captain tried to force his way past, but one of the toughs tried to deck him with a roundhouse punch. The captain ducked, then tripped over a chair, smashing it to splinters.

When the second tough moved in, the bosun pulled a belaying pin from his jacket and waded in to help his captain. Bundgaard emerged from his office with a cudgel and joined the fight.

Karl and his patrol were passing by and heard the commotion. About the time Karl reached the shop, the front door flew open and the fighters fell through the doorway in a mass of bodies, fists and weapons. The patrol judiciously applied their cudgels. In a few moments, the fighters lost all interest in each other.

"Who are you and how did this start?" Karl asked.

Bundgaard interrupted before the captain could say a word. "These hooligans broke into my shop and attacked my men. I'm Dagmar Bundgaard and I'm . . ."

*Thunk!*A quick rap with a cudgel by Gunnar silenced Bundgaard immediately.

"You were about to tell me before we were so rudely interrupted . . ." Karl said.

The captain picked himself up. He wiped the snow and dirt from his clothes and the blood from his lips. "I'm Piet van Hoorne, captain of the ship *Maastricht* . This swindler sold me provisions on my last stop here. Instead of salt meat and fruit, most of the casks and kegs were filled with stones and sawdust. My crew nearly starved. I came to get my money back!"

"That's a lie!" Bundgaard shouted. "You tried to attack and rob us. Sergeant, I demand that these men be locked up!" Like two bantam roosters, Bundgaard and van Horne tried to start fighting again.

"This is a job for the magistrate. You are both going to jail until we can straighten this out."

Sputtering and trying to get out of Karl's hold, Bundgaard threatened, "Don't you know who I am? I have friends in very high places. Your commander won't like this."

"I've been in trouble with the commander before. I've heard stories about you. You'll get your say before a magistrate," Karl said.

* * *

The next morning, Karl got a summons to see the commander as soon as he arrived for his shift. The commander rose from his desk, walked over, slammed the door shut and got right in Karl's face. "What the hell did you think you were doing arresting Dagmar Bundgaard? His cousin is one of the King's

ministers. You should have just hauled that fat Dutchman and his crewman in and let it go at that. We're supposed to protect the people that pay us. Foreigners can rot in jail for all I care!"

Karl interrupted. "I've heard a lot of stories about Bundgaard, and they are all unsavory. He's a cheat and a thief. I decided to let the magistrate sort it out. Next time, maybe, I'll act differently."

"If there is a next time, you won't need to bother because you'll be out of a job. As of now, you and your patrol work the dock area at night, until I decide differently. Now, get out!"

Karl left, muttering, "Maybe I should look into becoming a farmer."

January 1634

"I never thought I'd be a duenna," John complained, while he walked behind Svend and Agnes through the snow. Today was Svend's big day to show Agnes around the ship. Agnes was so eager for the tour that she decided to accompany John and Svend on their errand beforehand. John pushed the wheelbarrow that would carry the wine Captain Foxe wanted for his own stores for the voyage down the cobblestone street. Luke had given Svend a list of what he was to purchase and a full coin purse to pay for it. It seemed that Bundgaard had passed the word that anyone who sold to Captain Foxe would be visited by his toughs. Sending John and Svend was Mette's idea, to avoid Bundgaard's monopoly and get a better price on the wine. John still felt uneasy about Bundgaard and hoped there wouldn't be any trouble for his captain. "We should only be here a short time. Then we can return to the ship for your tour."

Agnes smiled at Svend. The light snowflakes that had settled on her hair and eyelashes made Svend think of the fairies he had read about.

The wine shop owner was a rotund, red-faced gentleman who evidently sampled his own wares. While he loaded the bottles, he kept up a constant stream of advice. "Remember young sir; let the bottles have a chance to settle before you have them served. Also, store them on their sides to keep the corks moist. That will help preserve the wine's flavor." Svend paid for the purchase and then they left.

When they reached the ship, the snow was coming down hard enough to muffle all sound. Agnes' eyes lit up in delight. The rigging was covered in snow. "It looks like it's covered in lace!" Two crewmen spotted John and hurried down the gangplank to assist in bringing the wine on board.

"I must be old," John muttered, "pushing a wheelbarrow like this never was this hard before."

Svend laughed. "Mistress Roe, may I present the ship *Köbenhavn* and its crew, ready for your inspection."

Agnes dropped a curtsey. "Thank you, good sir. I am ready." She offered her arm to Svend.

John broke down laughing at their antics. Eventually, the laughter spread to Svend and Agnes and all three boarded the *Köbenhavn* , unable to stop laughing.

The laughter brought Luke on deck to investigate. When he spotted John laughing, he called across the deck, "Mr. Barrow, I sent you to fetch the wine, not sample it!"

John looked like a fish out of water, until he realized the captain was just pulling his leg. He turned to Svend and winked. "I guess I'm in trouble. You'll just have to escort Mistress Roe by yourself."

Svend helped Agnes ascend the ladder to the aftercastle. "Here is where the captain runs the ship." Agnes walked to the railing and peered down. She stepped back quickly, "That's a long way down to the water."

"Not half as far down as the view from the masthead," Svend said.

"This is quite high enough for me. I'll never go that high up." She gestured back to the stern and asked, "What's the porch at the end of the boat for?"

"This is a ship, not a boat and that porch is the captain's walk. When Captain Foxe wants some privacy, he has his own deck area. If you'll follow me, I'll show you his cabin and where the officers and staff are berthed"

For the next hour, Svend guided Agnes on a tour of the ship. The cramped crews' quarters were warm, even though it was snowing on deck and were rank with the smell of unwashed bodies mixed with the smells from the bilge. They beat a hasty retreat from the smells and took a short cut through the hold to reach the ladder leading to the forecastle. When they were back on deck, Svend announced, "That's the tour for the ship. Do you have any questions?"

Agnes blushed but asked, "It's been a long morning. Can you direct me to the necessary room before we go?"

Svend felt like he had swallowed a fly. Captain Foxe and Mr. Barrow were nearby and overheard the exchange. "Didn't I tell you, John? Just the other day I said we should have Mette come by to get a woman's point of view! We'll have to make provision for any female passengers we embark! Mistress Roe, I must apologize but the only one we have is for the crew. It would not be appropriate for a lady. I imagine what Svend choked on was the thought of trying to explain the head to you. Master McDermott, escort Mistress Roe to the King's Arms Inn. She can freshen up there and we all can have a nice meal before you escort her back to Sir Thomas' house."

* * *

During the meal, Captain Foxe regaled the youngsters with tales from his last voyage to the New World. Two hours later, while Svend walked Agnes to her uncle's house, she stopped to admire the ship through the curtain of snow. "I truly envy you, Svend McDermott. So many adventures ahead. I wish I could go with you." She took Svend by his hands, reached up on tip toes and kissed his cheek. "Thank you for letting me see a little of your new world." She paused for a moment and then pulled him along as she headed off for her uncle's house. "I should be getting home soon. Cook will wonder what's become of me."

Even with the snow swirling around them, Svend could have sworn the sun was shining.

* * *

That evening, after all the supper patrons had been served and the main room had cleared, Luke asked Mette to join him. "Mette, I've come to value your advice. I need a woman's perspective on a problem that has come up. The expedition's planning has overlooked the women's needs and that could cause

some serious problems. Could you take some time out from your busy schedule to help me identify what I've missed?"

"Of course, Luke. You've done so much already for me and my family; I would be delighted to help."

When she smiled, Luke screwed up his courage to ask the other question he had been afraid to ask. "Mette, I've also come to value my time spent here. I've never had a family and have no close relatives. Svend has almost become a son to me."

"He's spoken highly of you, too. He's missed his father and you are such a good influence. The other children have enjoyed the tales you've told in the evenings. I have, too. You should consider publishing your journal. People would be interested in the New World. You've brought a joy to the house that hasn't been here for some time." She blushed a bit. "I've enjoyed your company, too, Captain."

"Please call me Luke. This is very hard for me. I know you lost your husband to the sea and I'm not a young man, but would you entertain an offer of courtship? I've nothing to offer but myself and my ship right now. But if this expedition is successful, we should be able to retire very comfortably."

Mette sat as though she were in a daze. Luke slowly rewrote Dante's Inferno in his mind, with himself as the main character, as he waited for Mette's reply. Gradually, a smile lit up Mette's face. "I would be honored, Luke." In one galvanic leap, Luke's heart went from hell to heaven.

Mette continued, "I've had similar feelings, but was afraid to voice them. Let's wait to tell the children until your plans are more settled."

Luke took Mette's hand and drew her to him. It was quite some time before they remembered the expedition's needs.

* * *

The letter had arrived the day after Christmas, to announce that the miners Herr Cavriani had convinced to join the expedition were on their way to Copenhagen. Adolphus Bamberg had just enough warning to convert his warehouse into temporary quarters. When he finished, Sir Thomas and Reuben Abrabanel stopped in to check on the progress.

"Are these makeshift quarters going to be sufficient?" Reuben looked around skeptically. The canvas partitions gave little privacy. The two stoves, one at each end of the room, gave just enough heat to take the chill off.

"Once we get twenty or so people in here, it should be adequate. With all the refugees in town, they should be thankful that they have four solid walls and a roof. Captain Foxe says that he will quarter any overflow on board the *Köbenhavn* . Its temporary cabins are set up and can handle any families that arrive. We're just taking the single men here." Bamberg pointed to the door in the rear. "The sanitary facilities will be stretched, but the cold weather should help some. There was a new pit dug last summer."

Sir Thomas gave his approval. "You did a good job on such short notice, Adolphus. Two weeks seems like a short time for a group to travel in winter down the Elbe River. Have you heard how many miners are coming?"

"No, just that they left for Copenhagen about two weeks ago, and that I should expect a large group. Herr Cavriani was very sparse on the details. I'm not sure he was even there when they left. I'll send a

note to you when they arrive."

* * *

Late the next evening, just after he had retired for the night, a loud pounding on the main warehouse door roused Bamberg. In a heavy dressing gown and cap, he hurried to the door. The local sergeant of the watch, Karl, along with another man, covered in snow, stepped in when he opened the door. "I have a group at the docks who say you're expecting them. They say they're miners from Bamberg and look down on their luck. I didn't want them wandering the streets at this time of night, and in this weather, without making sure they were who they said they were. This man is their leader, Ludwig Steinbrecher."

"You did well, Sergeant. They are expected. The families are to go to Captain Foxe's ship' the *Köbenhavn* . Do you know where she's docked?"

"Yes, sir."

"Have the families report there. The rest are to come here. Herr Steinbrecher, how many are there in your group?"

"I have eight families and eighteen single men. We also have two wagon loads of tools and household goods. I'll send those to the *Köbenhavn* in the morning. The wives are looking forward to dry, rat-free quarters."

"Rest assured, the quarters we have are dry, rat-free and heated. While you get everyone unloaded, I'll roust out my assistants. We will get the fires going here to warm up the living area."

Bamberg whispered to Karl, "See me in the morning; I'll have something extra for your help, Sergeant."

"Thank you, sir. My men will appreciate it."

* * *

Over the next few days, the miners and their families settled into their new quarters. The trip from Bremen had been difficult due to the weather, but uneventful. All had experience working in the iron mines of the Upper Palatinate. Leopold Cavriani had found them and convinced them to join the expedition on a shares basis. Sir Thomas and the Abrabanels were extremely pleased with the skills Cavriani had listed for the recruits in the correspondence the miners brought with them.

Adolphus arranged for the Company's chief investors to meet with the miners at the warehouse. Seating was crowded, but everyone had a place and the room soon grew warm. Sir Thomas called for silence. "The main goal of this initial expedition will be to start a colony in the south end of Hudson's Bay, with a

layover station in Newfoundland. The colony in Hudson's Bay will initially serve as a fur trading post and provide a base for expeditions to locate and start mining operations for nickel and gold deposits. Herr Diedermann, your group of eight families will be part of that effort. Your families will be housed at the fort, while your advance parties work at locating the deposits and start the initial site preparation. Yours will eventually be the largest operation but will take some time to develop.

"Herr Steinbrecher, your group will be able to start iron mining near the layover station in Newfoundland. There was a previous English expedition that located iron ore deposits on an island in the harbor we plan to use. Your group will develop that deposit. It has the potential to be the largest iron mine in the known world. Now that you've heard what's planned, are you still interested?"

The only sound in the room was from the logs popping in the fire. Diedermann and Steinbrecher turned to their groups to find out their thoughts. The discussion became quite animated for a time.

Steinbrecher's group finished first. "We agree, but have some questions and suggestions. You mentioned a previous expedition. Will there be any problem from that and did they leave anything there?"

Sir Thomas smiled. "My father was an investor with that group. All they did was identify the iron deposit. We've confirmed from another source that the size of the deposit is much larger than they originally thought. Nothing was done at the site itself."

"In that case, how many foresters do you have on the expedition? We will need some lumber for housing and a lot of timbers for the mine. Also, at least two pairs of oxen for hauling."

Sir Thomas and Saul looked to Reuben, who was shuffling through his papers.

"Aha!" Reuben brightened as he found what he was looking for. "We have eleven families of foresters amongst the refugees with seventeen adult males. Will that be enough?"

"That should be adequate. You have yourselves a mine crew."

Diedermann's group was still vehemently discussing their options. At first, Sir Thomas appeared concerned with the level of apparent disagreement. As he concentrated on the exchange, he realized he could resolve the issue easily. "Herr Diedermann, if I might interrupt for a moment. We realize your group is mostly experienced with mining iron ore. Your concerns on whether those skills can be used in locating nickel and gold deposits are valid, since you don't know the source of our information. We have maps and pictures from Grantville's library, and for someone with your mining background, it should present minimal obstacles to locate these deposits. Once the sites are located and marked, we will send a second expedition to handle the refining and transportation of the metals." Sir Thomas sat down to wait for more questions.

From the back of the room, a voice rang out. "To the future of the Hudson's Bay Company mines!" Steins were raised in a toast and quickly downed. The crowd surged toward the tables to sign the work contracts.

* * *

The next day the sun was bright and the southerly breeze brought the temperatures up enough to start seriously melting the snowdrifts. Captain Foxe sent John Barrow to oversee the movement of the families' personal effects to the *Köbenhavn* and the tools to the *Wilhelm* .

John reported, "Everything's moved and stowed, Captain. And speaking of scoundrels, have you heard when we can expect to start loading our supplies? Time is getting short."

"My latest contact from Bundgaard is that we can expect the tools, weapons, and equipment later this week. He said nothing about the food stores. I'm beginning to worry on that score. The siege at Luebeck has already driven food prices up and rumors are rampant about future problems. Thank God we bought when we did."

John walked down the forecastle, muttering, "I hope you're right, Captain, and the rumors I've heard are wrong. Otherwise that thieving bastard may ruin the whole expedition."

* * *

To be continued in *Grantville Gazette* Volume 23

Deep Water

Written by Kerryn Offord

In October of 1633 Al and Sam Morton became instant heroes when they sank six enemy ships at anchor in the River Trave just down river from the city of Luebeck.

But that was then.

It took all of a couple of weeks before the city fathers reconsidered the status of the Mortons. In their careless enthusiasm, the brothers had sunk the ships plumb in the middle of the deep water channel. It was potentially a very expensive problem. With the channel effectively blocked, shallow draft coastal ships could sail around the wrecks, but no large merchant would be able to make it in or out of Luebeck. Someone was going to have to clear the deep water channel. The city fathers dumped the problem on the people responsible for creating it: Al and Sam Morton.

June 1634, Travemünde, Luebeck Bay

Sam Morton reassembled the non-return valves and attached the first one to the testing rig. These valves were too important not to be tested regularly. If he and his brother had ever forgotten the stories from their dive instructor about his time as a hard-hat diver, the recent stories coming out of Denmark would have been more than enough warning.

"Any word on a new diver yet?" Al asked.

Sam shook his head. "Nah, I guess the stories coming out about King Christian's latest execution machine have scared everyone off."

"You'd think the fact that we use the rig ourselves would be enough to give them confidence."

"Nah. They think we've just been lucky so far."

"Lucky? It's proper safety systems and preventative maintenance that's stopped us from having any system failures. Do they have any idea what the consequences are of a systems failure underwater?"

"You mean like what happened in Copenhagen?" Sam asked. "I think they know what the consequences are and they aren't willing to risk them."

"What we need is someone who doesn't know about the events in Copenhagen, or is too dumb or cocky to care."

"Where're we going to find anybody who hasn't heard about Copenhagen?" Sam asked.

"It'd have to be someone who hasn't seen the papers. That kind of death is too gruesome not to have been picked up by the media. I guess that leaves dumb or cocky, and I won't dive with 'dumb.'"

Sam grinned. "That leaves cocky, and I know someone who might fit the bill."

"Who?"

"Matt Tisdel. We certainly know he can swim."

"Yeah, I guess a state age group champion knows how to swim. Any idea what he's doing these days?"

"He was two years behind me at school, so he should have graduated this year. Let's send a cable and ask."

"Nah, we'd better go through channels and pass a request on to the Navy and let them ask Matt if he's interested in diving."

Luebeck

The harbor at Luebeck was hardly a hive of activity. The only vessels in port were those caught before the siege and small coastal traders able to make their way around the wrecks blocking the deep water channel. Miquel spat into the harbor. There was nothing there for a respectable sailor. It was the hiring hall again for him.

* * *

Miquel couldn't believe his luck. Not only did he have the chance of a job, but it was a well-paying one. If he got this job there would be no more sailor's hostel and miserable day laborer's wages. The Americans were offering employment for a whole quarter, by which time he should be able to secure a place on a ship out of Luebeck.

He looked down at the scrawled note from the hiring hall. It was in German, which he couldn't read. He approached a dockworker for help.

Travemünde, Luebeck Bay

Miquel knocked hesitantly on the door he'd been directed toward.

"Come on in, the door's open."

Miquel paused. That request had been in English. He knew enough of the language to recognize the instruction, but the accent was new. He pushed open the door to find two young men sitting at a table. "I am Miquel. I have come about the job, the diving job."

Miquel's English was fractured, and it was immediately obvious that the two young men had difficulty understanding him. He thrust the note from the hiring hall towards one of them.

Sam accepted the note, read it, and then passed it to his brother. "You have come about the diving job?"

Miquel was relieved that they spoke German, a language he knew reasonably well. "Yes, the diving job. I am a good diver. I dive for coral off the Isla del Aire."

"Where's that?" Al asked.

"It is an island off the southern tip of Menorca."

Sam shook his head. "Never heard of it. Where's Menorca, Miquel?"

Miquel tried to keep the disbelief off his face. How could they not know where Menorca was? They were up-timers; they were supposed to know everything. "It is the northernmost of the Islas Baleares." This time Miquel saw the blank looks and preempted the question. "They are islands off the Spanish mainland, east of Valencia."

"I guess if its east of the mainland it has to be in the Mediterranean." Sam said.

Miquel was surprised that the up-timer could even work out that detail. "Yes, the Mediterranean."

"A coral diver. Hey, Al, that's better than we expected. Miquel, welcome to the team."

That night

"You know what?" Al asked.

Sam rolled in his bunk and looked through the shadows toward his brother. "What?"

"I don't think Miquel knows about what happened in Copenhagen."

"How could he not know? It must have been in all the papers."

"Yeah, but I don't think he can read and write."

Sam considered that for a few moments. "Do we tell him?"

"Nah! Let's just make sure he understands about the non-return valve and what it's there for. Then when he finally hears the story, he'll understand that he hasn't been at risk."

"Okay. Now try and get some sleep. We have to start teaching Miquel how to use the dive suit in the morning."

Late June

Miquel peeked over the salvage assessor's shoulder. He couldn't read the writing, but he could read the numbers. They were low, but a fair assessment of the collection of junk which was all he'd been finding. Hefollowed the assessor into the office where Sam and Al were working.

"The assessment, gentlemen," Gotthard vonHöveln said, handing his clip board over to Al. "If this is the best you're finding on the wreck then I will authorize the final breaking up of the wreck and you may

proceed to the *Falken* ."

"You think there's anything else to find, Miquel?" Al asked.

"No. The wreck was pretty much picked clean before we started. About the only thing of any value we found were her anchors."

"Right, then I guess we blow this wreck to pieces and move onto the *Falken*. "

Miquel was happy to hear that. Whereas the other ships had sunk in barely a dozen feet of water—easy pickings for anybody with a boat, or willing to risk walking on the ice when the river froze during the winter—the *Falken* had sunk in probably the deepest hole in the Trave. With only the tops of her upper galleries breaking the surface she had to be in a hole at least thirty feet deep. That should have put the gun deck and the hold out of easy reach. The pickings should be better.

A couple of days later

Al walked into the cabin with a letter in his hand. "Sam, we've got a problem."

"How do you mean?"

"The admiral wants us in Copenhagen as soon as possible . ″

"So we go to Copenhagen. Where's the problem?" Sam asked.

"You're forgetting the little matter of the city fathers and their deep water channel. They're going to insist we finish what we started. "

"Oh!"

"Yeah, oh! Miquel's competent, and the surface crews are well drilled, but for safety's sake we're going to have to find an assistant diver for Miquel before we can head for Copenhagen."

"Hell, it took long enough to find Miquel." Sam sighed. "Maybe he's got a friend."

"I don't think so. He spends nearly all his time on the dive tender."

"So what do we do now?"

"Send out an S.O.S. to the Navy. If they want us in Copenhagen, they need to find us a new diver to finish clearing the channel."

* * *

Hard hat diving. Matt Tisdel never thought he'd ever be doing that, but that was the assignment he'd been offered. There had been a few carrots attached. With the reputation of hard hat diving having taken a real dive with the stories coming out of Copenhagen, the Navy had been generous with its bribes.

He checked his travel orders. Yep, he was in the right place. He tossed his sea bags onto his shoulders and walked past the dive tender toward the office.

Matt had filled out a bit since Al had last seen him and it took a few seconds before recognition dawned. "Matt, what brings you here?"

"The Navy sent me."

Al gestured to a chair. "Take a seat. Actually we asked the Navy to ask if you were interested in doing some salvage diving, but that was a month ago."

"Well, I got my orders just a couple of days ago. Maybe they thought you still wanted me."

Sam poked his head through the door. "Hey, Matt. What brings you here?"

"The Navy sent him," Al answered.

"Does that mean I don't have to send that S.O.S.?" Sam asked.

"S.O.S.?"

"We just got instructions from Admiral Simpson to head to Copenhagen and we were wondering how we could be in two places at once. It seems you're the Navy's answer," Al explained. "So, first question how's your Spanish?"

"Spanish? Okay I guess. I've been in Ms. DiCastro's Spanish class the last three years, why?"

"Because your co-diver's a Spaniard. His English is lousy, and his German isn't a lot better. Come on through and we'll introduce you to Miquel.

Two weeks later

Miquel looked at the gun deck and swore. There was barely five and half feet of head room. Normally that wouldn't present a problem, but with the dive helmet on he couldn't stand up without banging his head. That meant he would have to go in on his knees. He pulled in enough line and air hose to give him some slack and went in.

He stumped along on his knees, dragging his weighted feet behind. Every couple of steps he reached out with his barge pole, searching in the dark for anything that might be interesting. There wasn't much though. When the Mortons sank the *Falken* they'd been a little over-enthusiastic. The blast that sank her had sent nearly every cannon on the *Falken* rolling around. He and Matt had managed to salvage the lighter cannon from the top decks and some through the gun ports, but Miquel expected to find the heaviest of them in one big tangled mess somewhere on the gun deck.

He tugged on his lines, telling Matt to give him some more slack, and moved forward on his knees, trying to keep his head high without hitting it on the low beams.

Further into the gun deck he hooked onto something solid. He worked his way closer until he was finally right on top of his discovery. It was a cannon, and one still attached to its carriage at that. He felt through his lines looking for the thick leader line. Hauling on the leader he soon had a heavy hauling line. He tied that around the cannon and worked his way back to Matt. Together they hauled on the line, to no effect.

Miquel sighed. It was too heavy and too entangled. He signaled to Matt that they should surface.

* * *

Miquel sat at the unsuiting area staring out to where the *Falken* just broke the surface. "The cannon are in a tangled mess and we can't move them," he told Daniel Spieker.

"What about making a lifting bag and using one of the spare air hoses to fill it?" Matt asked.

"Not enough height on the gun deck, Matt," Daniel said. "We'd need a bag about five feet in diameter, and with the gun deck barely five and half feet high, well, I'm sure you see the problem."

"Then what about cutting open the deck and lifting them straight up?" Matt asked.

"Cutting the deck with what?" Miquel asked. "Those decks have to be three or four inches thick. Using a saw underwater would take forever."

"What about explosives?" Matt asked.

"Do we have any, Daniel?" Miquel asked.

"No. The Mortons took it all with them to Copenhagen."

"Can't we order some more through the Navy?" Matt asked.

Miquel thought about it. Explosives would surely be a quick way to make a hole in the *Falken's* deck. "Daniel, would you write up a request for me and see that the Navy gets it?"

A week later

When he suggested ordering some explosives through the Navy, Matt had firmly expected it to arrive complete with someone skilled in its use. He'd been wrong. What they got was a demolitions kit, complete with a simple instruction booklet. The Mortons wouldn't have had any problems with what was sent, but they weren't in Luebeck.

Matt read through the booklet. On the face of it there wasn't much to working with explosives. You prepared your charge. Placed it where you wanted it. Set the detonator and after retiring a safe distance, set it off. It sounded simple. Too simple. "Miquel, I'd feel a lot better about this if we did a little experimenting with really small charges until we're confident enough to set a big charge."

"Nonsense, Matt. Sam and Al never played around with small practice charges. They went straight in and set their main charges. I have seen them do it. Read the manual and we'll see about setting our charges."

Matt sighed. It was times like this he wished Miquel could read. Then he'd know that Sam and Al didn't exactly follow best practice when using explosives. However, Miquel was the boss, and anyway, he wanted to see if he could do it.

"Okay, but I'll be placing the charges in snorkeling gear. There's no way I'm going to handle explosives for the first time in a dive suit."

"Whatever makes you happy, Matt."

* * *

Matt swam to the surface unrolling the spool of wire as he went. He handed the spool to Miquel and hauled himself onto the dive tender. "That's done. Give the order to clear the water while I connect the wires to the blasting box."

While Miquel hurried off to order everyone out of the water Matt connected the wires to the blasting box. When that was finished, Miquel was standing beside him. "All clear?" he asked.

"All clear," Miquel confirmed.

Matt nodded and started loudly calling out the countdown. "Blasting in five, four, three, two, one . . ."

BOOM!

The water over the middle of the wreck erupted.

"I hope that doesn't mean we used too much," Miquel commented.

"I used as much as the formulas said I needed to cut through those main beams, Miquel. What is it you're worried about?"

"If the blast was that violent on the surface, might it not have also blasted the gun deck? We don't want to make a hole in the roof just to find the cannon have fallen through a hole in the floor."

Matt stared at the wreck. Miquel had a point. The blast could have damaged the gun deck. "It should be okay. There's at least five feet of water between the charges and the gun deck. Anyway, we'll know soon enough."

* * *

Less than a quarter of an hour later Matt was back in the water in his snorkeling rig swimming around on the surface examining the hole he'd made in the *Falken's* deck. Satisfied that there were not going to be any danger he took a deep breath and duck-dived down for a closer look. The hole was a little bigger than he'd planned, and the edges had a lot of sharp splinters that might catch on the lines or air hoses. Whoever was acting as dive assistant would have to take special care at that point. He poked his head through the hole and looked around. With the additional light his new hole let in, he could make out the tangle of cannon and the ropes that should have restrained them. They were still going to have fun getting the cannon out, but the hole would certainly make things a lot easier.

Later that day

Matt accepted the rope from Miquel and looped it around the top cannon. When he was satisfied he tugged on a signal line and settled back in the gun deck well away from the cannon should it swing about when it lifted.

Matt found himself counting the hiss-click of his non-return valve as he waited for the cannon to start moving. Well into the four hundreds it finally started to move. Matt stopped counting and signaled Miquel.

Slowly the cannon lifted, trailing thick ropes. It was going to be his job to deal with the ropes if they caught on anything.

The cannon rose only a few inches before its progress was stopped by a rope. Matt stumped forward in his weighted boots and pulled on the offending ropes. That didn't achieve anything. Above water they'd use an axe to cut the rope, but that wasn't possible underwater. Matt had to saw at it with a machete-like blade.

After a few minutes sawing, he swapped hands. A few minutes later, he swapped back. Sweat was starting to run down his face, and the face plate was starting to fog up. There was nothing he could do about the sweat, but he could clear his face plate. He stopped sawing at the rope to suck in some water through the spit cock and sprayed it on the glass. Then he spent the next few minutes futilely trying to remove the foul taste of the river from his tongue.

Eventually he cut through the rope and the cannon rose again. To be stopped by another rope. Matt sighed and moved in to cut it away.

Matt was completely exhausted even before the cannon was freed. Watching it slowly ascend he signaled to Miquel that he needed to talk. This was way too much like hard work.

* * *

"How long did it take to clear that cannon?" Matt asked.

"You were down a bit over two hours," Daniel answered.

Matt turned to Miquel. "At this rate we could be here until Christmas. There has to be an easier way to cut those ropes."

"How would you cut them up-time?" Miquel asked.

"Cutting shears, I suppose."

"Well, we don't have any. Any other ideas?"

Matt shook his head. "No, but could we at least attach the cutting blade to a pole? Every time I had to crawl under the cannon to cut a rope I was terrified it was going to fall."

"Daniel?" Miquel asked.

"Sure, I can do that. I should have thought of it earlier actually. With a pole you should be able to use both hands and put more power into each cut."

"That would be great, Daniel. It was darned hard work doing it one handed," Matt said.

Two hours later

Miquel paused in his sawing and tried to relax his shoulders. If this was how it felt using Daniel's new cutting pole he could only admire Matt's perseverance with the hand blade. It might not take them until Christmas as Matt had suggested, but it *was* going to take several days to get to the bottom of the tangled pile of cannon.

That evening

Matt sank lower into the steaming bathtub. "I'm going to need a new set of shoulders tomorrow."

"You weak Americans. A little real work and you're out of work for a week."

Matt snorted. "And I didn't hear a certain Spaniard complaining about his sore shoulders?"

"No, that was just your over-active imagination. There are no Spaniards here."

"This ignorant American thinks that the Balearic Islands are part of Spain."

"Then the ignorant American is truly ignorant."

"Yeah, anyway, what are your plans for when we finish clearing out the *Falken* ?"

"I was hoping just to save a little money and then get a place on a ship out of Luebeck, but since using the new diving equipment I've been thinking about buying a couple of the new snorkeling sets and trying my luck doing salvage work in the Caribbean."

"You mean treasure hunting?"

"Yes. On my last trip to the Caribbean, I was able to dive on the site of the *Santa Margarita* ."

Matt heard a heavy sigh from Miquel. "What's the problem?"

"A snorkeling set will be better than what I used last time, but I would still be limited to a few minutes at a time. What I need is a hardhat suit. The trouble is, I can never afford one."

"Hey, for a share of anything you can find I'm willing to chip in some of my savings and anything we get as a bonus from this job."

"Thank you, Matt, but even if we recover all the cannon our shares wouldn't be enough for a full hard hat rig."

"Don't forget the cannon balls."

"Yes, Matt, one shouldn't forget the cannon balls. There are many thousands of them, and we will have to lift each one to the surface. You think cutting the ropes today was bad, wait until you have individually picked up three or four thousand cannon balls. It is no picnic."

Matt could feel his shoulders tighten at the thought of lifting that many cannon balls. "Does it have to be a hard hat? Why not SCUBA? How deep are you planning on diving?"

"The waters where the *Santa Margarita* was lost were a little over forty feet deep."

"At those depths in the Caribbean you won't need a dive suit. Why don't we talk to the guy who made the helmets and see if he can make us a SCUBA rig?"

Workshop of Asmus Brockmann

Asmus put aside the books Matt and Miquel had provided and sat back in his chair. Closing his eyes he thought about the SCUBA rig the American and his colleague wanted.

"I know the books say the diaphragm is rubber, but maybe you can use leather," Matt said.

"You are behind the times, Herr Tisdel."

"Huh?"

"You haven't heard about the Gribbleflotz Kirlian Imager?"

"No." Matt shook his head. "What's that?"

"Never mind what it is. Just accept that it uses rubber. I will ask my contacts in Magdeburg about getting some." Asmus steepled his hands. "Of course that will take time."

"How much time?"

"I'm sure I can have a working regulator available well before anybody can make SCUBA tanks."

"SCUBA tanks are going to be difficult?" Matt asked.

Asmus opened his eyes and smiled. "Anything small enough for a man to carry that holds enough air to be worthwhile will be difficult. So, do you still want me to start work on your new underwater breathing apparatus?"

"Can you make one that can connect to a surface compressor?" Miquel asked.

Asmus sat up. "You mean replace the existing helmet with just a regulator on the end of the hose?"

Miquel nodded.

"Well, I suppose that could work. There is the problem of a reservoir for the diver to breathe from . . ." Asmus started doodling on the pad he was using to take notes.

"Reservoir?" Miquel asked.

"Yes, normally the helmet acts as the diver's air reservoir. If you do away with the helmet, the diver needs a reservoir of pressurized air to draw on . . . I think we will need a storage tank. Nothing very big, just enough to ensure the diver has a steady supply of air."

"You could make one?" Matt asked.

"I think so. A reservoir tank fed from a compressor doesn't need to hold more than a few minutes of air. We can probably get away with only a couple of hundred pounds pressure. And the plumbing will be simpler. Yes, if I can get the rubber it should be possible."

Matt stood up. "Well, if there's anything we can do to help, you know where to find us."

Asmus escorted the two divers out and returned to sit at his desk. He gazed at his doodles for a few minutes before turning to a clean page and started to sketch breathing apparatus.

A week later

Matt cut the last fiber of the last rope and the cannon floated free. At last. He pushed on his pole with

the saw bladed knife attached, then carefully got to his feet. Kneeling in the dive suit while he cut the ropes anchoring the cannon was extremely uncomfortable and he welcomed the opportunity to stretch his legs.

As the cannon floated through the hole he'd made in the top deck he stepped forward, probing with his pole, trying to decide which of the half dozen remaining cannon to work on next.

There was a strong jerk on his safety line. Then it was repeated, rapidly. He looked up to see what was pulling on the line, and froze. The cannon he'd just seen heading for the surface was now heading for him. He threw himself backwards. At least he tried to throw himself backwards. Most of his body moved easily out of the plunging cannon's way, but his feet, each of them in special boots weighed down with nearly twenty pounds of lead, stayed anchored to the deck.

The cannon missed his foot, just, but it crashed through the gundeck, and the trailing ropes and the deflated lifting bag dragged him down.

He bashed his head on the back of the helmet when it hit the deck on the way down, then his feet hit the bottom, and his torso continued falling until it hit the cargo in the main hold.

Bruised and aching, Matt tried to step out of the tangle of ropes and lifting bag. His left foot moved easily enough, but his right foot was caught. Using his belt knife he cut away the various ropes until he could see what was holding his foot.

"Oh, shit!"

The cannon had smashed open a large box and his foot had followed the gun barrel into the box. The cannon and its carriage were crowding the opening so he couldn't pull his foot out.

He tried to reach down to remove the boot, but the bulk of the helmet and the heavy breastplate made it impossible to get a hand near his foot.

"God damn sonofabitch." Matt tried to move the cannon. It wouldn't budge. He leaned on it, breathing heavily, and wondered what the hell to do. Then he realized all he could hear was his own breathing and he knew he was in real trouble.

On deck

Everything was going as normal. Miquel had just signaled that a cannon was on its way up and preparations were being made to lift the cannon onto the tender. Then Daniel noticed the change in rhythm of the number one compressor. "Keep pumping, Hans."

A sudden increase in the rhythm of the compressor meant that the resistance to the flow of air had been reduced. It could be nothing, just a momentary glitch, or it could signal something really drastic, like a break in the air hose.

"Matt's in trouble," Jürgen Weidemann called.

"Georg, what's Miquel doing?" Daniel asked Miquel's attendant.

"He's asked for more slack," Jürgen replied.

Twenty-five feet underwater

Miquel spotted the major problem quickly. The "whip" hose between Matt's helmet and the control valve had been ripped apart, leaving him with only the air trapped in his suit. He descended toward Matt. If he could free him quickly, getting him to the surface would be a simple matter.

A few seconds was all it took to realize there was going to be no quick fix. Although the cannon carriage didn't appear to be crushing Matt's leg, it did make it impossible to free his trapped foot. Mindful that he didn't have a lot of time before Matt ran out of air Miquel tapped Matt on the shoulder and signaled that he was going up for a replacement whip hose.

* * *

Matt knew something was wrong with his air supply because he couldn't hear the regular hiss-click of the non-return valve. He must have torn it when he crashed through the gundeck. He had to trust Miquel and the support team. If anything could be done, they would do it. He just had to try and relax so they would have the maximum amount of time to change his connection to a new air hose. He tried to distance himself from what was happening, because every time he thought about his situation he started to gulp air, wasting it. *A working diver at thirty-three feet needs nine cubic feet of air every minute. The helmet and suit probably have about six cubic feet.*

Of course half of those nine cubic feet a working diver should receive were safety factor. So, at a pinch, at this depth, a working diver could function on only four and a half cubic feet per minute—or he could work for about one and a half minutes on the contents of the suit and helmet alone. However, right now he wasn't working. That meant the air in his suit and helmet should last longer.

But how much longer?

On deck

"Emergency ascent, Miquel's coming up. Get the stage into the water," Georg Doppel called.

Daniel swung into action. "Jürgen, Hans, help swing the stage."

The three men had the stage swung overboard and into the water when Miquel burst through the surface and bobbed about.

"Jürgen, pull him closer to the stage," Daniel called.

Jürgen used the safety line tied around Miquel's waist to pull him towards the decompression stage.

Miquel grabbed hold of the stage and pulled himself aboard. Then he unclamped the faceplate so he could call out to the deck crew. "Matt's trapped and his whip hose is torn. It's too fiddly to replace wearing gauntlets. Bring me aboard so I can unsuit. We can use my air hose and I'll free dive."

The deck crew guided the stage onto the deck, and while Hans and helped Miquel out of the helmet. Daniel ran to get the tools Miquel would need.

"Get me a face mask, and drop some weights into a tool bag as well, Daniel. I want to get down again fast. Matt doesn't have much time."

Miquel sat impatiently while Hans unbolted the breastplate and Jürgen removed the weight belt and the leather straps that held the helmet firmly down on Miquel's shoulders. He knew they were working as quickly as they could, but Matt was thirty feet underwater with only minutes of air.

Finally they got the breastplate clear. Miquel stood up as Hans and Jürgen pulled at the neck opening and the heavy suit slipped easily down his slim frame.

Miquel reached for the equipment he'd asked Daniel to get. He pulled on the up-time face mask before checking the contents of the tool bag. There were the two wrenches he'd need to reconnect the air hose and four six-pound cannon balls, more than enough to carry him straight down. He felt a hand on his shoulder. It was Daniel with the air hose. Miquel waited for him to tie it to the tool bag. Then with the weighted tool bad looped over his left arm, his left hand holding onto the air hose, and his right hand clamped over his face mask to stop the force of entry pulling it off, he jumped feet first into the water.

The weighted tool bag pulled him straight down onto the deck of the *Falken* . Within seconds he was looping the slack air hose ready to join Matt.

* * *

Matt had been drifting in and out of awareness, or maybe it was consciousness. He had a vague idea that carbon dioxide buildup would lead to unconsciousness. The fact that he was capable of that much thought reassured him. He wondered how it had been since Miquel left him. It couldn't be long, not if he was still conscious. He was breathing as slowly as he could, to give Miquel as much time as possible, but his body was starting to shake with cold. That wasn't good. It meant his body was burning the oxygen he needed to stay alive.

The clink of metal on metal ringing through his helmet dragged Matt back from the edge of panic. Then he realized something was holding his helmet. That had to be Miquel. He was back, and he was fitting a new hose to his helmet. Matt let loose a sigh of relief, and then he started worrying again. How long would it take him to replace the whip hose?

Suddenly water cascaded over the ports in his helmet. And then he heard it, the reassuring hiss-click of the non-return valve. The water must have been the contents of the whip hose. Miquel had done it. He'd saved his life.

He felt something, a hand, grasp his and squeeze it. He squeezed back. Then he saw Miquel. Hell, he was free diving. How long had he been holding his breath? Matt knew Miquel could hold his breath for a long time, but even sponge divers had limits. Which was one reason why he didn't panic when Miquel squeezed his hands once more before heading for the surface.

Matt watched Miquel follow his safety line up until he was out of sight. Then he just stood there, waiting patiently for Miquel to return, savoring to the life-giving sound of air passing through the valve.

* * *

Miquel broke the surface in a rush. "He's okay. Matt's alive," he called to the men on the support boat. "I'm going down again to try and free him."

"Understood," Daniel yelled back.

Miquel duck-dived, and using Matt's safety line, pulled himself down to Matt.

His explorations found that Matt's foot was trapped in a big, solid looking box, which had been badly damaged by the falling cannon. If the cannon had fallen another few inches its gun-carriage would have crushed Matt's leg. Instead it just obscured the opening, loosely trapping Matt's foot in the box. He tried to move Matt's foot. He could move it a little. He could even get a hand into the box to move around its contents to give more room, but the heavy dive boot wouldn't come free. He tried to unbuckle the boot, but with just the one hand he couldn't free the strap. There was only one thing for it. He reached up to Matt's belt for the dive knife.

It was a very good quality knife, with a razor sharp blade, but it still took a lot of effort to cut Matt's foot free of lacing and straps that held the heavy boot to his boot. Clamping the blade in his teeth Miquel eased Matt's bootless foot out of its trap.

Once Matt was free it was the work of a few seconds to maneuver the boot until it came free. Miquel dropped a couple of the small bags he found inside the box into the boot before pulling it out of the box. He was interested in knowing what Matt had found. He dropped the boot and it's cargo into the tool bag and passed it over to Matt. There was no way he could swim to the surface carrying all that weight, but in his dive suit Matt should have no trouble.

On Deck

"Daniel, how long to fix this?" Miquel asked, holding up the dive boot he'd cut free.

Daniel accepted the dive boot and examined the damage. "Hans could have it ready in an hour or so." Then his exploring fingers discovered something inside. He tipped the boot and two small leather sacks fell out. "Hey, what's this?"

Miquel looked on curiously. "I forgot about those. They were in the box Matt got caught in. What's in them?"

Daniel opened the drawstring on one bag and emptied it into his hand. "Silver." He looked over towards Matt. "Jeez, if you fell into a midden you'd come out smelling of roses."

Gotthard vonHöveln, the ever present salvage assessor, held out his hand. "I'll take that, thank you. As salvage from the *Falken,* it is the property of the city of Luebeck."

"What the hell? Matt almost died for that," Daniel protested.

"That would have been most unfortunate, Herr Spieker. However, he didn't." Gotthard held up the moneybags. "Herr d'Alcaufar, could you describe the box you found these in?"

"It was about so wide, so high, and so deep," Miquel indicated using his hands.

For the very first time since Daniel had known the lawyer, he could have sworn there was a smile on his face. "Is that good?"

"Yes, that is very good. The manifest lists two strong boxes of about the size Herr d'Alcaufar indicated. These bags are but a small portion of what should be in those boxes."

"Shit! What are we doing sitting around doing nothing while there's a fortune sitting right below us? Hans, get this fixed." Daniel tossed the heavy dive boot to Hans. "Matt, are you okay to go down again?"

"Sure, as soon as Hans fixes that boot and we can rig a replacement hose and test it."

"Right, then I declare an early mid-day break. We'll resume diving in an hour."

That evening

Matt walked over to where Miquel was leaning on the gunwale looking overboard. "Thanks."

"You would have done the same for me," Miquel muttered.

"I would have tried, but I can't hold my breath as long as you can."

"Then we are fortunate that it was you in trouble and me who was available to come to your rescue."

"Yeah, but what about next time?"

"We worry about it when it happens. Come, let's join the others in drowning our sorrow at how little of the silver the city of Luebeck is letting us keep."

A few weeks later, in the workshop of Asmus Brockmann

Matt lifted the back pack with the small reservoir tank on it. "I thought the reservoir was going to be on the surface."

Asmus nodded. "That had been my original thought, but I after you left I got to thinking. If anything happened to the air line the diver would run out of air immediately. This way he has a couple of minutes to get to the surface. Also I noticed in the books you left that the up-timers often used the SCUBA supply to inflate a buoyancy vest and thought you might like that ability."

Matt stared at the air tank. A buoyancy vest would allow a diver using the new rig to control their buoyancy just like a hard hat diver. "That's great thinking, Herr Brockmann."

"Thank you. I hope it is what you want."

Matt thought about Miquel diving in the Caribbean. They might not be able to afford a hard hat rig, but this lightweight dive rig was within their means. "I think it's exactly what we want, Herr Brockmann."

1635, near Marquesas Keys, the Caribbean

Three of the team from Luebeck had decided to accompany Miquel to the Caribbean. The whole crew, though, had contributed funds to the treasure hunters. There wasn't enough to buy a hard hat rig, yet. However, a little success using the lightweight diving rig Asmus had built and they would be able to afford to have one built according to the plans they had with them.

Miquel put on his face-mask and pulled up some slack in the lines and air hose. He clamped a hand over his face mask and jumped feet-first into the warm brilliantly clear waters of the Caribbean. Using his pole he started searching along the sea bottom.

Elegy

Written by David Carrico

Magdeburg, April 1635

Andrea Abati moved down the hallway with a light step. This was one of Marla Linder's lesson days, and he didn't want to be late.

Working with Marla was such a joy to him. As a *gentilhuomo* —or castrato, as he and those like him were more vulgarly known—his life in Italy had been one of performances mixed with adulation, a certain amount of scheming in the papal court, and frequent dalliances with ladies—often married—who enjoyed both his notoriety and the fact that an unanticipated pregnancy would never complicate their lives. In his early thirties, his voice fully mature and in the prime of his singing life, he had not yet begun to teach. But then he came to Magdeburg and met Marla Linder.

Andrea's friend, Maestro Giacomo Carissimi, called Marla's voice golden. Andrea thought that the maestro was guilty of an understatement. The young woman's voice surpassed his own in range, and was fully the equal of his in timbre. What she lacked was technique. And she awoke in him the hunger to teach, the desire to take a younger musician in hand as a gardener might take a sapling, to nurture the raw talent, help to shape it and grow it, until full maturity was reached. And as that hunger grew, Andrea's life began to change.

Il Prosperino, Andrea had been called in Italy. The name literally meant "The Prosperous One," but was usually meant to say "Little Prospero." It had actually been bestowed on him because in his early days in Rome he had been somewhat of a protégé to Prospero Orsi, an artist and fellow citizen of Norcia,

Andrea's home. Some wit had said, "Look, here comes Prospero and his Prosperino," and the name had stuck. He hadn't minded—in truth, he had been a bit smug about it. The name was appropriate, because he had indeed prospered in almost every way.

If musical talent was the cornerstone of Andrea's fame in Rome, flamboyance had certainly been the keystone. Flamboyant speech, flamboyant dress, and definitely flamboyant liaisons with the ladies. Yet here in Germany, exposed to the music found in Grantville, the uptime instruments and works and harmonies, bit by bit the flamboyance began to drain from him. That alone had shocked him when he realized it was happening. But to find it replaced with a desire to teach, when he had always looked down on teaching as the refuge of those who either could not perform to his high standard or those who were past their prime, that had been an even greater shock. But before long, *Il Prosperino* had been replaced by Master Andrea.

Andrea smoothed a hand down the front of his short-waisted black velvet jacket, and grinned to himself. Of course, he had not given up all culture and appearances, but now it was somewhat different. Now he did not seek to shock or titillate or over-awe; he demonstrated instead . . . what was the French phrase Marla had told him . . . oh yes, *savoir-faire* . Andrea was now a "class act."

Marla had been his first student. He had many more students now, including several girls from the Duchess Elisabeth Sofie Secondary School for Girls. He enjoyed teaching every one of them, but Marla was still his favorite. He smiled. Her passion for the music may not have exceeded his own, but it was certainly equal to it.

Music wafted down the hall; piano, then flute. Marla must be practicing the flute piece for the concert as well. Andrea opened the door just a moment after the music stopped in mid-phrase.

"It still doesn't sound right." Marla sounded determined. Andrea smiled. Determination was a frequent state of mind for Marla.

"I think it sounds fine." Hermann Katzberg spoke from where he sat at the piano.

The Steinway grand that Marla had escorted to Magdeburg in late 1633 was still the reigning queen of keyboards in the city. It had somehow become the property of the Imperial and Royal Academy of Music in Magdeburg. Andrea still wasn't sure just how Master Carissimi, the head of the academy, had

managed to bring that about, but he had. In addition, no less than three of the Bledsoe & Riebeck pianos, built with hardware salvaged from old up-time pianos, had made their way from Grantville to Magdeburg in the last two years. The academy had managed to acquire one of them, which was now the principal practice piano.

"It's not right," Marla insisted again.

"What's not right?" Andrea asked.

"This passage." She pointed to the music on the piano.

Andrea studied the passage in question, then straightened.

"Play it again."

Marla raised the flute, licked her lips, and nodded to Hermann. He began the accompaniment part; she entered moments later. Andrea listened attentively, but also observed Marla's physical actions.

At the end of the phrase, she stopped, making a face as if smelling something rancid. She turned to Andrea and waited.

"You are breathing in the wrong places. You don't have enough diaphragm support."

"But that's where my flute teacher told me to breath!"

Marla sounded somewhat offended. Andrea looked at her with his best Master Andrea frown. "Marla, breathing is breathing, whether you play a flute, a pennywhistle, one of those *molto grande* tubas, or sing. I know breathing. And I tell you, you are breathing in the wrong places."

He pulled a pencil from his jacket pocket, leaned over the music, and made two marks. "Breath here and here, and firm your diaphragm, just as if you were singing the high notes."

Her expression skeptical, Marla raised the flute and played the phrase again, Hermann following her lead. Andrea listened with head cocked to one side, nodding. She finished with a bit of a flourish, then gave her teacher a nod.

"You were right, Master Andrea. It does sound better that way."

"Don't sound so surprised," he growled. He was unable to keep the smile from his face as her skirling laughter filled the room. "As Franz would say, play it again to prove you know it."

Again the flute notes sounded; again he observed.

"Excellent!" Andrea applauded. "Now, can we begin the songs we are supposed to be rehearsing today?"

"Yes, Master Andrea."

May 1635

Maestro Giacomo Carissimi, the head master of the Imperial and Royal Academy of Music in Magdeburg, settled into his seat next to his good friend, Girolamo Zenti, proprietor and master craftsman of the instrument crafting firm of the same name.

"Good evening, Girolamo."

"Good evening, Maestro."

Giacomo wanted to shake his head. Even though they had been friends for several years now, Girolamo would always speak to him with utmost respect in public. He started to chide his friend, but in the end just sighed and held his tongue. They had had this conversation before. He doubted that anything would change if they rehearsed it one more time. He looked at the programme instead.

Franz Sylwester, the *dirigent* —or conductor, as the Grantvillers would have it—had established a theme of "Songs Without Words" for tonight's concert, declaring that only up-time works would be performed. There were six works on the programme: three orchestral works, two voice solo works accompanied by the orchestra, and a flute solo accompanied by piano. Giacomo ordinarily would have attended most of the rehearsals, but his schedule of late had been so burdened that he had been forced to set that pleasure aside. As a consequence, he was truly looking forward to tonight's performance.

The orchestra had quietly been warming up for some time. Matthaüs Amsel, the concert master, now strode out to the front of the orchestra. He bowed to the polite applause from the audience, then proceeded to tune the orchestra. Once they were tuned to Matthaüs' satisfaction, he took his seat.

This was the first concert of the year for the Magdeburg Symphony Orchestra, and everyone who was anyone in Magdeburg was present. Giacomo had seen *Hoch-Adel* by the dozens when he entered, as well as members of the government and various influential members of the community. Even the Committees of Correspondence were represented . . . or at least he thought he had seen Gunther Achterhof in the back of the room. And of course, Mary Simpson and her coterie of ladies he had heard Marla refer to as the "music mafia" were present in full force.

Franz Sylwester strode through the side door and out to the podium, where he bowed to the audience. Giacomo watched as his friend stepped onto the podium, gathered the eyes of the orchestra, and raised his baton.

The soft flute opened over the ripple of the piano chords; Vaughan Williams' *Fantasia on Greensleeves* was begun. The strings came in singing the melody in the lower strings with a descant in the violins. So simple, yet so beautiful.

Giacomo would always have a fond spot in his heart for Ralph (pronounced "Rafe" for some unknown English reason) Vaughan Williams. Despite the fact that the man was a professed atheist, he had written some of the most beautiful hymns and songs Giacomo had ever heard. And his orchestral writing! Remembering the performance of *Fantasia on a Theme by Thomas Tallis* from last year's summer concert, Giacomo shivered.

This other fantasia, he had to admit, was much lighter, although still exhibiting Vaughan Williams' deft orchestrations and lush string sounds. He knew that Franz regretted having to substitute piano for the harp part, but there just had not been time to have craftsmen experiment in building a full concert pedal harp from the descriptions and pictures found in various books in Grantville.

Ah, here was the transition of the piece, where for contrast the composer brought in another air, another folk song from England entitled "Lovely Joan." Melodically darker, moving somewhat quicker, written in what was almost a driving style, until it grounded out into the solo flute line again, and returned to a final statement of the original theme. So light, so airy, almost as if it were sung instead of played. The violins lilted the final statement of the theme, and quietly decrescendoed to fade away.

The audience was rapt for a moment, then applause broke out. It was more than simply polite, but not as fulsome as Giacomo expected to hear later this evening. Franz took a bow, then left through the door.

In the resulting moment of quiet murmuring, Giacomo quickly perused the programme. Yes, his memory had not failed him. The flute solo Marla was to perform came next. Marla and Andrea had talked of little else for days, until they were both happy with both the notes and the musicianship.

And speaking—all right, thinking—of Marla, it was as if she had been summoned. She appeared in the side door, holding her silver flute as if it were a standard, and marched to stand in the curve of the grand piano which was placed in front of the orchestra. She bowed to acknowledge the substantial applause—it was no secret that she was the darling of the patrons of Magdeburg—as Hermann Katzberg settled himself at the keyboard. Marla nodded to Hermann. With a single chord from the piano she launched herself into what sounded as if it were a tour-de-force.

According to the programme, this was the S *onata "Undine"*by Carl Reinecke, a composer who was not extremely well-known in the up-time. Marla said he had written some lovely pieces, and this sonata was apparently well known among flutists.

The first movement had a passionately stated theme that passed back and forth between the flute and the piano. The piano part was so lush it was almost made the work a duet. The tone darkened momentarily, flute and piano both working as if under a cloud, then returning to the lighter tonality.

The second movement was an allegretto in a most vivacious manner. Marla played incredibly rapid passages. Just as Giacomo began to worry about her ability to breathe, there was a brief interlude where the piano played solo, but all too soon the flute returned to recapitulate the original theme of the movement.

There was a very brief pause for a spurt of applause and a buzz of whispers in reaction to the bravura performance of the second movement. The audience hushed as Marla raised her flute again.

The third movement was aptly marked *andante tranquillo* . Tranquility was indeed its hallmark, and even more than the first movement this was a duet between the two instruments, calling back and forth to each other, then meeting to harmonize, then fading away.

The fourth movement was the most passionate of the work. You could hear the passion in the music, but you could also see it in Marla. That tall, almost regal figure in a white Empire gown—her favorite style—was bending and swaying—now slightly, now slowly, now deeper, now faster—in time with the music. Much as one of Frau Bitty's dancers would move in the dance on stage, so Marla moved in the dance of the music in the air. Even Hermann was caught up in it, hunching forward as his hands rushed up and down the keyboard in places, in others leaning back almost languidly.

The ending was a complete surprise, as all of the storm and passion seemed to fade away to a calm, almost placid theme, with both musicians playing lightly, lyrically, to a final soft chord.

Applause began as soon as Marla lowered her flute. She stood, smiling that brilliant smile that lit every corner of the room. After a moment, she bowed two or three times in response.

Giacomo could see that his friend was breathing deeply. Despite her apparent facility with the instrument, she had worked very hard to play this piece. To his perceptive eye, it showed.

Marla waved her hand to Hermann. He stood at the piano keyboard to take his bow. She bowed one final time, and together they left.

Once again there was a brief moment between the performances. Giacomo leaned over to his friend. He had no need to glance at the programme; he knew well what the next work was.

"Wake up, Girolamo."

"You slander me, maestro, if you think I would dare to doze off now."

The side door opened again. Their mutual friend Master Andrea Abati strode forth confidently—as if he could walk any other way—followed by Franz Sylwester. As Franz assumed the podium, Andrea bowed to the applause. The corners of Giacomo's mouth bent upwards in a smile. Despite his changes in outward appearance and demeanor during the last year or so, Andrea still bowed as if he were a king acknowledging the fealty and praise of his subjects. Some things might never change.

Andrea looked to Franz. The music began.

A vocalise, Giacomo remembered from the conversation with Marla when the concert programme was

developed, was a vocal exercise sung on an open syllable. But when Marla or Mary Simpson said "the vocalise," they referred to a work by one of the greater composers of the up-time twentieth century, a Russian named Rachmaninoff. It was titled simply "Vocalise" and was on the programme tonight at Mary's personal request. In fact, it was the first piece chosen, thus determining the theme.

After two chords from the accompaniment, Andrea opened his mouth and the melody began. Within six notes of the beginning he had everyone's rapt attention. Quiet, contemplative, not quite mournful, the sound of his voice lifted quietly, ebbing and flowing.

Giacomo closed his eyes, listening to one of the two finest voices in Germany—in the known world, for that matter. Andrea's voice had always had that classic castrato silkiness, a timbre that just wasn't found in a woman's voice. Tonight, however, without words to get in the way, without the baroque ornamentation that pre-Ring of Fire music required, he was free to pour all of his art, all of his passion, all of his being into realizing a powerful melody. It was as if he was a living flute, equal to that which Marla had played early, but warm with life, fountaining song forth from his heart and soul.

To Giacomo, Andrea's pride had always been forgivable. To be able to sing with that voice—ah, what a gift.

He opened his eyes again and watched as Andrea sang, his hands before him, body and hands moving slowly as if in a dance. As Marla had done before him, the passion of the music flowed through Andrea as well. It could well have been a study for the ballet, watching the minimal movements of that tall slim figure clad in black velvet that nonetheless evoked so much in partnership with his voice.

Chills chased up and down Giacomo's spine as he listened to trills that were so fast they seemed indeed to be played on a flute. He seemed to float like an eagle, soaring higher and higher, riding currents of song until a final pinnacle was reached where for a timeless moment he seemed released from the bonds of earth.

After the barest of pauses, there was a slow descent to a final syllable that faded to infinity. Franz closed his hand—the orchestra stopped. Andrea was frozen in his final position. No one moved—it seemed that no one breathed. Giacomo watched as Andrea, timing by an internal clock, finally broke his position, which instantly triggered a massive applause from the audience. *Hoch-Adel* were on their feet, clapping as fervently as any of the burghers and guildsmen. Some of the stolid Germans were roaring as loudly as the excitable Italian standing to his right.

Andrea gave bow after bow, grinning widely. At length he stood to one side and waved to the orchestra. Franz stepped from the podium to give a bow. In turn, he gestured to his players. As one, they stood to receive their just acclaim.

Franz stepped forward once more. Joined by Andrea, they gave one more bow, then exited through the side door.

Giacomo and Girolamo dropped back into their seats.

"God and all his angels." Giacomo mopped his brow. "I am as limp as a wet rag, my friend."

"Not me, maestro," Girolamo declared. "I quiver like a bell that has just been sounded."

"Well, it is a good thing for both of us that we have reached the *Intermissio* . Perhaps we can regain our composure before they begin again."

"We had better," Girolamo intoned. "Marla has yet to sing. Mind you, I don't see how she could do better than Master Andrea. But by all that is holy, if she equals him, I will be in a state of grace for weeks."

Giacomo laughed. "I somehow doubt that the Holy Father would agree that hearing heavenly music will forgive your sins and pay your penance. Not that I disagree with your opinion of the quality."

"Well, he should. I think he would if he only heard what we will hear tonight."

"Enough! You border on sacrilege." Giacomo's smile belied his words. "If you would earn merit, go find me a glass of wine, for I am as dry and dusty as the Via Appia in high summer."

"At your command, maestro. Just see to it that you mention this to Saint Peter."

The intermission concluded just after Giacomo received his wine. Ushers walked through the throng waving gold and silver fans on high, signaling everyone to be seated.

Girolamo settled at his side with a sigh, and whispered, "When do we hear Marla sing?"

"Shhh. After the *Pastorale* . Minutes only."

Franz returned to the podium and took his bow. The orchestra began the performance of the *Pastorale* from *Messiah* , by George Friederich Händel. An international programme indeed, Giacomo thought, with works by an Englishman, a Russian and two Germans having been played, and works from a Frenchman and a German of Jewish descent yet to be heard. Hmmm, no Italian. How had that slipped by him? He'd have to have words with Franz about that, he thought with a smile, before returning his attention to the music.

The Händel piece was almost soothing. It came from a time not too far in advance of their own and by now should sound familiar to the audience, as it had received two other performances in the last ten months. It opened with a very formal stately theme, almost a processional, which came to a moment of pause, then entered into a fugal section that had a joyful feel to it. The various string sections passed themes back and forth with a verve and élan that was . . . refreshing, Giacomo decided. All too soon, the *Pastorale* was completed. There was reasonable applause from the audience, after which Franz left the room again.

Giacomo waited, knowing what to expect but still scarcely daring to breathe. Finally, Franz reentered from the side door, his wife Marla on his arm. The applause began the moment she was seen, and crested as he handed her off to stand before the audience alone. She bowed again, smiled that illuminating smile of hers, then stood expectantly. Giacomo sat immediately, going to so far as to lay a hand on Girolamo's arm to encourage him to sit also. The remaining audience caught on. Within moments the room was almost as still as a mausoleum. Marla looked to Franz. He caught the regal nod, and began.

It was Andrea's idea, actually. After agreeing to perform the *Vocalise* , he had insisted that Marla should sing also. Giacomo put it down to the master teacher being protective of his stellar student. Of course, when that student was as popular as Marla, not including her might have caused a riot. Passionate music lovers had done stranger things, he had learned from the history of the future.

But it was also Andrea who suggested what she should sing, something a little on the radical side. He

recalled an up-time orchestral piece that evoked in him some of the same feelings as the Rachmaninoff, insisting that Thomas Schwartzberg arrange it as a vocalise. And then he drilled her on it, over and over and over again, until she reached even his standard of acceptability.

The low strings began their pizzicato plucking of strings. After two measures the beautiful melody of Gabriel Fauré's *Pavane* was heard in the room. Marla's golden voice was almost sirenesque in how it reached out and enticed everyone to follow her in what was truly a dance. Lilting, soaring, at times leaping, everyone danced with her—orchestra, patrons, guildsmen, burghers and all. As she swayed on the stage, they swayed with her—as her voice rose and fell, they would sit taller or relax. More than a few of them, from what Giacomo could observe, would unconsciously move their hands slightly in imitation of her arm movements.

It wasn't a long work; it soon began to slow. It was as if the dancers were dropping out one by one, leaving Marla and only a few attendants to complete it. Gracefully, gracefully, she sang the final phrases, holding tones out for what seemed like an impossibly long time, to the last few notes—the last steps of the dance, as it were.

Hers was not the bravura performance that Master Andrea had delivered, Giacomo decided as he stood and applauded with everyone else. But her warmth, her style, her grace had involved everyone in the room in a way that made them feel a part of the music. Andrea had performed; Marla had given them a gift of love.

Giacomo quit analyzing and shouted "Brava! Brava!" along with Girolamo. He beat his hands together until they hurt.

The final work on the program was almost an anticlimax: *The Hebrides* overture, by Felix Mendelssohn. It was a new work for the orchestra. Of course, as new as the orchestra was, almost everything was a new work for them, Giacomo admitted.

It was a lyrical work, in some ways, working the string sections very melodically, especially the low strings. He closed his eyes again to listen. Images of the sea were evoked. He remembered trips to the shore in Italy, watching the waves rolling in without ceasing, sun glinting from the blue water.

The following section was laden with brass and was more tumultuous, as if a brief storm had blown across the sea. The storm was indeed brief, and the music returned to the lyrical mode.

As he rode the waves of sound, Giacomo mused. The wind players were continuing to improve, he noted. Marcus Wendell, the Grantville band director, had estimated it would take a year for down-time

musicians to grow proficient with the new and changed wind instruments: the metal transversal flutes, the clarinets, the saxophones—all new forms. Oboes and bassoons, vastly different than their ancestors. The valves available for the trumpets and their cousins, the very different mouthpieces. Yes, it had taken every bit of twelve months for the players to first learn their instruments, and then to learn to play together. But the result . . . oh, the result was well worth Giacomo's wait and their travail.

To hear this music in a hall, with the ambience and the harmonics unfettered, that was bliss. To hear the players proving that they could measure up to standard of the up-time music was emboldening. And to see young Franz—Giacomo blithely ignored the very slight difference in their ages—a down-timer himself, leading them in their work with style, grace and panache was a confirmation. Now, now he knew for certain that the music he was beginning to hear in his head would be realized.

The music began to grow in intensity, drawing Giacomo from his thoughts. The final section began to echo the themes and treatments of the storm. The rush to the finale was on.

The orchestra arrived at a grand chord . . . and then Herr Mendelssohn played his little joke. Just as everyone was prepared for the piece to end, the clarinet restated the opening theme—surprise!—making the audience think that there was more to come, just before it died away.

The moment of silence that followed had an air of uncertainty, of "are they really done with it," but finally the applause began. Giacomo was smiling as he began clapping his hands. The more he considered the composer's little prank, the funnier it became, until he started laughing. Noticing that Girolamo was looking at him with a quizzical expression, he shook his head.

After Franz had shaken his hair back and taken his bows, and after the orchestra had taken their bow, voices began to be heard calling from the audience.

" *Die Sänger!*"

"The singers!"

" *I cantanti!*" came from burly Girolamo at Giacomo's side.

The calls grew both in volume and in frequency, until after a few moments there was a constant roar above the applause. Franz held both hands up in surrender. Smiling, he beckoned to the side door.

The room erupted as Marla entered, followed by Andrea and Hermann, who was carrying . . . a chair? Now Giacomo was truly intrigued.

The two singers arrived in the center, joined hands and took a bow. Andrea then held up his hands and motioned for everyone to hush and be seated, while Marla beckoned to Franz to come join them. He did so with a very bemused expression on his face.

"Thank you for coming tonight," Marla said to the audience. "We had hoped you would enjoy our offerings enough to ask for an encore." Laughter sounded all around the room. "And indeed, we have one planned. However, there has been a slight change in the plan." More laughter as Franz's expression went from bemused to surprised to suspicious in that many moments.

"Today is my husband's birthday." Applause. "He has reached the advanced age of twenty-seven." Laughter and applause. "And so, with the connivance . . . I mean the *cooperation* of our friends . . ." Marla turned and waved at the orchestra, who waved back. "I have a song I would like to sing for

Franz."

She tugged on Franz's arm. For a brief moment he resisted, a mutinous expression on his face, but only for a moment. Then he smiled—a bit forced, Giacomo judged, but graceful nonetheless—and suffered himself to be led to the chair that Hermann had placed at the front of the audience.

Marla returned to the center, and clasped her hands in front of her. "The song I'm about to sing is from the future, but it isn't one of the grand works that you typically hear from me. Nor, for those of you who come by The Green Horse tavern on certain nights is it one of the Irish songs I sing with my friends.

"For all that, it is a classic in its own way. I offer it to you, but I sing it to my husband. *Unchained Melody.* "

Marla bowed her head for a moment. Giacomo was impressed with how quickly the room became quiet. When she raised it again and looked at Franz, Hermann began the introduction. After four measures of quiet piano, Marla began to sing.

Unlike the previous vocal pieces, this one had lyrics in English. Giacomo had heard Marla practicing this song several days before. The lyrics weren't what he would consider immortal poetry, but when mated with the music . . . ah, they became truly memorable.

Quiet, oh so quiet Marla's voice, but it filled the room as she sang to her love, her darling, as she sang about hungering for him. Giacomo knew without looking that everyone could hear, that everyone had once again been enraptured by the young woman's talent. But now, now there was something—a tone, a timbre, an emotion—something that he had never heard in her voice before. The low notes positively throbbed.

Another voice joined Marla as she began the second verse. Giacomo's eyes opened wide and his head snapped to focus on Andrea Abati. He was standing two paces behind Marla, mirroring her posture and position. Shadow to her glory, his eyes closed, he poured his voice out to complement hers. Singing descant, he followed Marla's lead as she mourned the passage of time and questioned whether her love still responded to her.

They two had sung together before. And they both were called angel voices, yes. But this . . . *ai, Dio, que bellisima!* It was enough to tear the heart from a statue, the quiet passion of Marla supported by the pure fire of Andrea.

The twined voices swelled on the first line of the chorus, surging to a peak as Marla poured forth her need, then beginning to fall off of it. Each successive line dwindled, until the last two words were sung in the same quiet intensity of the beginning.

Marla sang the opening lines of the interlude, voice floating, the lower register of her voice just so resonant, so full, the intensity so quietly overpowering that Giacomo forgot to breathe. The music evoked the image of flowing waters that the words described.

Andrea re-entered, still with the higher descant harmony, perfectly partnering Marla's voice. In one little corner of his mind, Giacomo was amazed at how perfectly they matched—it was as if one throat was producing two tones. The final phrase swelled as Marla called her love to wait, leading to the return of the verses.

Now the full voice was unleashed, now Marla was unfettered, now the passion was totally unveiled. And Andrea kept step, note by note, singing around her voice, somehow blending, yet still it was Marla's song.

The climax of the entire song arrived with the first line of the chorus. The tempo slowed, and the singers crested on the word "need," seemingly holding the note forever, although Giacomo knew that it was barely the four beats of one measure. At last, they descended, repeating the pattern quieter and at a lower pitch for the second line.

Andrea dropped out for the final line. Marla broke her pose as she began the phrase, holding her hands out toward Franz, sustaining the word "love" for a long moment, allowing the briefest of pauses, and then very softly singing the final two words *". . . to me."*

Her voice just seemed to hold that note forever, until Giacomo realized with a start that he couldn't hear it any longer.

There was a long moment of silence.

Songs of love were not uncommon. Street music, art music, they could be heard almost any time, anywhere. But tonight, tonight had been different. Tonight a woman had bared her soul in truth, unheeding of the public who witnessed it. Tonight a love had been declared, had been poured out like a drink offering on the altar of God, in so selfless and unmannered a fashion that Giacomo marveled. Truth to tell, he was somewhat uncomfortable with observing it, as if he had unwittingly committed an act of voyeurism. Perhaps everyone felt something of that, for the silence held.

Finally Franz stood and stepped to his wife. He claimed Marla's hands and raised them to his lips. At that moment, the silence shattered as the wildest applause of the night broke free.

* * *

"I am not worthy of you," Franz murmured as he kissed Marla's hands, ignoring the uproar behind him.

Marla simply smiled and shook her head.

"You knew—everyone knew—you were going to do this, and nobody told me."

"Nope." The smile grew larger.

"You change my life and my plans at your whims."

"Yep." Marla's eyes began dancing

"And there is nothing I can do but love you."

"You just remember that, because the changes are just beginning."

Marla giggled as Franz's expression wavered between alarm and curiosity. Curiosity won.

"What do you mean?"

"You're going to be a father."

* * *

Just when Giacomo thought the noise was beginning to taper off, Marla melted into Franz's embrace for a passionate kiss. The audience just exploded with applause and cheers.

Magdeburg, May 1635

Dear Aunt Susan—and you too, Jonni, I know you're reading this

Boy, do I miss email. I<u>Hate</u> writing letters!!!!!!!!!! (sigh) But I promised I would keep you up to date on stuff, and I can't afford the telegraph very often, so here I am scribbling on paper.

First news is, I'm pregnant. And yes, I'm sure. I've missed my second period, and I've always been like clockwork before now.

x o x o x o x o x o x (kisses and hugs)

Okay, are you guys through celebrating? Seriously, this is really going to put a crimp in some things. My best guess is it happened in early February, so we're pegging the due date in early November. I was supposed to sing in the anniversary concert for the Battle of Wismar like I did last October. I'll probably be as big as a whale, so it looks like I won't be doing that. Even if I wanted to appear on a stage like that—which I don't!— my diaphragm will probably be pushed up to the bottom of my lungs. I'll be doing good to breathe, much less sing.

Our first big concert of the year happened a couple of nights ago, and everything went really well. I played my flute in one song, and sang in two more. Everyone seemed to like them pretty well. Mary Simpson was very complimentary. I don't know why some people think she's a real hard case. She's never been anything but nice to me and Franz.

I told Franz he was going to be a father after the concert. I thought he was going to pass out on the spot! He's been treating me like a porcelain doll ever since. He keeps trying to make me sit down, and doesn't want me to do anything. I don't know who's more scared, him or me.

Yeah, I'm scared. I'd be nervous if we were still in the USA, I'm sure. I'm really nervous now. I

mean, if something goes wrong, we don't have the doctors or the hospitals or the medicines or the tools or . . . I'd better stop that before I start crying again.

I am excited, too. I think I'll like being a mom. But if you've got any advice for me Sis, or you too, Aunt Susan, I really want to hear it.

That's all for now.

Love to you and all the kids.

Marla

x o x o x

Magdeburg, August 1635

Dear Aunt Susan,

Me again. Thanks for sending me the nursing bras. I've really started putting on weight (wonder why?), and I'm enough larger already that these feel more comfortable.

I've been really lucky—the whole morning sickness thing wasn't much of a problem. That's good, since I don't puke easily. I did twice, though. Turns out Franz's stomach is a little sensitive. I looked up from the first time, and he was positively green. I started laughing, and he started to get mad, then he got a funny look on his face, and before I knew it he'd pulled the bowl away from me and added his supper to mine. Afterwards, he laughed with me, but the next time it happened I made him leave the room.

Well, we've finally settled on names: Paul Otto if it's a boy, after my brother and his father; and Alison Wilhelmina if it's a girl, after my mother and his mother. Franz kept wanting to dump these huge German names on the kid, and I told him no way. He finally came around to my way of thinking.

Franz surprised me yesterday. Gunther Achterhof put him in touch with a woodcarver, and he brought home a cradle. It's beautiful! It's not very big, but it will do for a few months, anyway, and it's hand carved out of oak, with musical notes and stuff on the head and foot boards. I cried.

Speaking of crying, how long will I be so emotional? And don't tell me 20 years! I mean, when my hormones finally settle down, will I get back to normal again? I know it's a dumb question, but this is my first time, remember?

Umm, I know it's asking a lot, but if you or Jonni could see your way clear to coming to Magdeburg around November 1 and staying until after the baby is born, I would really appreciate it. There are several Grantville women in town now, but they're not family. You know—it's not the same. Let me know if you can.

Gotta go.

Love.

Marla

Magdeburg, October 7, 1635

"You are sure you will be fine?"

Marla swatted her husband on the arm with the programme.

"Will you get backstage where you belong? I'm fine. I'll be fine. And I've got Mary here watching over me."

Mary Simpson leaned over Marla. "She'll be fine, Franz. I'll take care of her. Go."

Franz stood by Marla's chair for a moment more, then slowly turned and headed for the door, looking back over his shoulder more than once. He straightened up just in time to avoid walking into the doorframe.

"Men!" Marla snorted. "He thinks I'm totally helpless."

"Actually, dear," Mary smiled, "the problem isn't that he thinks you're helpless, it's that he knows *he's* helpless. Whatever happens with you and the baby, he's already made the only contribution he can make, and men aren't wired for patience and helplessness. Are they, John?" She poked her husband.

"Not for that," John Simpson said. "Mary was lucky. I was gone a lot with the Navy while she was carrying Tom. I'm sure I'd have driven her crazy."

"Oh, heavens." Mary laughed. "You'd have been there every morning, clipboard in hand, taking statistics and measurements, figuring out if I was behind the optimum health curve, laying out exercise plans and diets. I wouldn't have had a moment's rest."

Mary patted John's hand. Marla didn't miss how his much larger hand curled around her small one. She'd never believed that John Simpson was quite as stoic and hard-shelled as everyone said he was. After Mary's adventures last year, she had noticed that he seemed a little more . . . demonstrative, maybe. He certainly smiled at her more in public than he did before.

"Anyway, be patient with him, dear. It's much better than a husband who doesn't care, and he'll level off after the baby's born."

There followed several moments of conversation, until someone on the other side of John Simpson claimed Mary's attention. Marla sat back and fanned herself with the programme. Early October notwithstanding, at eight months pregnant she was hot almost all the time. She felt as big as a house, and about as maneuverable as one of the Admiral's ironclads on the river. Please let this kid get here soon!

To take her mind off her condition, Marla started reading the programme, although she knew it by heart. Franz had been rehearsing the orchestra for weeks.

Wellington's Victory– Ludwig Beethoven.

Lament for a Fallen Eagle– Giacomo Carissimi

1812 Overture– Piotr Ilyich Tchaikovsky

All music associated with battle and victories, two from the up-time and one from the present. Appropriate for the concert commemorating the second anniversary of the Battle of Wismar.

"Does it feel strange to be sitting here instead of singing the lament tonight?"

Marla looked up to see Mary focused on her again.

"Yeah, a little. I really wanted to sing the duet version of it with Master Andrea like we did last year." She laid a hand on her swollen abdomen. "But junior here kind of got in the way."

Marla had sung the first performance of the lament back in December of 1633 in Grantville. It had been arranged for the instruments that were available, which weren't many. She still remembered Maestro Carissimi muttering about barbaric villages beyond the bounds of civilization when he discovered there was no orchestra available. So, for the first anniversary of the battle, when he was asked to have the work performed for the first time in Magdeburg, the maestro had gleefully re-orchestrated the music to take full advantage of Magdeburg's orchestra. He had also, after discussing it with Marla and Master Andrea both, re-scored the vocal part to be a duet. It had been Marla's first opportunity to sing with someone of Andrea's calibre and it thrilled her. She had been looking forward so much to singing it again this year. Sigh.

"So, how is the orchestra going to do the cannon shots for the overture?"

Marla laughed. "They've got several shotguns loaded with blanks, and they're firing them into a fifty gallon oil drum with one end cut out." Mary's eyebrows climbed. "I don't know if it sounds like a cannon, but it makes a big sound. They only got to rehearse it once, so Franz is a little nervous about that."

"Since the cannon blasts aren't exactly timed to the music," Mary mused, "if one of them doesn't quite hit the mark, no one would know."

"That's what I told him."

"From the looks of the programme, Franz must be ready to start exploring the symphonic works." Mary raised her eyebrows.

"You mean he hasn't told you yet?" Marla was surprised.

"No." Mary smiled. "But then, he has had a lot on his mind lately,"

Marla laughed again. "He decided recently that he wants to work through the symphonies of Beethoven, do one, maybe two a year. And Marcus has miniature study scores for each of them, so we don't even have to have them transcribed from recordings. Some of Marcus' students are copying out the first symphony score and parts now."

"Surely he'll do more than that?"

"Oh sure, both down-time and up-time. But Beethoven's first symphony will be the first one they do."

Mary started to say something else, but at that moment Franz emerged from the side door. The applause began.

* * *

Marla sank back into the seat of the carriage. Her feet hurt. Her feet hurt clear up to her hips. Or she assumed it was her feet that were hurting—her lips quirked—she hadn't had a good look at them in weeks. She rested her hand on her abdomen, and giggled for a moment. Dressed in a forest green gown, her belly looked like an overly ripe Black Diamond watermelon. Then she wished she hadn't thought that, because watermelon sounded really good, and she knew what her chances were of getting any in October in Germany. She leaned her head back and closed her eyes.

Between her feet aching and junior deciding to perform gymnastics in time to the music, Marla had been somewhat distracted from the concert.

The Beethoven piece, one of his minor ones, had been chosen more for the theme of the work rather than its artistic merits. It had sounded well, though.

And Master Andrea more than did justice to Maestro Giacomo's work. That one Marla had definitely heard.

The climax of the evening was the 1812 Overture. It had definitely been received well, ersatz cannon and all. Marla giggled as she remembered seeing the audience jump in time with her baby as the shotguns had roared.

Afterward had been the obligatory round of conversations with the patrons, guildsmen and burghers and their wives. That's when her feet had really started hurting. Franz had hurried through that as quickly as he could, asking their friend Isaac to go call their rented carriage to the door much sooner than she thought he would.

The carriage rocked as Franz climbed in, having finally closed off the conversations and made his farewells. He reached over and took her hand. "Tired?"

"No." Marla snorted. "My eyes are dusty and I'm just cleaning them." She opened said eyes in time to watch him laugh.

The carriage—another mark of Franz's concern for her well being—only took a few minutes to move through the streets to their house. Her husband handed her down with great care, then reached up to pay the driver. He helped her up the steps and opened the door as the carriage rattled off.

Marla sighed. Home again. She was ready to get the dress off, throw her shoes into a closet and get into

a comfortable bed gown. Another month to go. She wasn't sure she could make it.

Franz closed the door behind them. She felt him come up behind her and place his hands on her shoulders. "Shall I take your coat?"

"Please."

* * *

Franz reached to put Marla's coat away, then heard a strangled gasp. Without a thought, he dropped the coat and spun. In the light of the little lantern on the side table, he could see a look of sheer panic on his wife's face. His instinctive step to her splashed.

Splashed?

He looked down, and realized Marla was standing in a puddle. His immediate reaction was relief, followed by biting his lip to keep from laughing, believing that she'd had an accident.

But then Franz realized he didn't smell the acrid smell of urine. His panic returned, redoubled. He reached to her as she clutched at his arm, long pianist's fingers sinking deep into cloth and flesh.

"God." A whispered prayer, then louder and frantic. "Franz . . . my water broke! The baby's coming!"

"What?"

Marla's voice cracked. "The baby's coming! It's too early!"

Franz was on the verge of gibbering, but one look at the fear on Marla's face told him he couldn't. Drawing on the strength that had let him face down Rupert Heydrich, his nemesis, over a year ago, Franz gathered Marla into his arms.

"Shh, shh," he repeated over and over, hand stroking her hair as she hiccupped. After a few moments, he held her out at arms' length. Good. She was calmer now. There was still a wild light to her eyes, but she wasn't about to go to pieces.

"It is not going to be here this minute, love. Let me help you to the bed and out of that dress, and I'll send for the midwife."

He watched as Marla visibly grasped for composure. She nodded, and led the way to the bedroom.

Magdeburg, October 8, 1635

There was a knock at the door. Franz rose, stiff from sitting all night. He opened the door to find Mary Simpson standing in the light of the dawn. With her were Lady Beth Haygood and his good friend Isaac Fremdling.

"May we come in?" Mary asked.

Franz stood to one side, waving them in as he yawned.

They all found seats in the small parlor, except Isaac, who leaned against a wall.

"How is she?" Lady Beth's face was worried.

"I do not know." Franz's voice was weary. "Her water broke after we got home, and I sent for the midwife immediately. She and her helper came at once."

"Who did you get?"

"Greta . . ." Franz searched for the name.

"Oh, I know her." Lady Beth smiled and patted Franz on the arm. "She's good. She's been to Jena and learned quite a bit. There's been a bit of tension between her and some of the other midwives, because of her insistence on cleanliness now."

"I tried to stay with them," Franz continued, "but when the labor started hard, the midwife ordered me out. She said they didn't have time to tend to me as well as Marla."

"When was that?"

"I do not know. Some time after midnight, I think."

"So," Mary said, "she's been in labor about nine hours, maybe, and in hard labor maybe three or four?"

Franz gave a tired nod of affirmation.

"Well, that's not all that long. Especially for a first child."

"Oh, my, no," Lady Beth smiled. "I was almost twenty-four hours with my first, and there was another woman in the OB ward at the same time who'd been there twelve hours when I got there and still didn't have her kid until after I did."

Franz's expression must have changed, because Mary rushed to say, "But that's not always the case. Marla's probably going to have an easier time of it. She's tall enough that you don't realize how wide her hips are. She really ought to have it soon."

At that moment, there was a yell from the bedroom.

"Oh, good, they've had her start pushing," Lady Beth said.

* * *

Others had dropped by from time to time during the morning. It seemed everyone they knew wanted to know how things were progressing, but none stayed more than a few moments other than Mary, Lady Beth and Isaac.

A few of the callers brought food and drink. Franz was able to eat some bread and butter when he was encouraged to, but the one sip of coffee he took caused his stomach to roil and he put the cup down. The beer likewise turned his stomach. Only cautious sips of water seemed acceptable.

Shortly before noon the screaming stopped. Franz raised his head from where he had nearly dozed off in exhaustion. He looked at the others. He didn't know what expression was on his face, but Mary reached over and took his hand.

It seemed an eternity before the midwife appeared, still in what the up-timers would call her uniform: hair under a white hood, white gown over her clothes. She was wiping her hands with a small towel as she came through the door. She folded it away, but Franz's stomach lurched as he caught a glimpse of blood on it. The next thing he knew, he was on his feet.

"How . . . how . . ."

The midwife's expression never brightened. Within his soul, Franz began to moan.

"I am sorry, Herr Sylwester. We did everything we knew to do, but we could not save your daughter."

Franz wavered, and Isaac was at his side instantly, grasping his arm to steady him.

"What . . . what are you saying . . . that my child . . ."

The sympathy on the midwife's face was almost more than Franz could stand.

"Your child was stillborn, Herr Sylwester. I am so sorry."

Franz just stared at her numbly.

"How is Marla?" Mary asked, coming up on Franz's other side.

"Physically, she is exhausted, yes. Very tired. But she will recover. I am worried, though. She made us wrap the baby and give it to her. This is not good. She must let go. The more she waits, the harder it will be."

The moan in Franz's soul began to climb his throat and force its way out. Isaac pulled him around so they were face to face.

"Franz . . ." he felt Isaac shaking him gently.

"Franz . . ." Isaac caught his gaze.

"Franz, remember . . . 'The Lord giveth, and the Lord taketh away . . .'"

"'Blessed be the Name of the Lord,'" Franz whispered. He stared into Isaac's eyes, the man who was the closest thing to a brother he would ever have, and saw the reflection of his own grief. He saw, too, the love that Isaac bore for them both. That allowed him to straighten in Isaac's grasp.

"Franz, your wife needs you."

"Marla."

"Yes, Franz, Marla needs you. Go to her."

Isaac released him. Franz turned to the bedroom. The midwife stood aside, touching his arm as he passed.

Franz stopped inside the door. Marla had been cleaned and dressed in a fresh gown, and the bed linen had been changed. She sat up at the head of the bed, humming to the bundle in her arms.

Marla was exhausted. Even for her, her face was pale; her eyes were so dark she looked bruised. Her hair was limp and lanky from sweat. But at that moment, she was so beautiful to Franz it almost tore his heart out.

The midwife's assistant murmured an apology as she brushed by him with the bundle of soiled linen. Marla looked up to see him. The smile that crossed her face pierced him

"Franz, you're here. Come see our daughter!" She bent her head down once more and sang wordlessly.

Step by slow step, Franz crossed to the bed. He forced a small smile to his face as Marla looked up at him.

"See . . . isn't she beautiful?"

Franz swallowed, and whispered, "Yes . . . yes, she is." He swallowed again, bent over and said in a normal tone, "May I hold her, please?"

"Okay, but be gentle."

Marla very carefully transferred the bundle to Franz. He straightened, and pulled a fold of the blanket away from where it draped over part of the baby's face. God in Heaven, she was beautiful. Fuzz of black hair, perfect round little face, perfect little fingers peeking out from under the blanket. He watched closely, hoping there had been an error, but there was no movement; no fluttering of eyes, no twitching of features. No breath of life.

Hope died.

Franz felt his arms beginning to shake. He turned away from the bed and pressed his lips against the little forehead.

"Go with God, Alison Wilhelmina," he whispered. The midwife had quietly come up. He let her take Alison.

"Franz?" from behind him. Steeling himself, he turned, sat beside his wife on the bed, taking her hands in his.

"Did you see her, Franz? Did you see Alison? Isn't she beautiful?"

Her eyes searched his.

"Yes, love."

"Franz?"

Deep breath.

"Marla, Alison is with the angels."

He watched as the black dawn of desolation overtook the light in her eyes, grieving as it died. He watched as the awareness pierced her heart, as the cold fact of death became a stone in her soul. He watched as her face crumpled. He watched as she whispered brokenly, "Oh, Franz," and her mouth opened to wail and keen, though nothing came out.

He heard keening, nonetheless, as Marla turned to him, hands clutching at his shirt—keening from her soul and his. As his arms enfolded her, he wondered if it would ever stop.

Franz held his wife. Tears mingled as they mourned together behind the shroud of her long black hair.

Magdeburg, October 11, 1635

Susan Garrett stood on the doorstep, shivering. The cool weather outside was a perfect match for the state of her soul.

The door opened enough for Franz to peer out. His face brightened and the door swung open. "Aunt Susan! Come in."

Susan carried her bag in and set it to one side. She waited for Franz to finish closing the door, then threw her arms around him in a crushing embrace. His arms returned it. They stood together for a long moment, two kindred mourning souls drawing comfort from each other.

After a long moment, she pushed away to arms' length and looked up at him.

"You look horrible, Franz." And he did, too—haggard, hair unkempt, eyes so dark they looked bruised. He also looked bewildered.

"We did not expect you so soon."

"I started packing as soon as the first telegram came. Mrs. Simpson sent it, telling me that Marla's water had broken. When I got the second telegram, I started trying to make travel arrangements. I finally managed to get on a train, and here I am."

Susan looked around. "Where's Marla?"

"Asleep."

Franz was wavering where he stood, obviously exhausted. Susan led him to the chairs, and sat with him.

"Am I in time for the funeral?"

Franz shook his head.

"No, it was yesterday. We could not wait any longer."

Susan felt a pang, but understood that even in the cool of October, without embalming, a body, even that of a new-born infant, had to be buried soon. Still, she would have liked to have seen the baby. With a deep breath, she set that aside. "So, since I missed it, tell me what happened."

Slowly, halting often, Franz began to describe the events after his world came crashing down in ruins. "Mrs. Simpson took charge of everything. She saw to it that the invitations went out . . . "

"Invitations? You send invitations to a funeral?" Susan had heard the Germans did such things, but until now she hadn't really believed it. She was astounded.

"Indeed. Mary talked to me and managed to make sense of what I said. She drafted everyone in sight whose hand was legible to prepare and deliver the invitations."

"So who was invited?"

"The Simpsons, Lady Beth Haygood and her husband, many of the Grantvillers in Magdeburg, Masters Schütz, Carissimi, Abati and Zenti, of course. The orchestra. Gunther Achterhof and a couple of the people from the Committee of Correspondence in Magdeburg. I tried to tell Mary it was too many, but she wanted to make sure that everyone who wanted to come had the opportunity. I'm not sure they were all there, but a lot of them came."

Susan shook her head, still having trouble with the idea of sending invitations to a funeral, for heaven's sake! Every time she thought she was used to the way the Germans did things, something new would pop up. There was a long moment of quiet.

"So, where is she buried?"

"Since neither Marla nor I are Lutheran, I felt it was best to not try to find a space in one of the Lutheran church cemeteries. There is a new city cemetery, created after the sack of the town, that is open to everyone. We found a space there. A beautiful place, really, at the top of a slight rise near a tree. It will be long before the space is needed again—perhaps not until after Marla and I are gone—so we will be able to visit it for long and long."

"The . . . space is needed . . . "

Susan was perplexed. Surely Franz didn't mean what she thought she heard. Franz looked at her, and his mouth quirked wryly.

"Aunt Susan, you must not think of our cemeteries like yours, with the nice neat rows of graves, each with its elaborately engraved memorial stone. The land is only used for a time. After some years, if the space is needed, the old bones are dug up and placed in an ossuary, allowing the burial of someone new."

Horrorstruck, Susan's hand flew to her mouth. Surely he didn't mean that . . . that Alison's little body could be . . . would be . . . desecrated like that.

Franz smiled sadly, and took her other hand in both of his. "It is the custom, you see. But where we laid her, it will not happen for a long time."

"Does . . ." Susan spoke past the thickness in her throat, "does no one stay buried?"

"Only the very rich, who can afford to build grand memorials that will cover their graves." Franz coughed. "Such we are not."

"We'll see about that," Susan muttered, thinking to herself.

Another quiet moment.

"The wood crafter who built Alison's cradle also built her coffin," Franz murmured. "It was so small . . . *she* was so small. I could have carried it in one hand."

Susan looked up at Franz, to see him staring blankly at the wall across the room, slow tears trickling down his cheeks.

"I carried her out and placed her in the wagon bed, then brought Marla out to the carriage. Once we were settled, the wagon driver started off. Within steps, Gunther Achterhof had stepped in front of the wagon to lead the way, and Klaus and Reuel had come forward and taken the bridles of the wagon and carriage horses. I looked out, and I could see a few other Committeemen walking alongside. With the friends that had joined us at our house, we had become a procession. Despite our slow progress, it was not long before we reached the grave, where more friends were waiting for us."

"Was Byron able to make it?" Byron Chieske was the husband of Marla's sister Jonni, assigned to something with the military in Magdeburg.

"Yes, he was invited, of course. He came. He said nothing, only embraced us and shook his head."

"That's Byron, all right. Never one to say a word if he didn't have to."

Susan watched as Franz wiped his eyes and his face.

"So, if you didn't go to the Lutherans, who did the eulogy?"

"Herr Washaw."

"Which one? There's more than one of them around."

"Herr Lennon Washaw."

"Lennie—that's okay, then. He's a good man."

"Yes, he is. He started by saying that he was neither a preacher nor the son of one, but he was a deacon in the Methodist church and he had known Marla's family for years, so he counted it both his responsibility and his sad privilege to speak. He read from the Bible, Psalm 23 it was, and then he spoke for perhaps a quarter of an hour."

After a moment of silence, Susan asked, "So what did he say?"

Franz shook his head. "I do not remember much, but I do remember that it eased the hurt for a few moments. Then he prayed." The tears started trickling down Franz's face again. "And . . . and after the prayer . . ." He swallowed. "After the prayer I . . . took Alison's coffin in my arms and . . . and placed my child, our child in the earth." The tears were streaming now. "And then I turned and led my wife away. Leaving my heart behind."

Now the sobs began, great wracking, heaving sobs. Susan gathered Franz into her arms. He slumped against her, face hidden in his hands as a torrent of grief was loosed.

After a time, the tempest passed. Franz straightened, wiping his face first with his hands, then with his sleeves. "I am sorry, Aunt Susan. I should not have lost control like that."

Susan took his chin firmly in her hand and turned him to face her. "That's foolishness, Franz Sylwester. You've been storing that up for days now, haven't you? Trying to be strong for Marla, I reckon."

Franz nodded with a somewhat shame-faced expression on his face.

"You can't bottle that up inside of you, child. It will poison you. Grief is natural, it's a part of life on this earth, and the only way to deal with it is let it flow through you and then move on with the rest of your life."

Franz gave a very small smile, but Susan was glad to see it. "I think Herr Washaw said words much like that."

"Wouldn't surprise me. Lennie's a pretty wise man for his years, for all that he's no senior citizen yet. You could do a lot worse than to go to him when you need help with these feelings."

"I will keep that in mind."

"You do that." Susan sat back, and took a deep breath. "I imagine Marla took this hard."

Franz's expression twisted in pain. "Yes, she did. But I worry for her, Aunt Susan. After the first day, she will not cry."

Susan's heart sank.

"I thought I heard someone."

Susan's head snapped around, to see Marla standing in the doorway to the rest of the house. Her heart continued its fall, thudding to the floor between her feet.

Marla had always had an air, a quality about her, that had seemed to make her shine. No more. Hair that had always seemed to float, now just hung, limp and dark. Her face was drawn, almost as if skin had been stretched across a bare skull. And that skin, which had always glowed before, now was opaque and dull, like a thin parchment. But the worst was her eyes. What had once been shining blue beacons of life and liveliness were now lifeless chips of granite embedded in dark holes.

Susan felt the tears starting in her own eyes as she stood and walked over to her niece to enfold her in

her arms. She tried to draw Marla's head down to her own shoulder, whispering, "Oh, baby, I'm so sorry," but Marla would not bend.

Stepping back, Susan took Marla's hands, and said, "I know it hurts now, Marla, but you will get through it. It will be all right."

Dry-eyed, Marla shook her head slowly. "I don't think that anything will ever be all right, ever again.

Magdeburg, Late October, 1635

"Maestro Giacomo, it's like Marla has died." Andrea Abati spoke in Italian. "But her body doesn't know it yet. She looks and sounds like some failed attempt by Pygmalion, some kind of clockwork device, or perhaps a female golem devised by some Kabbalist. I don't understand it. I know that the loss of a baby in childbirth hurts, but it happens all the time."

"Ah, my friend." Giacomo Carissimi picked up his wine glass. "There you are slightly mistaken. It does not happen all the time, not to those from Grantville. More than nine out of every ten of their children survive their childhood." Andrea's eyebrows elevated. "Yes, they do. I learned that while I was teaching at the school. It amazed me.

"Their newborns are usually healthy, and usually arrive with few problems. So Marla's background would have told her she should have had every expectation of having a healthy baby girl. And consequently, when tragedy struck, she was even more devastated than one of our own generation would have been."

"I grant you that." Andrea waved a hand. "But still, should she not be recovering even somewhat?"

"Andrea, have you never seen a mother lose a child and grieve so severely she wasted away?"

"All right, I concede the point. And poor Franz is almost as bad, grieving for his child and then grieving almost as strongly for his wife." Andrea drummed his fingers on the table top so strongly the wine danced in his glass. "Surely this cannot happen. God cannot have given her that voice, only to see her waste away and not use it."

"I agree with you, my friend, but you will have to take that up with God. I have already spoken with Him about it. Perhaps He will listen to you."

"There has to be something we can do!" Andrea slammed his fist on the table, causing wine to slop out of his glass.

"What do you suggest?" Giacomo set his glass down and leaned forward.

"I don't . . ." Andrea sat bolt upright, thoughts racing. "Then again, maybe I do know." He drained his glass in one gulp. "Maestro, please be available to me tomorrow evening."

With that, Andrea was gone, leaving a bemused Giacomo to finish the bottle of wine by himself.

Magdeburg, the next evening

True to his word, Master Andrea returned the following evening. Giacomo opened the door at his knock, and stepped back to let an apparition through.

"My, Andrea, you do look . . . what was the phrase the Grantvillers use . . . oh, yes . . . you look a wreck."

Giacomo's mouth quirked as he sat across the table from Andrea. His friend was a sight. Normally very well-groomed and particular about his appearance, he was a definite exception to that rule tonight: hair disheveled, blood-shot eyes, definitely wearing the same rumpled clothes he had worn yesterday. A muscle tic'd under his cheekbone with some regularity. The hint of breath that wafted across the table made Giacomo glad they weren't sitting closer. "So, Andrea, what have you wrought?"

"Wrought, indeed, maestro. I have not slept since I left—coffee is wonderful stuff when you want to stay awake, drunk as the Grantville military prepares it—hot, strong and bitter. And because of it, I have this."

Andrea pulled a paper from his coat pocket. Giacomo set a glass of wine in front of him. Ignoring the wine, Andrea leaned forward, eyes intent, almost blazing. "Maestro, Signora Marla will not or cannot sing—it matters not which. Here . . ." He slid the paper across the table. "Here are the words she would sing if she could."

Giacomo took the paper and began reading the text scribbled on it. His eyebrows climbed his forehead as he read. As he set the paper down, he looked to his friend with new respect. "Andrea, I did not know you were a poet . . . and in English, at that."

Abati waved a hand in disregard. "Maestro, I am no such thing. These words were given to me. Given to me for Marla. We must sing for her, maestro, sing for her soul struck dumb. Write the music, please. Write music that only I can sing, music that can burst her bonds, that the gates of her hell cannot prevail against."

Giacomo felt the burning gaze of his friend as if it were a physical force. Perhaps he caught some spark from him, for his heart quickened. "All right, Andrea. I will do my best."

A very tired smile crossed Andrea's face. "Good." He drained his glass of wine as Giacomo picked the paper back up and began intently studying the text.

After a moment, there was a clank. Giacomo looked up to see Andrea slumped over the table, mouth open and eyes closed, asleep. The cup was overturned beside his head. Shaking his head with a smile, Giacomo returned to the text.

Magdeburg, Early November, 1635

Franz sighed as he settled Marla into her seat. She stared straight ahead, hands clasped in her lap, seemingly oblivious to everything around them.

When Master Andrea had contacted him about the recital that he was going to perform, he had insisted that Franz attend with Marla. When Franz demurred, Andrea grew more insistent, in the end all but demanding that they attend. Franz finally acquiesced, but now he wondered if the wiser course would have been to decline the invitation.

This was not a large public concert, for which he was thankful. It was a recital, with only the elite of the patrons in attendance; Mary Simpson's "music mafia" and their friends. Some few of them did stop and speak to Marla, which made Franz a little nervous. In her current frame of mind, he was never quite sure what his wife would say. Aware nonetheless of the pitying glances directed their direction from all around them, he sighed, wishing the evening was over.

The side door opened. Master Andrea strode into the room, followed by Hermann Katzberg. Wearing his customary short waisted jacket and long trousers in black velvet, Andrea made his usual flamboyant bow, then straightened and nodded regally to Hermann. With that, the recital began.

It looked like Andrea, *il primiero gentilhuomo* that he was, intended to follow Franz's philosophy for a concert. The first item on the programme was a cantata for soprano, *Tra le fiamme* , by Georg Friederich Händel. Despite his state of preoccupation, Franz found the musings of the poet about how he was "playing with fire" in his pursuit of love both witty and well done. Andrea, needless to say, more than did justice to the four arias and interlude recitatives. At the end, the performance was well-received by the elite audience.

The Händel work proved to be a warm up, for the next work on the programme was nothing less than *Der Hölle Rache kocht in meinem Herzen (The vengeance of Hell is in my heart),* more usually known as The Queen of the Night Aria, from *Die Zauberflöte* , by W. A. Mozart. The contrast of range and style between the earlier work and this most bravura of soprano arias was marked. Franz was caught up in it, forgetting for that moment the burden that was his constant companion. Once again he marveled how the body of a man, even though castrato, could produce a voice equal to Marla's.

Master Andrea drove the aria to its triumphant conclusion. The audience responded in kind, with loud extended applause.

For contrast, the next three songs were of a different style, composed some years later by Franz Schubert. The singer's composer, Marla called him. Three of his best followed the Mozart: the quiet, almost serene *An die Musik(To Music);* the introspective *Nur wer die Sehnsucht kennt (Only one who knows longing)*; and *Gretchen am Spinnrade (Gretchen at the Spinning Wheel)***,** where Gretchen's dreams and longings for her lover Faust were set against an accompaniment that was almost more of an art work than the melody.

Again, Master Andrea sang with superlative skill. Nonetheless, Franz detected an air of . . . almost distraction in the master. He had worked too much with Marla and Andrea both not to notice when someone of that calibre was not totally focused, and Andrea was not.

None of the patrons seemed to notice, which did not surprise Franz. Their applause was again long and loud.

That was the end of the programme, but Franz was not surprised to hear members of the audience call for an encore. It also did not surprise him to see Master Andrea hold up his hands after a moment and motion for quiet.

"Thank you, thank you." Andrea bowed slightly and spread his hands. "As it happens, I do have one more song to sing." There was laughter in the room. "It is not an up-time song, however. It is a new song, one written by Maestro Giacomo Carissimi, who has agreed to play piano for me tonight. In addition, we will be joined by Johan Amsel on the viola."

There was a moment of moving bodies as Hermann left by the side door, Johan entered, and Maestro Giacomo arose from his seat in the audience to come to the piano. The maestro played a note; Johan plucked strings to verify his tuning was still sound, raised his viola and positioned the bow, then looked to Andrea.

"We present to you," Master Andrea said, looking directly at Franz, " *Elegy for Lost Innocence.*" A chill chased down Franz's spine, and the hairs on the back of his neck prickled.

The piano began, quiet chords, and Andrea began. It was a lullaby, simple, like something Franz's mother would have sung to him. Soft and lyrical, Andrea's voice was like silk.

"Hush little baby,
Go to sleep.
While you're sleeping
Angels keep.
Hush little baby,
Child of love.
Jesus watches
From above."

They repeated the lullaby. Johan joined them the second time, playing a harmony that complemented Andrea's melody.

At the end of the lullaby, Andrea dropped out, and the piano and viola played a transition that, as it progressed, grew more dissonant and louder. Johan began attacking his strings, producing almost percussive sounds.

When Andrea entered again, it was with full voice.

"She's gone!
How could you take her?"

Full of passion, pure cutting edge of white-hot intensity, Andrea put voice to a bereaved mother's soul. As the text was presented by the song, a mother's heartbreak was bared, her anger and grief revealed. It built and built, spiraling higher, founded on the piano and entwined with the viola.

"She did nothing wrong!
She didn't deserve to die!"

As Andrea poured forth all his art, all his skill, Franz felt that never had he heard the *gentilhuomo* so much at one with his music, so nakedly baring his own soul.

A hand clutched his. He froze for a moment. Looking down, Franz saw Marla's hand in his. Heart in his throat, he looked to his wife. At the sight of slow tears trickling down her cheeks, his own eyes grew wet, but a tremor of joy was felt for the first time in weeks.

"Send her back,
Take me in her place!"

The song crested with Andrea on a note so high that Franz wondered if even Marla could reach it. Partnered by the moaning viola, Andrea keened.

The music stopped. For a brief moment only.

"Take me in her place."

Andrea's voice repeated the last line of the climax down an octave, quietly fading, as if the anger had burned out and the grief had worn thin.

There was another interlude of piano and viola, playing a hint of the lullaby. Andrea sang another verse.

"Lord Jesus, take her in your arms.
Lord Jesus, keep her safe and warm."

Marla's head bowed, and Franz could see her lips moving.

The piano and viola led the way back to the lullaby theme. After a time, Andrea rejoined them.

"Hush little baby,
Go to sleep.
While you're sleeping
Angels keep.
Sleep in the arms

Of the Lord,
You'll always
Have my love."

The music faded away. The patrons applauded, but Franz was very aware of the many glances directed their way.

Marla looked up at him. She smiled—smiled! Oh, it was a small smile, and a sad one, but it was a smile! It was enough for his soul to want to burst out singing to rival Master Andrea.

"Hello, love," Franz managed to say.

"Hello, yourself." The smile grew a little wider, a hint of her old sparkle entered her eyes, and she squeezed his hand. They sat there, oblivious to their surroundings, simply gazing at each other, while the applause ceased and the patrons began to stir around and leave.

Just as Franz became conscious of all the motion, Marla stood. He followed her as she walked to the performers.

"Thank you." Marla spoke to them, simple and direct, then kissed each lightly. She smiled again when Johan blushed, then stepped back beside Franz and joined hands with him.

The four men were grinning widely. Their eyes were bright indeed—perhaps a hint of moisture, Franz thought. Then he noticed that there was a certain self-satisfied air to the two Italians. Suddenly a connection was made.

"You planned this," Franz accused. "You intentionally wrote that song and staged this recital for the purpose of drawing Marla out."

"Actually, it was a division of labor," Giacomo said. "The music is mine, yes; but you must look to Andrea for the words."

"Are you a poet, then, Master Andrea?" Marla asked. "Shall we add that to your list of many accomplishments."

"No!" Andrea was emphatic. "This once, I wrote words. This once, to bring my best student back to me." He adopted a mock sternness. "You have missed enough lessons. We have much work to do to make up for them."

Marla laughed, and the sound was balm to Franz's soul. The others must have felt the same, for they all fell silent. Franz looked to his wife—her eyes sparkled, her cheeks were flushed, there was a smile on her lips and she clutched his hand. The only evidence of the events of the last few weeks were the shadows beneath her eyes.

Franz's heart was so full it could burst. He looked to the others. "I owe you a life, my friends. It is a debt I can never pay, but know that at any time, for any need, I am yours." The intensity in his gaze impacted them all—they knew how deeply he felt at the moment. Young Johan blushed again and ducked his head; the others simply nodded, not attempting to downplay the moment.

Marla looked around the group one more time. "Thank you, thank you all. It is the love of the friends

God has given us, friends like you, that have lifted us—lifted me—in this time of darkness."

"There will be other children," Giacomo said softly.

Marla smiled through the sadness. "I know that. And I know that by enduring what we have just walked through, whatever happens, we will survive."

"Survive and prosper," Andrea said. "Survive and prosper."

Marla turned to face Franz, and looked into his eyes. "Survive, and prosper, and love—love above all."

Coda

From "The Fall of Fire: The Coming of Grantville and the Music of Europe"

Charles William Battenberg, B.A., M.A., Fellow of the Royal Academy of Music, Schwarzberg Chair of Musicology, Oxford University

1979, Oxford University Press

Chapter One – The Advent of Grantville

". . . story of Grantville's appearance is a matter of fact to every child in school . . . endless tomes on the impact of Grantville on politics and technology . . . impact on musical arts was, if anything, even more profound . . . hesitated to attempt yet another survey, but a number of new evidentiary sources have been uncovered in recent years, including journals of several notable figures . . . course was shaped by the triad created by the fortuitous meeting of composers, performers and the first modern conductor . . ."

Chapter Two – The South Advances

". . . one of the earliest known works evidencing influence of Grantville's music is *Lament for a Fallen Eagle* , by Giacomo Carissimi, renowned Italian composer . . . several versions exist in the composer's own hand . . . followed in short order by *The Passion According to St. John* and the opera *Brutus* . . . Carissimi was nothing if not prolific . . . early works were all transitional, all produced while Carissimi's assimilation of up-time forms and techniques was still in progress . . ."

". . . most musicologists agree that the first work by Carissimi that exhibited his fully mature style was

Elegy for Lost Innocence , written on the occasion of the death in childbirth of the first child of his very good friends Franz Sylwester and Marla Linder . . . the composer was in full command of his newly expanded palette of techniques, forms and modalities . . ."

". . . The first performance was apparently given in a recital by Andrea Abati, the noted castrato, who was also a good friend of the bereaved parents . . .recently discovered journal of Duchess Elisabeth Sofie of Saxe-Altenburg describes the recital in great detail . . . the young duchess indicates she was greatly touched by Abati's performance of *Elegy* , and joins with other contemporaneous accounts in raving about how beautiful it was yet how great the impact . . ."

". . . *Elegy for Lost Innocence* is infrequently sung. Perhaps one performer in a generation will attempt it. Modern sopranos find the emotional demands to be equally as harsh as the technical demands . . . it is more often heard in the transcription for violin made by Franz Sylwester . . . still heart-breakingly beautiful . . ."

". . . journal of oldest surviving child, Alexandria Maria Sylwester . . . herself no mean performer . . . asked her mother why she had never sung the *Elegy* . . . responded with 'That's Andrea's song, not mine.' . . .explains tradition amongst descendants of Marla Linder . . . none have sung *Elegy for Lost Innocence . . ."*

Chapter Three – The North Responds

". . . Heinrich Schütz entered the scene in 1634 . . . perhaps took longer to assimilate the up-time methods than his Italian contemporary . . . began writing in a strong style almost immediately . . . moved in a different direction . . ."

". . . wrote in large works, beginning with *Fantasia on a Theme by G.F. Händel* , based on the *Sarabande* from *Suite No. 11 for Harpsichord* . . . recorded in the journal of Lucas Amsel that Schütz considered it an *homage* to the up-time composer Ralph Vaughan Williams . . ."

". . . tradition has long been that Schütz's *Mass on Unchained Melody* was composed to mark the death of Marla Linder's daughter, much as Carissimi's *Elegy for Lost Innocence* was . . ."

". . . again indebted to the journal of Lucas Amsel . . . Schütz's *Passion of St. Luke* . . . his master confided to him that the famous aria, *Mein Herz Weiß,* or *My Heart Knows* , sung by Mary looking up at her crucified son. . .was written specifically for Marla Linder. . . justly famous . . . in its own way, just as demanding as Carissimi's *Elegy for Lost Innocence* . . . but 'She could not have sung it before losing

her baby,' Master Heinrich said. 'She would not have understood the pain.' . . ."

Chapter Four – *Fiat Lux*

". . . the triad of the composers—Carissimi and Schütz; the performers—Linder and Abati; and the conductor—Sylwester; these lit the beacon that drew a generation of musicians to Magdeburg . . ."

Butterflies in the Kremlin, Part Eight: As the Bear Turns

Written by Gorg Huff and Paula Goodlett

Sheremetev laughed. "Leontii is a fine man, but not nearly subtle enough for this. The new political officer for the Dacha is . . . Anya."

* * *

It was all Anya could do to keep her face still, even though she knew that very stillness was a tell in its own way. Sheremetev had to have done this on purpose; it was his way. Even his carrots were sticks. A promotion and a betrayal all in one. His means of keeping loyalty, to make any other loyalty impossible. She glanced at Natasha and the look of shocked enlightenment on her face gave Anya courage in a strange way. She knew that Natasha would be telling herself that she had always known, but Anya knew better. Natasha hadn't liked Anya because Anya was a peasant and was better at math than Natasha was. And especially because Anya was fucking Bernie, not going to bed alone.

That last thought sent Anya's gaze to Bernie who was looking at her like she had two heads. She turned her eyes away. Looking at Bernie was dangerous. Anya couldn't afford to let what she felt show on her face. Which brought her back to Sheremetev. He was examining her like she was one of the scientist's butterflies. A dead insect pinned to a plank for examination. She stood, bowed and smiled an easy, friendly smile. It was a smile she had practiced for years. "Thank you for your trust, my lord. You may depend on me."

"I was quite sure I could," was Sheremetev's smug reply. Then he turned to Natasha. "The Dacha will continue to run very much as it has in the past, save that projects must be cleared by Anya. To make sure that the results are, ah . . . desirable." Anya knew what that meant. Projects which would enhance Sheremetev's wealth, status or power would be approved. Those that detracted from those things would be disapproved. She tried not to look at Bernie. She tried not to think of Bernie.

* * *

Bernie, for his part, wasn't thinking very much at all. His time in Russia had taught him enough to keep him from trying to go across the table at Anya. No, he wouldn't have done that anyway. Maybe storming out of the room. Yep. That was probably what he'd have done back up-time. Mostly what he was doing was trying to take it in. Anya was a spy for Sheremetev. Funny, he couldn't even figure out why that would be such a betrayal. Sheremetev was just another Russian, a member of the high families just like Natasha and Vladimir. He was in the *Duma* and had as much right to information from the Dacha as anyone in Russia. Besides, the Dacha leaked like a sieve anyway. It was supposed to. The Dacha wasn't supposed to keep stuff secret; it was supposed to take the knowledge freely given by the up-timers and put it in a Russian context so that it could be used to make Russia a better place.

Somehow, in spite of all that, it was still a betrayal. Anya had been lying to him all along. Everything she had said or done since he got to Russia had been a lie.

* * *

Well, I suppose I should have expected this, Anya thought. She reached for one of the boxes. "Tell me, Irina, why my things are all over the place here."

Irina was a bit of a snot, one that Anya wasn't at all fond of. So she pretty well expected the girl's smirk, even though the words hurt.

"Bernie said that the Comrade Political Officer could requisition whatever room she wanted," Irina said. "And that if it was his room, he'd just as soon sleep with one of the horses."

Of Bernie himself there was no sign. He was out checking on a new steam engine. Which, Anya knew perfectly well, didn't need checking on. So the political officer requisitioned a room in the Dacha. One of the good ones. Not Natasha's . . . though she thought about it. She was angry enough.

At an undisclosed location somewhere in Russia

Mikhail Romanov, Czar of all the Rus, bounced his daughter on his knee with a mixture of relief and profound loss. The relief was because he and his family were safe—at least for the moment. The loss was not for the loss of power, but for the loss of his father.

Mikhail had been told that his father had died of a stroke during the riots and that was entirely possible. Filaret, Patriarch of Russia, had in fact had a series of minor strokes before the riots started and his response to the riots was quite likely to have led to another one, quite possibly fatal. Still, the timing was suggestive. Filaret would never have gone along with Sheremetev's takeover and he had the connections to fight back. Mikhail couldn't help the belief that one of Sheremetev's agents had managed to get close enough to the patriarch to help the stroke along. The possibility that Filaret was still alive was no more than a fantasy.

Mikhail knew that he should be fighting Sheremetev because of those suspicions and for the good of Russia. But he wasn't. He knew virtually nothing of what was going on in the wider world. He had no basis to plan and, for now at least, he and his family were being treated quite well. Also, from what he did know, Sheremetev's plan depended on his continued safety.

Life was full of strange twists of fate and even more so when you were living in a time of miracles. The Ring of Fire had seemed a wild rumor when they had first heard it. Sending Vladimir to check it out had

been a precautionary measure. But it had all proved to be true. Vladimir had stayed in Grantville to learn the secrets of the up-timers and Boris had brought an up-timer back with him. Bernie had started out as little more than a dictionary of up-timer English on legs. But being used as a dictionary has side effects. Poor Bernie had found himself in school. Mikhail laughed a little at that thought. One student and hundreds of anxious teachers, each insisting that he learn enough to explain some other artifact of a language was foreign to even those that spoke seventeenth century English. Mikhail could sympathize with Bernie's predicament; he wasn't a scholar by choice either. And he, like Bernie, had been forced by circumstances into a role he wasn't well prepared for when he had been dragooned into becoming czar of Russia.

Come to that, Vladimir wasn't a trained spy. That was Boris. Still, Vladimir was doing an excellent job—aided and abetted by the up-timers free way with their knowledge. He and Boris had kept Russia from the Smolensk War, even before Boris brought Bernie to Russia. Vladimir had married a up-timer girl and was well situated in their community. And quite openly, for the most part, sending tons of copied books to Moscow, along with information on innovations made since the Ring of Fire as down-time craftsmanship had combined with up-time knowledge. That part was harder, from what Mikhail understood, because some of the new businesses were much more secretive than the State Library of Thuringia Franconia. Still, Boris had left Vladimir a good core organization and Vladimir had expanded it. So the Dacha and the Gun Shop, Russia's industrial and military research and development shops, were well supplied with up-timer knowledge.

That knowledge, combined with Russian ingenuity and a willingness to go with simple, workable solutions rather than slavishly copy everything the up-timers were doing, plus a brute force approach that involved putting lots of people to work on projects that the up-timers could probably do with a lot less, had stood Russia in very good stead. Both industrially and in the recent battle over Rzhev. Russia had the beginnings of an electronics industry at the price of several people accidentally electrocuted. Telegraphs and telephones in the Kremlin and radios—soon—with experiments on tubes and transistors, Mikhail was told. So far unsuccessful. A test dirigible built and used at Rzhev and a much larger one under construction. Plumbing at the Dacha and starting to appear other places, including parts of Moscow. New rifled muskets with replaceable chambers for the Army and new breach-loading cannon as well. New pumps for clearing mines of water and for creating vacuums. Which apparently had a myriad of uses. Improved roads, steam engines . . . the list went on and on. Sucking up labor almost as fast as the new plows and reapers freed it, perhaps faster. The free peasantry—what was left of it—had been among the first to go to the factories and set up their own, along with the musketeers who were Russia's traditional merchant class.

Mikhail was less happy about some of the policy changes that Sheremetev had come up with. He didn't

mind the wood railroad to Smolensk, but selling to the Turks bothered him.

Moscow, the Grantville Bureau

Boris filled out paperwork and tried not to think about what was happening. Sheremetev was an idiot who had no concept of how to treat people to get the best work out of them. He couldn't inspire or motivate, save through threats. But, for now at least, the threats seemed to be working. Sheremetev had complete control of the *Duma* through a combination of bribes, coercion and outright threats. Worse, he was what the up-timers called a micromanager, and his decisions were wrong more often than not.

It wasn't that Boris disagreed with Sheremetev's assessment of the general situation in Europe.

The Swede was much more dangerous than the Pole. That had to be clear to anyone except an idiot.

But Boris didn't think Sheremetev really believed in paper money. Boris didn't really believe in it himself, in spite of the fact that he had seen it work in Grantville. But Sheremetev was pushing it as hard or harder than Czar Mikhail had been and the czar had believed in it and at least seemed to understand it. Boris figured that Sheremetev was just using it to sucker people into giving him gold and working for nothing.

Just outside the Ring of Fire, near Grantville

"Sheremetev is teaching us a lesson," Vladimir explained. "He's also tempting us, putting pressure on to see if we will defect. Well, if *I* will defect. You hold dual citizenship."

"What lesson?" Brandy asked.

"Don't try to hold up the Russian government. Or, more accurately, don't fail to cut him in on it."

"So how bad is it?"

"Bad! It's the advances." The ruble, now a paper currency, with the face of Czar Mikhail and the double-headed eagle on the face and the Moscow Kremlin and a Russian bear on the back, was valued at less than half the value of the Dutch guilder in spite of the fact that it was supposed to be equivalent to the silver ruble coin that had twice the silver of the Dutch guilder. Partly that was because the czar and *Duma* had issued rather more rubles than they really should have. But mostly it was because the Dutch merchants resented the heck out of the paper ruble. It had changed the whole trading landscape in Russia. Dutch merchants had gone from absolutely vital to convenient. And the price they paid at Arkhangelsk for grain, cordage, lumber, and other Russian goods had more than doubled.

Partly out of resentment, the Dutch wouldn't deal in Russian paper money or money of account based on Russian money. They would still accept Russian coins, but their refusal to deal in Russian paper had its effect. "If the canny Dutch merchants wouldn't take paper rubles, there must be something wrong with them. Right?" So rubles traded in Grantville, Venice and Vienna at less than a quarter of face value. And that was if you were basing face value on the amount of silver in a ruble coin. If you figured it in the price of a bushel of grain at Arkhangelsk versus the same bushel at Amsterdam, it traded at less than a tenth of its face value.

And it's really hard to make a profit if you're losing more than nine-tenths of your money to arbitrage. Vladimir spent his rubles where they would buy something, then shipped the goods to the USE for resale, just like he had been doing from the beginning. And, like any good man of business, he tried to find buyers in advance rather than shipping the goods on spec. What Sheremetev objected to was how much of the money Vladimir was investing in Grantville and the USE. Sheremetev wanted Vladimir to buy silver and gold and send it back to Moscow. Which made no sense at all. If Vladimir was going to do anything along those lines, he would be buying paper rubles in Grantville with silver where he could get a lot of them, then shipping the rubles back to Moscow where they would buy more.

Vladimir had contracts to sell five thousand stacked-plate mica capacitors, plus several tons of other mica products. But what he didn't have was this quarter's shipment of mica and mica-based components. Also missing were a couple of hundred miles of cordage, several tons of Russian hardwoods, plus sundry other goods. In other words, several million American dollars worth of goods, which he was morally and legally obligated to provide. And about half of it had been paid for in advance. He was insured against

loss at sea. With Swedish control of the Baltic, the insurance hadn't been all that expensive.

What he wasn't insured against was Sheremetev and the *Duma* preventing him from bringing out the goods. Goods that had never sailed from Nyen ,Saint Petersburg it would have become in that other history. Goods that had never even reached Swedish Ingria. It wasn't just that money wasn't coming in—money that had already come would have to be paid back with penalties for non-delivery.

Vladimir wasn't broke exactly. He was now deeply in debt. In some ways it was better than being broke, but in others much worse. Partly to gain access to the developing tech and partly just because it was good long-term financial strategy, he had invested in some of the more long-term projects. He was, for instance, fairly heavily invested in three of the companies that were working on down-time manufacture of automobiles. And he was the major investor in a group that was working on the tubes for microwaves. They didn't expect results for years, but they were working on it and Vladimir was the primary backer of the research. Microwave tech was just too useful to ignore because it was hard to do.

Vladimir hadn't been particularly extravagant in his investments, or at least he didn't think he had. There was room in his financial structure for occasional delays or even an outright disaster. Most of the time. But not just now. Just now he was, ah, making a movie. "Well, the advances and the movie."

"Oh! Now don't blame me!" Brandy said.

"I didn't say a thing," Vladimir protested. "You asked."

Brandy, or rather Judy the Younger, had introduced him to the producer. Gino Bianchi, a down-timer from Italy who had a great deal of experience in producing plays and extravaganzas. He also had Els Engel to play Rebecca Stearns, Agnes Engel to play Kathy Melton, for whom the Las Vegas Belle was named, and Karl Shubert to play Hans Richter. *Der Falke,The Falcon* , wasn't really the Hans Richter story, though he had a major role. It was the story of the forming of the USE. In fact they had almost called it *The Birth of a Nation,* but the mixture of laughter and disgust from the up-timers had killed that name.

"It's going to make a fortune once they finish it," Brandy added. *Der Falke* was over budget and behind schedule, in part because the differences between staging a play and making a movie were so great and in part because it was just plain hard to do the air scenes. They knew what they wanted—they had all seen *Star Wars* after all—but getting it was another matter.

"I know and we could cover the cost well enough if it weren't for . . ." Vladimir waved vaguely eastward indicating the political events in Russia. "As it is, the money we put into the film, and more, is needed to cover the missing shipment. We've got to find a way to get the goods from Russia to the USE. And I can't set anything up with Natasha because anything I send will probably be seen by Sheremetev before Natasha gets it. If she gets it at all."

"How much time do we have?"

"Several months, perhaps three to six. But that's only if we can be sure that we can get the stuff out of Russia. If we can't, we need to start cutting back as soon as possible."

"Well, I can send a fruitcake," Brandy said, "but given how well secured the Dacha is, I don't know if she will get it. And I don't see how we will know until the stuff shows up or doesn't."

* * *

"We will be having guests."

Natasha looked up at Anya's comment. "Guests?"

"Yes. Representatives from the Ottoman Empire. They have been looking at factories on the Don and Volga rivers and we have been told to be circumspect in what we show them."

Natasha hated to ask Anya but she needed to know. "What is going on?"

"The government is looking for new allies in case Gustav Adolph and the USE decide to look east for new lands to conquer."

"Insanity!"

"Actually, it's not," Anya said with what sounded like real regret. "You know that Sweden is perfectly willing to bite off pieces of Russia. Our access to the Baltic is now Swedish Ingria and we pay taxes to Sweden on every cargo that sails from Nyen .And peasants run from Ingratioto be serfs in Russia, while the Swedes complain and threaten about their running and our use of Arkhangelsk, even though it's iced in half the year. Suddenly Gustav has all these new weapons, the USE is rapidly becoming the richest, most industralized, nation in Europe . . . Yet still he complains about our holding back the grain shipments when he knows we lost a quarter of this year's crop to the early storm."

"But the up-timers would never let . . ."

"Let? 'Let' is not a word used with kings, Natasha. Besides, Mike Stearns is not the prime minister anymore. Do you really think Wettin would even try to stop Gustav?"

"You really don't care about anything, do you?" Natasha spat. "Whatever your master says, you parrot . . . the party line!"

Anya looked at her and Natasha realized that their relative positions were not what they had seemed. She was still a princess, but Anya had the ear of a boyar and—for now at least—the most powerful man in Russia. It also occurred to her that pissing off someone with the ear of what amounted to the shogun of Russia might not be the best idea in the world. Since Sheremetev had taken power there had been a purge of the bureaus the like of which hadn't been seen since Ivan the Terrible. The Dacha and the Grantville Bureau had gotten off fairly lightly—in large part because between them they were the goose that was laying the golden eggs. But even they weren't untouched. Boris had lost several people who were considered politically questionable and the Dacha remained under guard.

Then Anya said, "Actually, I despise him. Both because of what he has done to me and because he is, in general, a nasty piece of work. Unless you happen to be a close friend. However, that doesn't blind me to what he is doing. The Limited Year hasn't been repealed and the bureau men aren't screaming about it anymore. They're too busy covering their asses by kissing his. The purge in the bureaus has been extreme, but it hasn't been entirely political. A lot of the deadwood has been removed and there is greater opportunity for those with more talent and fewer family connections. Peasants aren't just going to look for gold in the mountains, they are finding factory jobs all along the Volga. The jobs suck, but they are better than being a farmer.

"As to Sheremetev's foreign policy . . . However noble of character the up-timers may be, they aren't in control of the USE. They have influence out of proportion to their numbers, but those numbers are miniscule. Poland is probably less of a threat to us than the axis of Sweden and the USE. From where we sit, the biggest difference between Napoleon or Hitler and Gustav Adolph is that his army would probably do quite well in a winter war in Russia. He was born and raised in Sweden, after all. If King

Gustav should decide to take Poland and keep coming east, we will be facing a force that outnumbers us and outguns us, led by a man who is quite possibly the greatest general of the seventeenth century. We will need allies. All of them we can get.

"Natalya Petrovna," Anya said, "I take no joy in the thought of war with Bernie's people. But I learned at an early age that what I want doesn't control what happens."

* * *

"Bernie seems to think so, but our research has shown that you spend much more in fuel for moving the same weight with heavier than air craft," Grigorii Mikhailovich explained rather more fully than Filip Pavlovich Tupikov thought was really necessary.

"Bernie?" Lufti Pasha asked.

"A member of our staff hired from, ah, central Germany," Filip said. Bernie was gone while the Turks were visiting the Dacha. This was for three reasons. First, the Turks didn't officially acknowledge that the Ring of Fire had happened. They knew about it. Filip imagined that every beggar in Istanbul knew about it. But they didn't acknowledge it. So, it made it easier for the delegation if he wasn't there. It would help to avoid slips of the tongue. The second reason was that it would be much easier to keep the topics of conversation to what they were doing and avoid giving away technical details of how they were doing it if Bernie wasn't around. At least it was supposed to. Filip gave Grigorii a look. And finally, Bernie was just likely to say something stupid about the Turks and their presence if he was here. He had been difficult to live with since Anya's promotion and the revelations of her previous job.

"I understand." Lufti Pasha smiled at Filip. Clearly a man who knew how to play the game. "Will we be meeting him?"

"I am afraid not," Filip said. "He is supervising the installation of a phone system at Dedovsk." Not that the phone group needed Bernie's supervision. "Now, if you will come this way, we will show you the chemistry labs, where we do not attempt to turn base metals into gold. Rather we make dyes and medicines . . . and if we can get better access to your naphtha, we will be making fuels and plastic materials."

* * *

"Send him a jar of Sophia's special borscht," Anya said. She was getting just a little tired of Natasha unloading on her about the actions of Sheremetev. It wasn't her fault that he wanted to make the point that Vladimir was still under his authority even in Grantville.

Natasha looked her, clearly confused. "What?"

Amateurs, Anya thought. "Like the onion apple pecan cake." She watched as Natasha went so pale that she wouldn't even need the white pancake makeup that, in spite of everything, was still popular in Russia among the upper class. It was quite enjoyable to see. "Surely you didn't think I wouldn't know?" Anya kept her voice light and even managed to put a bit of surprise in it. Sort of like a teacher explaining to a student that yes, she was aware that two plus two equals four.

"Sheremetev? Does he . . ."

"No, I don't think so. Your sister in-law seems quite a bright young lady. The cakes are good because it is quite unavoidably obvious if they are tampered with. All that crust. And, considering the list of ingredients, it's unlikely that anyone would filch one to eat at home."

"Then how?"

"The hole in the middle! You failed to eat the evidence . . . which is understandable, I guess. But you also failed to crumble up the cake remains, which was just plain stupid!"

"Who examines table scraps?"

Anya looked at her. Could Natasha really be that naïve? Then she realized that in just that one place, Natasha could be that naïve.

"I'm sorry, Princess, truly I am. I didn't realize how sheltered you have been." Anya paused then spoke in as dry and dispassionate a voice as she could manage. "People who live on the border of starvation examine table scraps as automatically as breathing. We do it in the hopes of easing the constant pain in our bellies. And we keep right on doing it even after the threat of starvation is gone. It becomes a habit that can stay with us the rest of our lives. At least, it has with me. Besides, when my time at the edge of starvation ended, my time of training began. There, failure to notice things was severely punished. I never knew what I was supposed to notice so I tried to learn to notice everything."

Anya had spoken more than she'd meant to. Which didn't invalidate her training or experience. She still watched Natasha, noting the reaction. It wasn't understanding that she saw in Natasha's face, but perhaps the first realization that there might be something in Anya to understand. That the labels "spy" and "traitor" weren't all it took to define Anya in her totality. And that, in turn, sparked a realization in Anya that there might be more in Natasha than was encompassed by the up-timer expression "rich bitch."

It wasn't much, but it was a beginning. It was unlikely that Natasha and Anya would ever become bosom buddies. However, something approaching mutual respect might be possible. Perhaps even an alliance of sorts. Even so, that was for later. For now . . .

"Actually, I doubt that the restrictions on your brother's exports are aimed as much at you or him as they are at the king of Sweden. What are capacitors used for?"

"Radios mostly, the ones we're sending. A few of the really big ones are probably for use in power plants or the big radio stations," Natasha said.

"So, command and control of their armies and propaganda?"

"If you want to look at it that way, I guess."

"Believe me, that's the way His Most High Excellency looks at it." Anya shrugged. "Not that he objects to inconveniencing your family. I'm told that having to deal with people he can't control upsets his liver. And you aren't that popular with most of his support group." Quite a few members of the boyar class had gone from being dismissive of the Dacha and what it might produce to resentful of the Yaroslav's semi-exclusive control of the technology. Not that even semi-exclusive wasn't overstating the case. Aside from the part given over to the government and the rights sold to other groups, more than half of the stuff produced in Russia based on information from Grantville and the Dacha was produced without license. A blacksmith would get a good look at a new plow or a scraper and copy it on his own. Glass works were springing up all over the place and who was to say where they got the formula they were using? Ice houses, using natural and manmade ice, canning and freeze drying plants were also springing up. And the list went on.

It was true that the Yaroslav family generally got it first. That early access made it possible for them to arrange partnerships with merchants and manufacturers that were producing significant profits. As they had gained in wealth, they gained enemies among the great families.

Natasha nodded agreement. "Do you think the exports are a danger to Russia?"

"It's not that important," Anya said, "not when compared to the information your brother provides the Dacha. "

"Do you think you could . . ."

Anya was already shaking her blond head. "Not a chance. Whether it's to bring Vladimir to heel, send a message to Gustav or because he just wants more silver where he can get his hands on it, Sheremetev isn't going to change his mind about it. You will have to find a way around the restrictions." She considered a moment, then continued. "I would suggest going through a Polish merchant. Someone who is friendly with Sheremetev and has connections with one of the banks in the USE. Not an Abrabanel but perhaps an Abrabanel connection."

"That will take time to set up and Vladimir needs the goods now."

"Does he need the goods or just assurance that they will be coming?"

"The goods would be best, but assurance would probably work."

"You'll need to send him that bottle of borscht then."

Anya watched as Natasha tried to work out why she was helping, then gave up the effort. "Why?"

"Bernie!" The word exploded with rather more force than Anya would have preferred. Since Sheremetev's revelation they had barely spoken. Anya had no idea how to deal with the situation. Because, for the first time she could remember, she cared what someone else felt about her. Not with her head, but with her heart.

Natasha was looking at her, head tilted like some sort of inquisitive crow. Or perhaps a vampire getting ready to dine, if the half smile was any indication. "Do you want him back or want him dead?"

Anya took a breath to get herself under control. "I know whose fault this is and it's not Bernie's."

"Whose fault is it?" Natasha seemed truly curious.

Anya's first response was that it was her fault. That was what had prompted her comment. But she had really had very little choice. Telling Bernie the truth would have been dangerous to him and, especially, to her. Even if he had accepted it and tried to keep her secret, Bernie was not a good liar. Besides, by the time she had any reason to tell him it was probably already too late. So . . . Sheremetev? His fault? No, not really. He was just doing what any boyar class player might be expected to do and if he hadn't, she never would have met Bernie in the first place. Fate? God? Anya believed in God, but the god she believed in was an autocrat like Sheremetev, even more difficult to please and more likely to punish than the caring, beneficent being Bernie believed in. Anya had long since given up any hope of satisfying the God of Abraham or looking to him for succor.

Which brought Anya back to . . . "Mine," she said with a certain finality. Whatever the other factors, Anya knew that she had betrayed Bernie's trust.

* * *

Natasha was expecting Anya to blame Sheremetev. She was expecting justifications, excuses, reasons why Anya had been forced into what she had done. And by now she knew enough to realize that there would have been quite a bit of truth in them. Some things Leontii had mentioned about Anya and her family. The cold, simple "mine" was the last thing she expected. She had to regroup.

Bernie hadn't exactly been a joy to be around since the revelation of Anya's spying. Nor had Anya been. But . . .

Natasha wondered . . . could it possibly be? True love? Could Anya, cold as she was, truly be in love with Bernie?

"You want him back, don't you?" Natasha asked.

There was dead silence for longer than Natasha could have imagined.

"Yes." Anya's voice was soft. "I do want him back."

Natasha thought for a few moments. "Bernie isn't . . . subtle, Anya. He may realize that you didn't have a choice, but he may not. Have you talked to him at all?"

"Talk to him how? The moment he sees me enter a room, he's back out the door. I think he's only eating because the women in the kitchen are slipping him food so he doesn't have to come inside."

"Hm. I could, perhaps . . ."

"You'd talk to him for me?" Anya looked hopeful.

"Depends," Natasha said. "What can you do for me? And my brother?"

Embassy house, outside the Ring of Fire

The heavy, opaque glass jar arrived with a note explaining that Natasha's Aunt Sophia, having received and enjoyed the Apple Onion Nut Cake, had decided to reciprocate by sending Brandy a jar of borscht from her old family recipe. This statement was followed by a list of ingredients which would make a maggot vomit. With a post script from Natasha. "Vengeance is mine. :-)"

"At least, thank God," Brandy muttered, "We don't have to really eat this stuff."

"It would only be fair," Vladimir said. "After all, Natasha eats the cake."

"Yes, but the cake is actually good. The name just stinks." Brandy held the jar of borscht at arm's length. "Unlike this soup, which stinks to high heaven. And beyond."

They were alone in the kitchen—which wasn't an easy thing to arrange. Servants were all over the place, all of the time. Even at three in the morning, you were likely to find someone awake and doing something. Brandy had told Tate Garrett, their chef, that they needed some privacy. Tate managed to figure out a way to keep Kseniya, the priest's wife and their housekeeper, out of the kitchen overnight, even though it involved Tate producing something extra-special for breakfast. And it also involved owing Tate big time, at least according to Tate.

"Maybe we should have dumped it down the toilet . . ."

"Good Lord, no," Brandy said. "It'd be our luck that the plumbing would back up!"

It wasn't as bad as Brandy feared, once they'd gotten rid of the soup. Inside another well-sealed but smaller jar, was the latest intelligence from the Dacha.

"Hm . . ." Vladimir murmured.

"Hm?" Vlad's "hm" was the type that sounded like good things were happening.

"Well, I've got a name," Vladimir said. "And Natasha has outlined a plan. But we can at least assure our creditors that the merchandise is on the way."

"That's good."

* * *

Pyotr Chudinov looked over his mule train then gave the signal and started the trip to Vitebsk. He carried on his mules several capacitors—whatever those were—and one Russian steam engine made at the Dacha. Also several letters to a Polish factor he was acquainted with. Pyotr hadn't asked, but from Vitebsk the capacitors would travel down the Daugava to Riga which would put them in Swedish territory. Since he had paid his bribes, his main concern at this point was bandits.

And a bit of concern that someone might pry a bit too closely into certain items that were headed to a certain town in Germany.

All in all, it would be a lot better for Pyotr and his family if no one noticed that. Not that Pyotr would be taking them all the way. He would pass them off to a Polish merchant and where they would go from there Pyotr had no official idea. Not that it was hard to guess. Considering that Princess Natalya was sending them and where her brother was.

The Dacha

"And how is Gustav Adolph different from Adolph Hitler, in the up-timer histories," Misha asked.

"He's Swedish, not German." Nikolai laughed.

"Hitler was . . . would have been . . . Austrian, not German. Gustav made himself Emperor of Germany the same way Hitler did in that other history, and is at war with a lot of the same people. France,

England, and maybe next year, Poland.

"Which would be just fine with me." Nikolai wasn't laughing now. "Damn Poles! With their false Dimitrys, murder and looting. At least we taught them a lesson at Rzhev."

"And after that?" Misha asked. "How long before Gustav's Operation Barbarossa?"

"He's too canny for that. After all, the histories make it quite clear how it turned out."

"Yes, because Hitler was a lousy general and didn't understand Russian winters. Gustav is a very good general and does understand Russian winters. But that doesn't make him less ambitious than that crazy up-timer. Just more dangerous."

Bernie had been paying a bit more attention to politics since Anya's revelation. And he was having a lot of trouble making sense of it all. He appreciated that Gustav Adolph had ridden to the rescue of Grantville in the Croat raid, but he didn't approve of the USE having a king or the New US being reduced to just another state. It seemed like Mike Stearns had given up too much of what America had been up-time. Maybe he had no choice but that didn't make Bernie any more loyal to some Swedish king and his German prime minister. By now Bernie had more friends in Russia than in Grantville. It wasn't that Bernie had any great love for the government of Russia, especially now, but America was gone. Left up-time.

And the USE seemed just another down-time nation. its up-timer ideals increasingly diluted by those of the down-timers. From where Bernie was sitting, there wasn't that much difference between Czar Mikhail with Sheremetev and King Gustav with Wettin. At this point, Bernie just hoped that the kings, emperors and czars of the world didn't start a war that had up-timer fighting up-timer. He honestly didn't know what he would do if that happened.

Meanwhile he had work to do. The telephone systems they were working up for the Russian cities used telephone operators that switched the calls by hand, but they wanted an electromechanically switching system. The EMCM, Electro-Mechanical Calculating Machine already used solenoid switches for its memory and combinations of them to produce Nand and Nor gates so Bernie was having to look up Nand gates to figure out if they could be applied to the telephone switching system. After several hours Bernie found out that Nand was short for "not and" in Boolean algebra. He still didn't have a clue whether it could be used in a telephone switching system. But he sent the definition of a Nand gate, complete with the ones and zeros, to the phone guys. Then he went on to the next question someone wanted him to work on.

* * *

"Where are you headed, Tim?" Ivan Maslov asked, looking over Lieutenant Boris "Tim" Timofeyevich Lebedev's new uniform—complete with the new lieutenant's insignia with more than a touch of envy. Then he grinned. Tim was back in Moscow, a second lieutenant with considerable experience with latrines. Tim was still not as good as Ivan was at war games but was getting better.

Tim shuddered. "My uncle . . . he requires my report."

"But you did well at Rzhev! At least officially." Ivan didn't envy Tim his great uncle at all. He had met the old monster once and that was more than enough. But Tim's great uncle was, by good fortune, a supporter of the Sheremetev faction, which now controlled the *Duma* . Not one of the first supporters but he hadn't been purged, not even sent out of Moscow. General Shein, on the other hand, was now in charge of one section of the Siberian frontier, demoted and sent as far from Moscow as you could get and still be in Russia. From what Ivan had heard, General Shein had missed execution by a hair's breadth.

"My uncle is not limited to official channels," Tim said. "I'm to have a chat with him. Which translates to giving him a full report on everything that happened. It will take hours, I promise you. Hours! I won't be able to gloss over anything."

Ivan knew that Tim would much rather gloss over parts of what happened in Rzhev. More for Izmailov's sake than his own. Which was a pretty positive response to someone that had you cleaning out latrines.

* * *

Tim's great uncle was no one's fool and ten times as politically astute as Tim ever wanted to be. It had taken him all of a minute and a half to get through the fiction of the contingency plan. He had laughed at General Izmailov's notion of giving Tim a medal and then having him shot. A rough, cackling laugh, that seemed to come from the depths of hell. "A good plan," his uncle said when he finished laughing. "But he was wise not to carry it through. I would have regretted having a man of such wit put to death."

Tim waited. Silent. At attention.

"Well?" his uncle barked.

"Yes, sir. General Izmailov is a great general and a great asset to Russia."

"But a friend of Shein's, one of his protégés, in fact. Keep your distance from him, boy. Sheremetev's not fond of Shein. The war party didn't do well in this last shake up. I'll try to keep your general alive for you, but not to the point of risking the family. Now tell me about Khilkov. What went on? And why did Izmailov let him do it?"

Tim told him. It wasn't like General Izmailov had much choice, considering Khilkov's family connections. Then they went on to the situation in Rzhev and the Polish border in general.

"Rzhev was a screw up, sir," Tim said. "They didn't have the steam ships to take advantage of it, even if they had held the town. It really was magnates going off on their own."

"I don't doubt it, boy. That's what started Dimitryads. Poland uses its magnates to test the waters."

"Yes, sir. But they didn't have the logistic train to support it even if it had worked."

"You seem pretty sure of that, boy. The Poles are cavalry. They need their horses but can steal the rest."

Tim hesitated. He was in fact quite sure that cavalry would be trashed if it lacked infantry support and Russia controlled the rivers for troop transport. But his great uncle was a boyar of the *Duma* and ruled

the family with an iron hand. "Not with us controlling the river with steam barges. War horses need grain, horseshoes, and so on. Cavalrymen need food and equipment—which breaks in the field—and gunpowder. They would do damage but with the steam barges to put troops in front of them and the walking walls and cannon . . . especially with the AK3s . . . they are going to run out of cavalry long before we run out of bullets. Over the course of an hour cavalry can outrun a steam barge, but over a day they can't keep up. With the dirigible to locate them. . ." Tim shook his head. "They wouldn't last a week."

"Tell me about the flying ship."

"It told us where they were. Which was important in Rzhev, but would have been even more important if the Poles had tried to push farther in. It would have let us see where they were going and get there first. They would have been forced from one trap to another, until they were utterly destroyed. Cavalry is doing well to cover thirty miles a day; a dirigible can cover that in an hour. Then go home and tell the infantry and mobile artillery where the cavalry is headed. Cavalry's day is over except as support troops. If that." Which was a risky thing to say because his great uncle had been a cavalry commander under Ivan the Terrible.

All in all, it was a grueling interview and Tim was happy to get back to the Kremlin. Though Tim didn't know it, the interview had a strong effect on the policies of the *Duma* . Cavalry, which had always been the province of the service nobility, was downgraded in importance and so was the service nobility. Instead, the musketeer class with its rifle companies would be given more support and respect. It wouldn't happen in a year or even a decade, but between the destruction of Khilkov's cavalry and the many reports, both official and unofficial, the writing was on the wall. Eventually, because the service nobility was the class that produced the bureaucrats and the musketeer class was the class that produced the merchants, the private sector would gain—a bit at a time—the ear of the government and the public sector would be heeded a bit less. The years of limited mobility would not be allowed to lapse. With inflation, that would mean that more and more of the peasants would be able to pay off their debts to the lesser nobility and seek factory jobs.

Totally by accident and without ever knowing it, Tim had struck a blow for freedom. A small blow. Even a tiny one. But who knows? Enough such tiny blows and even the massive edifice of Russian serfdom might eventually fall.

* * *

"At last, at last!"

Brandy had to grin. Vlad's happy dance was a combination of many things, not least of which was some old football player's antics after a touchdown. Where he'd ever seen it was beyond her. One of the best things about the seventeenth century was the lack of football, as far as Brandy was concerned. Every fall she did her own happy dance about that.

"Does he do that always?" The speaker was an old Grantville hand in a way. Karl Paschkewicz was a merchant from Silesia who was in and out of Grantville three or four times a year.

Brandy looked Paschkewicz, a bit surprised. "No, not really. But we'd been pretty worried about this shipment."

"I hope he's as happy when he finds out how much fell off the wagon on the way here," Paschkewicz muttered, and Brandy looked at him and raised an eyebrow in inquiry. "Ah, I have a message for the prince."

"From?"

"Perhaps I should speak to Prince Vladimir?"

Brandy looked him, then shook her head sadly. "If you say so. Vlad. Business." The dance stopped at Brandy's tone. "The shipment is not complete and Herr Paschkewicz has a message which he feels he must deliver to you."

"Not complete? How incomplete?" Suddenly there was nothing at all comical about Vlad's stance.

However, Brandy had to suppress a smile at the merchant's sudden gulp.

"Ah . . . the shipment was unexpected, Your Highness. Preparations had not been made. It was necessary to grease some palms. And the contents of the shipment were the only, ah, grease we had."

"Whose palms?"

Brandy didn't recognize the names but it was clear that Vlad did. They were Polish nobility. They talked about who had gotten what and how much. The most important items were mica-based electronics. Which both Russia and the USE would prefer not to have fallen into Polish hands. They would go a long way to providing the Poles with tactical range radios. Of course, the way the Polish nobility worked the fact that some Polish nobles had radios didn't necessarily mean the Polish government had them. The best Vlad could come up with was a maybe. If Russia or the USE ended up at war with the Polish-Lithuanian Commonwealth, it might be that they would be facing radio-equipped forces . . . or it might not.

The letter, it turned out, was from Cass Lowry. How he had found out that the shipment was coming here neither Vlad or Brandy could make a guess at, but he had figured it out and used the information to insert a letter into the shipment. The letter included quite a bit of complaining about the way he was being treated since Sheremetev had taken over plus a few tidbits about the Russian arms program. There was now production of caps and a simple change in the design of the removable chambers of the AK3, combined with replacing the flint with a hammer attachment. These changes turned the AK3 flintlock into the AK4 caplock. And just about doubled the rate of fire for as long as you had loaded chambers. Cass also talked a bit about the eastern frontier of Russia and Brandy wondered if he was planning to resign without notice.

* * *

"We have very little choice, Papa," Pavel said. "Ten thousand AK3s to the Turks, due . . . very soon. The gun shops will be working like mad."

Boris nodded. Things were getting better . . . mostly. Not so much for the Bureau men as for Russia in general. Food and silver were arriving from the Ottoman Empire. Wheat was expensive in Moscow but not yet too expensive. Steam engines, rifles and lots of other things were going south in exchange. Boris was concerned about the rifles, but not that concerned. No. That wasn't quite right Boris was really worried about the rifles but selling them to the Ottoman Empire wasn't the issue. The AK3 was an incredibly simple weapon to make. Selling one to the Ottoman Empire or the Poles or anyone else was as bad as selling a million of them and there was no way that they could keep the Ottoman Empire or the Poles or the Swedes, for that matter, from getting hold of an example rifle. So they might as well sell as many as they could. At least they weren't selling the Ottomans the breach-loading cannon. Though Boris wasn't at all sure that would do any good.

"And so, certain boyars gain more silver and gold from the, ah, southern trade," Boris said. "But at least they haven't shorted the grain supply . . . much."

"And our people are prepared." Pavel smiled. Potatoes had become incredibly popular among the peasants. You could hide a plot of potatoes from the taxman, or at least hide how many there were. There was considerable upset among the Bureau men about the amount of farming equipment that was going south. But it was quiet, underground resentment. "Three of our people have paid off their debt and gone to work for the railroad."

"Signing loan from the railroad?" Boris asked and Pavel nodded. Even with the economy expanding and with inflation, enough rubles for a peasant to pay his way out of debt were hard to come by. So companies that had the money had started using signing loans to clear the peasant's debt, or, more accurately, transfer it to the company. Since the railroad was owned by the Sheremetev family, it had plenty of money for signing loans.

Except for its habit of nicking other peoples serfs, the railroad from Moscow to Smolensk was a project that Boris strongly approved of. It was wooden rails, since Russia was well-supplied with wood. Iron and steel were way too expensive for such a massive project. Boris wondered about the railroad. Sheremetev tended to be on the pro-Polish—or at least the less-anti-Polish—faction in the *Duma* . The railroad could serve to facilitate trade with Poland, and through Poland with Austria-Hungary, but it could also be used as logistical support for an attack on Poland. Boris wondered which Sheremetev had in mind. Probably both.

Meanwhile the industrial base along the Volga was producing more and more goods. Mostly simple stuff. The stuff that didn't need that much infrastructure. But it was surprising how much fell into that category, when it wasn't competing with established products.

"And our factory?" Boris waited for his son to find the figures, then said, "Excellent. Absolutely excellent."

Freeze drying is expensive and time consuming when compared to canning . . . if you already have the infrastructure for a canning industry. It's much less so when it's competing against small-scale canning and down-time preservation methods. Once you had the foods freeze-dried, they were light weight and stayed good for a long time. Which made them highly prized, both by the military and the civilian population. Boris' family and some partners from the Grantville Bureau had put together a small freeze-drying plant near the family's lands and added a lot of gardening. Diced carrots, onions, peas, cabbage, beets, even berries, were all being diced up and freeze dried. Then sealed in waxed paper pouches and stored in crates. Quite a bit of it was sold to the army and more in Moscow. Aside from the extra income, it meant that they had fresh (or the next thing to it) fruits and vegetables even in late winter and early spring. Which did good things for the health of his family and his serfs.

The new farming equipment meant that he needed a lot less labor in the fields most of the time, which had given the serfs time for the gardening. Boris, with his connection to the Dacha and the information from Grantville and the Ring of Fire, was running a year or more ahead of his neighbors, which meant that his family was doing a lot better than others of the same rank. Which was a good thing because there was considerable inflation of paper money and silver was increasingly hard to come by. A paper ruble was—by law—worth the same as a silver ruble, but—in fact—worth less. How much less? No one knew. Gresham's Law was working at full force in Russia where the ruble was legally the same whether silver or paper, but not in Grantville where American dollars weren't tied to silver. Boris was, of course, paid in paper rubles—so the farm income was especially important.

* * *

Bernie peeked at Anya from under his floppy hat. He'd taken to wearing it lately, just to keep her from knowing that he was . . . looking at her. Longing for her, really.

The bitch. Why in the world couldn't he get her off his mind?

Cold hearted. Bitch. Spy.

*Yargh!*This had to stop. Had to.

He couldn't still love that . . . person who was trapped by her circumstances just as much has he was himself.

Could he?

* * *

Turn Your Radio On,

Episode Four

Written by Wood Hughes

Chapter Ten

Marc Kronzburg pushed the overlapping canvas flaps out of the way as he made his way into the Thuringen Gardens outside patio. Or formerly outside patio. The original patio had been outside. Now, a massive roof was supported by four thick stone walls that contained six oversized coal-fired fireplaces, which allowed it to be used during the harshest of winters. None of this had done anything to change the original name.

Spotting Irv Sonderman at his usual table near the outside bar, Marc made his way over to his quarry. "Happy Holidays, Irv! Got a minute?"

The manager of Thuringen Gardens gestured to a chair and continuing to deal with the lunch paperwork, replied, "Sure thing, Marc. "Edith! Would ya get Marc here a beer? Thanks."

Irv Sonderman had been a long haul truck driver before the Ring of Fire. Then, during the celebrations that initiated Thuringen Gardens, he found himself in the right place at the right time with a pocket full of cash and a tractor full of beer. Of the eleven founders, only Willie Ray Hudson, Irv, and a couple of others still were involved in the business.

Turning back to Marc as he set down his pencil, Irv crossed his forearms on the table, "So, what's the word, Marc? We gonna be able to do business or what?"

"Of course, we'll be doing business, Irv! I told you that." Marc beamed, "The Voice of America would be proud to have *Live from the Thuringen Gardens* on our air following *The Ole Timey Radio Hour* . It's just technicalities have to be worked out."

"Like money," Irv commented flatly. "I told you, Marc. You ain't getting into my till."

"But you've got to see our point, Irv. So far, our deal with the Pentecostals is close to doubling our revenue from that hour from the overage alone. I've already raised the rate on the spots that run during

the show and I've still got a waiting list."

Marc held up his hands and shrugged his shoulders. "When I talked it over with Mr. Grover, he agreed. We only gave them that small of a percentage deal because they were a religious organization. We can't offer the same deal to you. If you want on, we need to make sure we get a comparable deal factoring in the commercial benefits to the Gardens."

Irv scowled and took another sip of his beer. "I don't see how it's worth it to the Gardens. We're already the biggest bar in town. Everyone already comes here. I just don't need the show all that much."

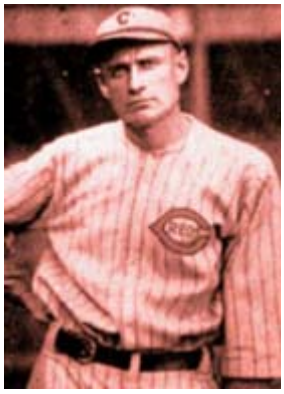
"True, but Tip has also been asking about the time and with the big hall he's built so close to the Deborah trolley stop, he's been pulling in more and more customers from Saalfeld and the workers from the river industrial park."

"Bah! Tip's is a Swedish hang out. They might as well paint the place yellow." A waitress came over and handed Irv a ticket. Irv stood up, craned his neck to look at the patron who was asking for the tab, and scribbled his okay on the paper.

This gave Mark the opportunity to change the subject. "Maybe not, Irv. Listen, why don't we deal with this after New Year's? Maybe we can work something out then.

"By the way . . ." Marc reached into his bag and pulled out the book he had borrowed from Irv last summer. "Here's that baseball book you loaned me. Great stuff.

"You were right, Irv. The statistics in baseball are unlike anything I've seen before. I did see one statistic you had circled that confused me a little though. Why did you circle the 226 sacrifice hits record?



"Oh, you mean the Yankee team record." Irv beamed. "That's the sole remaining record from a player that my granddad loved. Wally Pipp. He was traded from the Yankees to the Cincinnati Reds late in his career. He had been a great hitter, led the American League twice in home runs and was one of the original members of the Yankees infamous Murderers Row with 996 runs batted in for his career."

"Granddad got a shot in the Cincinnati organization as a first baseman while Pipp was there. He always said that Wally Pipp was a great guy, helped him to learn more about being a first baseman than anyone Granddad ever played with. Too bad about his timing though." Irv's face showed momentary distraction. Then he glared right at Marc.

"I get it. Wally Pipp, the most consistent Yankee infielder during the previous nine seasons was pulled from the starting lineup for a young guy that Pipp had scouted out of Columbia. That was Lou Gehrig, and Wally never got back into the starting rotation again.

"What you're telling me is we can always be replaced." Irv leaned back in his chair and thought a moment. "Okay. What if we guarantee to match your revenue from the church show plus five percent?"

Marc smiled as he exhaled. That approach had been tricky, but getting to know Irv so well, he had figured that Irv would see the point himself. "I'm sure we can talk Mr. Grover into something like that. We are talking about the base amount plus estimated expenses for the remote broadcasts up front, aren't we?"

* * *

When the service ended, Constanzia picked up her overcoat and muff and shuffled down the side aisle to the exit. She couldn't help noticing how much different this church was from the elaborate gothic churches she had attended in Augsburg. Its construction was sturdy, straightforward and simple; exposed beams supporting the roof above, half timbered, plastered exterior walls, and plain glass windows about every six feet along the sidewalls. She noted the progress being made on the installation of balconies along both sides of the sanctuary with staircases connecting them to the entrance area referred to as a narthex. Behind the altar and choir loft, she knew that Reverend Chalker had an office and a small apartment.

Constanzia preferred to attend the early service here. The church had grown so much this year that it provided three morning services and two afternoon services each Sunday. Since this was the Catholic and up-timers' Christmas service, they were all packed in. Even with having to slip through the crowd, though, she could make the second Lutheran service and not upset her uncle and her elder half-brother, Johann Martin Sulzer, who always kept their eyes on her religious education.

With the news this week that her father would be visiting for business reasons during the upcoming Protestant Christmas season, she didn't want any premature word about her personal life in Grantville. She could break that news herself, if it needed to be revealed.

As her cousin Catharina tried to explain to her, the Pentecostals were basically like Lutherans. They believe that people became true Christians by faith—then it got interesting. Unlike most Christians of the era, they were not cessionists. They believe that miracles, healings, and prophecy still happened just like in the Book of Acts. In particular, they thought that after a person became a true Christian, the Holy Spirit would come on them and they would speak with other tongues just like the apostles. Reverend Chalker was even more flexible. He believed that if someone kept coming to the church, the Lord was speaking to him or her, which was good enough because that conversation may take some time.

While there were frequent outbursts of speaking in tongues during the services, for reasons of his own, Fischer kept his dramatic and highly emotional exhibitions limited to his evening services. From what Constanzia understood, those had become filled with an amazing emotional power. There had even been cases of apparent healings. Reverend Fischer just seemed to dominate whatever stage he was on. With that rugged complexion and short-cut, thick, black hair that draped over his forehead, he just looked the part of a leader.

When asked about Fischer's different way of handling services, Reverend Chalker reasoned, "No reason scaring off the little babies in the faith by showing them the adults only version."

During the service, Fischer had introduced the new elders to the congregation. Now, as Constanzia had finally reached the narthex, she approached the reception line of the new elders and their wives. First, there was Georg Heinrich Vitzthum von Eichstedt. Herr Vitzthum von Eichstedt was a widower who

lived in Rudolstadt. He actually traveled to Grantville every weekend to attend the services ever since Enrico Abona, the director of Kelly Construction, first invited him. Hermann Neuhoff and his wife Catherine were so busy in a conversation, she moved past them to Johann Friedrich and his wife, Maria. Johann tended to the foot care outreach program ever since he joined the church family.

Finally, was Enrico Abona himself and his wife, Leanna Villarreal. She had joined the church by what Brother Chalker called "the old fashioned way." She married into it. Next to them was Balthazar Schenk, one of the count's minor officials at Schwarzburg castle, who was going out with one of Leanna's friends. Constanzia couldn't remember the girl's name, but Schenk's father had worked for von Eichstedt's father.

As Constanzia finished exchanging pleasantries with Leanna, she felt a tap on her shoulder. Turning, she was surprised to see Hans and Maria Kurger. It had also been announced at the service that Hans had heard the call to the ministry and was to become the newest Pentecostal minister, beginning studies this week.

Maria, who was tightly gripping her husband's arm, smiled as she greeted Constanzia. "Fraulein Garb, I'm so glad to see you coming back to our services. If you're not careful, Hans and I will have you teaching Sunday School classes before you know it!"

Constanzia laughed. "As long as it doesn't involve teaching Latin, it might be appealing to me. These up-timers just don't have a good, basic, classical education at all."

Along with most down-timers, Constanzia was amazed that with all the advanced knowledge they brought back with them from the future, knowledge of the classical fundamentals was not common among up-timers. Hans and Maria smiled and nodded their emphatic agreement.

Maria continued, "Constanzia, did you hear that Ingrid Nemeth's son Terrell has been detailed by the army into something called 'T&T Training'? Ingrid's not sure what that is, but she's asking us to pray for a quick end to this war so whatever it is, Terrell won't be in jeopardy doing it.

"Now, may we invite you to have lunch with us?"

Chapter Eleven

January 7 (Christmas Day, Julian), 1634, Erfurt, USE

Snow flew into the old smokehouse as he entered. Colonel David Leslie stomped the slush off his boots, leaned his SRG rifle against the wall, and closed the door behind him. He pulled his cape off, shook it and hung on the peg beside the doorway, then lit the candle stub he had left on the table this morning. He fiddled with his new iron campstove until a somewhat out of place, cheery flame took hold of the kindling.

Flopping down on his cot, Leslie pulled off his boots, examining them for daily wear and tear. "Ah, there you go, my laddy! I knew that you'd finally opened up that wee little hole. It's to the cobbler you'll be going in the morning."

At least the horses were well fed, better than any winter since he joined his uncle, Lieutenant General Alexander Leslie, on this continental adventure back in 1630. Well, not his uncle precisely. More like his father's bastard cousin who had done the family proud. The feeding certainly boded well for this season's foals. With so many mares bearing this season, his cavalry should have no problem with adequate mounts if the war continued another five years, another small miracle thanks to the Americans and their gadgetry.

Thinking about the American up-timers and all the stories they told still gave Leslie headaches. His other destiny would have been to command all Scottish forces to historic victories, only to go to defeat at the hands of an English Puritan. Then, to be knighted by the restored monarchy and be given lands and pensions, taking honor to his grave. Well for sure, with what he'd learned now of future cavalry tactics, no New Model Army of Englishmen would see the day they would crush his forces, by God.

Leslie's professional Holy Trinity these days was Stuart, Forrest, and Sheridan. Aye, those were cavalrymen's cavalrymen! First with the most, indeed! From what he had been able to gather from all those fine books, only Wilson in his massed cavalry raid through Alabama had led a mounted force as well trained as the one he was readying for the spring campaign. So many good Scottish names in that horrid blue and grey war of those up-timers.

But Leslie was engaged in his own horrid war, this one with more divisions making less sense. When he first enlisted, it all seemed so clear. Protect the Reformation against the Papist. Then he found that his men's pay was coin from the purse of Cardinal Richelieu. Now, he commanded units combining Catholic and Protestant soldiers. Nothing made sense.

Uncle Alexander had told him, "Nephew, we cannot bother ourselves with what might have happened or could have happened. We can only be true to our duty as we see it on this day.

"It's fidelity we pledged to Gustavus Adolphus and as long as he continues to show himself a leader worth following, it's fidelity we'll be giving. If he believes in these Americans, we will continue to call them allies ourselves."

Aye, and marvelous allies they had proved to be. People more loyal because Americans had shown ways of sharing the burden more fairly, of increasing the crop yields, and reducing the size of the army, while increasing it's firepower and maneuverability.

It was like that new song his men now sang. On this Christmas night, he would indeed sleep in heavenly

peace.

* * *

"So, Constanzia, I understand you're seeing a radio star."

Constanzia could feel the blood rushing to her cheeks in embarrassment at her father's words. "What? Who told you that? *Martin* !"

Marco Garb's face broke out in a big grin as he observed his daughter's reaction. So, it was true what his stepson had been writing to him about Constanzia.

Constanzia's half-brother, Johann Martin Luther Sulzer, was fifteen years her senior and thought of himself more as an extra father than a brother. When Grantville first appeared in the world, Marco had dispatched Martin there to become his eyes in this new place. However, it was soon apparent that Martin didn't have the guile to successfully obtain the information that Marco needed. Thus he asked his youngest daughter to visit her Aunt Potentiana in Badenburg, which was close to where the Ring of Fire had appeared, and see what she could do.

Her brother had managed to get both her and her cousin Catharina jobs teaching at the high school. From there, she had done very well indeed. From the high school student partners of the Barbie Consortium to the young owners of the Other People's Money mutual fund who had recently graduated, Constanzia had smoothly used her position teaching Italian at the high school to get to know every one of the young lions of Grantville's financial community.

"No, Papa. I have *not* been *seeing* Reverend Fischer, no matter what my nosy older brother thinks. Catharina and I have attended services at his church occasionally." Constanzia thought to herself that twice a week could truthfully be described as occasionally. "But we've never been alone together a single time. Besides, what if I were? I'm over twenty-one!"

"Now, now, Tesorina, you should know by now that I trust in your judgment. Would I have asked you to come here on my behalf if I did not?" From her reaction, Marco was now certain that there was more to how his "Little Treasure" felt about this radio preacher than just spiritual.

Whether Marco had trust or not in his daughter was not the important issue. Once his stepbrother Emanuel Sulzer and his wife's sister, whose house they were guests in on this Christmas evening, found out about little Constanzia's deviation from the Lutheran faith, it would be him, not Constanzia, who would catch hell.

When he met Potentiana's sister Constanzia Turettini, she had been a recently widowed mother of six. Her first husband, Heinrich Sulzer, had died in a horse accident. Marco had fallen in love at first sight. He even converted to the Lutheran faith in order to make her his own. Another year had brought them Jean Achille Garb, their first child together. But the next birth a year later of his beloved daughter came at the price of the life of his love. He had named the baby after her departed mother.

After some years of mourning, Marco had decided to revert to his Calvinist faith, although he had kept his vow to raise all his children and stepchildren as his wife had wished. It was good that Emanuel lived so far away. A firmer believer in the tenets of the Lutheran faith could not be found than Emanuel, who saw no good from any non-follower of Lutheranism in any way.

"Now, enough of our play. Tell me what you've learned of the investments I asked you to look into for

me."

For the next hour, Constanzia gave her father a detailed run down on the young people running the investment opportunities Marco was studying. Finally, after reviewing his notes, Marco mused, "The board meeting is tomorrow. It's good to have alternatives to the capitalization call for a second steel plant location that Frederic Swisher is going to present to us."

Since the Ring of Fire, Constanzia's father had become a major player amongst the investment community of her hometown, Augsburg. He had guessed early that betting the new technology these Americans had brought would survive, no matter what happened to the Americans themselves. The investors who followed his lead had been richly rewarded, to the point that they had been able to get Marco a seat on the Board of Directors of USE Steel to watch over their interests.

It had been an amazing rise for Marco Garb, born Marco de' Gilbelli, an immigrant boy. He left his hometown of Turin with his parents for Geneva. They hoped they could practice their Calvinist beliefs there. As the Holy Roman Empire exerted its power in oppressing Protestants of all faiths, Marco moved on to the Imperial City and ancient Roman outpost of Augsburg. A city proud of its historic tolerance of different faiths. He had even adopted his cousins' Germanized version of their family name in order to fit in better with the local business people. After all, his third cousin Johann Baptist Garb was still the Swedish Resident, or as the Americans called it, "consul" in Augsburg at that time. It was Cousin Johann Baptist who took it upon himself to introduce Marco to all the important financial leaders of the Imperial City.

"Now, about this young minister of yours, I must come with you sometime and meet this man."

Late January 1634, Grantville, State of Thuringia, United States of Europe

John Grover found himself whistling as he rode his horse away from the station that evening.

Pesky little song, I just can't get it out of my head, he thought. *But, I always did like "Will the Circle Be Unbroken?"*

That had been last Saturday night's featured song on the *Ole Timey Radio Hour* . If the mail received so far this week were any barometer, it would be as big of a hit as the first show's "Silent Night." Fischer and his bunch were really tuned into the market. Since they went on the air, mail to the station had more than doubled and that didn't count the mail directly to the show itself. Requests for more broadsides on how to build better crystal sets, requests for parts, requests for more commodity prices on the morning farm reports, it just went on and on. In fact, there didn't seem to be a category of station programming that didn't have more feedback and suggestions for improvement.

He turned a corner. *All this time on the air and we've only had one broadcast tube burn out.Way below Gayle's initial estimate but really close to what Art Berry had predicted if we would follow his advice about how to operate them, which we did. All in all, things are good. If that isn't enough to have me whistling a happy tune, there are the rest of the projects that GE is working on.*

* * *

". . .Then Chief Dan Frost pulled out his guns and shot the evil horsemen as they galloped down the street toward him. All the townspeople, maybe some of your parents even, were up on the rooftops shooting at them until they were either dead or decided to give up.

"Then they all hopped into their trucks and sped down to the school house to help out Jeff, Julie and Dr. Nichols and the others who had been holding off the other band of Croats all by themselves. And that's how Grantville fought off the Great Croat Raid."

"So children, remember that in a democracy, everyone has to respect each others rights and stand up to defend them together. Now let us pray . . ."

In the barracks of the Yellow Regiment, one of the troopers threw a boot at the wall. "Again he did it, Swen! You and I both were there at that damned schoolhouse and this Fischer didn't even mention the part we or Captain Gars played."

"You're too sensitive, Henrik. It is just a story told to children. He doesn't mean anything by it."

"But, he's never given any credit to the part we're playing in fighting this war on any of his shows. No credit at all. I think we should say something to Lieutenant Ivarsson."

Chapter Twelve

February 1634, Jena, State of Thuringia, United States of Europe

Der Kronz was very pleased with himself and the results of this little trip to Jena. Add up all the new six-month ad buys and this was by far his best visit to this town yet. With the increased listenership, no one had even blinked at the latest rate increase. Sticking the folder containing this particular ad contract into his very thickly filled satchel was especially satisfying.

"So, Mordechai, what is it with the 'Marc'? Isn't the name your mother gave you good enough for you now?"

Marc grimaced. *Cousins! Who could live with them?* "I told you, Isaac. It's a perfectly normal and modern name for Jews in the twentieth century." Marc responded, "A very good name for dealing with all the up-timers around these days, and the Germans too for that matter."

"Leave your cousin alone, Isaac! If Mordechai wants to be called Mordy or Mortimer or Marc or whatever else, it's his business as long as he's still looking for a good Jewish girl to settle down with and have kids." Marc had hoped to avoid that particular topic this trip, so to his way of thinking Rachael's defense was a double-edged sword.

Marc was about to reply, when the door bell jingled as several burly, heavily dressed men walked in with grim expressions on their faces.

"Good morning, gentlemen," Isaac said. "How may I help you?"

"You can give us back our father's money that you stole for one thing, Jew." The man in the middle with the long blond beard snapped. "Franz Holstein. You and your dirty Jew usury ruined him."

Isaac should have known that Franz Holstein would cause him trouble. Nothing but hate in his eyes every time he came into Isaac's door with his payment. Even when though Isaac regularly forgave him for being a few days late, never once did a thank you come out of his lips. But Isaac had been startled at the news of Holstein's suicide on Christmas night, the Lutheran Christmas just past.

Isaac replied cautiously, "I heard about your father. I'm very sorry, but I assure you his unfortunate death had nothing to do with the loan. I offered to forgive him the last quarters interest and put him on a new payment . . ."

"Shut up, you Goddamned lying Jew." The man on the left slammed the palm of his hand down on the counter top. "Martin Luther was right! He called it. All of you are just poisoned, envenomed worms who should be expelled for all time. Well, this is the day, thief! We're here to take back all the money you stole from good Christians, just as Luther instructed."

All three men whipped out their down-time, single shot pistols and aimed them at Isaac and Marc.

Isaac raised his hands above his head as he slowly backed away from the counter. The pistols these men were brandishing were only accurate at a very close range. His chances were better further away.

"Gentlemen, please! Calm down! There's no need to do anything rash," Isaac began, using his gentlest tone, "Very well. You shall have your father's money. There is no need for bloodshed. Rachael, go to the back and bring out all the money we received from Mr. Holstein. Bring the accounting book as well, so these gentlemen can see for themselves it's all there."

Rachael, hands still raised, started backing toward the door to the back room.

The blond, bearded brother barked, "Stop, you Jew whore! My brother told you. All your money! Franz, go with the bitch. Make sure they have nothing left."

The third brother, evidently the youngest, tried to vault over the counter. His right boot landed awkwardly on the side of a stool behind the counter, tipping it over and losing his balance.

His pistol discharged. The loud sound rumbled through the small office as its shot burrowed it's way into a ceiling joist, startling the other brothers who responded by jerking the triggers of their pistols.

At the sound of the first shot, Marc raised his satchel to protect himself as Rachael screamed and dived for the open doorway behind her. While Franz struggled to regain his feet, the other brothers were at a loss as to what they should do next. Isaac heard one of the bullets buzz past his right ear, and quickly reached for the small of his back where he carried his modern Walther PPK/S pistol.

"Freeze, Holsteins!" Isaac he flipped off the safety and, using the two handed grip he had been taught, pointed the weapon at the nearest, now frozen, brother.

The front door crashed open, ringing its bell madly. "Committee of Correspondence! Lower your weapons and surrender!"

* * *

"Is everyone okay, Marc?" John Grover was still stunned at the close call that his sales manager had just relayed.

Marc nodded. He'd just arrived back in Grantville, following the aborted robbery attempt. Naturally, he'd first hurried to the station to turn in his contracts before retreating to his home for a very long and very hot bath to relax his tense muscles.

When he walked into the station, Maria Kurger and Fischer were finishing up double-checking the week's mail receipts with Helga Armbruster and John Grover. He collapsed in the nearest chair and blurted out the entire story.

"My God!" Fischer called out, "They quoted Martin Luther? Marc, I'm so sorry. So many things that man did that were so good, then just three years before his death a hateful publication like that."

In January 1543, in a spasm of emotion, Martin Luther had written his pamphlet, "On the Jews and Their Lies," a virulent and impassioned denunciation of Jews that spewed forth Luther's premise that Jews couldn't be counted on to ever convert to Christianity. It charged that all their belongings had been stolen from Christian families by the use of lies and usurious lending practices prohibited to good Christians. His proposed solution included that their synagogues and schools be set on fire, prayer books destroyed, rabbis forbidden to preach, homes razed, and property and money confiscated. Luther argued that Jews should be shown no mercy or kindness, have no legal protection, and should all be drafted to forced labor or expelled for all time. Four centuries later, the Nazis used quotations from this pamphlet to justify the Final Solution.

The prevailing view among historians after World War II was that Luther's expressions of anti-Jewish sentiment had been a persistent influence in the centuries since the Reformation. A minority, before Grantville had arrived in this time to find out the truth, believed that Luther's anti-Jewish writings were largely ignored after the sixteenth century, before being rediscovered by anti-Semites in the twentieth. They argued that even the banishments of Jews in some German states were no more common than similar banishments of Christian denominations during the Post Reformation period. The Ring of Fire had proved that minority right. Unfortunately for Marc and his family, not right enough.

Fischer went over and placed his hand on Marc's shoulder. "My friend, my elder brother in the faith of the One God, I promise you I shall do something about this. You have my word."

Marc just nodded and opened his satchel, preparing to turn his paperwork over to Helga. Looking closely at it for the first time since the incident, he tensed noticeably. There, just under the flap, was a small round hole. As he pulled out the folders within, a small round piece of lead fell out and rolled across the floor.

* * *

"What a wonderful performance Sister Jennifer gave tonight, my friends! And now, it's just about time for us to leave you again until next week. But my heart is heavy with a message that I need to share with you." Fischer paused while he decided which was the best inflection to use in delivering the message he had worked out in his head the previous afternoon.

"Friends, if there is one thing that we've all learned from Grantville, it's that it's the little things that make a difference in our lives. It's the little things, like adding legumes to the crop rotation. It's the little things, like using standard-sized pallets to more quickly ship goods to market. It's the little things!

"Little things like the printed thoughts and the works of great men yet unborn that have been brought back to us from that other future. If you're looking for the blessings of God, *it's the little things* !"

Now Fischer moved closer to the mike as he delivered the money line, "Yes, and God says, it's the little things that make the difference in our lives as well. The little things, like loving your neighbors and honoring God instead of worrying how you think others honor Him. Don't you know that Jesus taught us God is faithful in all things, even in the little things?

"Once He makes a covenant, He lives by it for eternity. What's more, he expects us to live by every little covenant we make as well."

By now, Fischer clearly understood the influence he was having on the unseen radio listener out there. He could almost see each listener nodding their head, understanding and following along with the pacing and the logic that Fischer was employing.

"But sometimes, even the greatest men made little mistakes. I want to talk about a little mistake that a great man made that we now understand thanks to our friends from the future.

"I've consulted with pastors and elders of every major branch of the Protestant faith who have come back to our time through the Ring of Fire on this. I have consulted with the up-time Lutherans such as Herr Lambert, who is known to you at the Leahy Medical Center, and Herr Koch, who is known to you from the mine. They all tell me that in the future all the Lutherans, from the Lutheran churches of Bavaria

and Austria, to the Missouri Synod and Evangelical Lutheran Church in America have issued statements repudiating this one mistake of Reverend Luther, while continuing to honor the caring and positive statements and actions toward Jews that had been taken by Luther throughout his long life up till then.

"My friends, this week I remind you of your duty to follow Martin Luther's lead throughout most of his life towards our elder brothers in the faith of the One God and to respect them as fellow citizens of our new nation."

As Fischer's "elder brothers" remarks finally came to their logical, yet emotionally powerful, end the night's closing song welled up in the background.

Chapter Thirteen

"Don't worry, *mein Liebling* . I'll stay safe." Hans Kurger kissed his wife Maria and hugged her tightly before swinging his duffle bag over his shoulder and stepping up to board the passenger train to Magdeburg. The Grantville Terminal was bustling with people. He turned to give a final goodbye to all the friends who had gathered to give him a send off to the war. "Praise God that He's given me such good friends as you. May He keep us all safe until we see one another again!"

"Amen, Brother!" "Halleluiah!" "God bless you too, Hans!" A chorus of responses responded to Hans' blessing. Maria fought to hold back her tears. Pete Enriquez stood behind Maria and placed his hands gently on her shoulders while Susannah Becker held her hand. Behind them, the crowd from the church and other friends of the Kurgers stood trying to show confident smiles, but feeling the anguish of knowing that a loved one was going to war and might not come back.

Hans had explained to Reverends Chalker and Fischer why he had decided to join the army for this year's campaign. After Chalker had proclaimed Hans fit to take his vows to the ministry, Chalker had asked him what mission did he feel called to perform. "Brothers, God has given me so much since Maria and I came to Grantville. But Magdeburg is still our hometown and with Maria safe here with all of you, I feel that I am being called to help defend it once again.

"Besides," he continued, "It is time that I got on with spreading the Word with my deeds as well. After this war is finally over, having served as a chaplain, I'll be in a much better position to bring new souls to Christ." He grinned. "Which we cannot doubt that even some members of the Committees of Correspondence need."

He climbed the remaining steps to the main aisle and found a window seat about midway down the old converted school bus. The seat was next to a patch in the body. From the shape of it, it had probably been put there to repair damage caused by the Croat raiders as they tried to get past the bus barricade to the high school almost two years ago. While the tires of so many of those school buses ruined, several had been enlisted to furnish passenger service for the newly completed rail line to Magdeburg. In case the bus was needed for off-rail transport along the line, several stops had a set of jacks on the siding track and a set of tires so the rail wheels could be swapped out if necessary.

With his final passenger now on board, the driver pulled the lever closing the door, started his engine, and slowly pulled away from the new downtown Grantville station. Behind, he towed three down-time

built cargo trail cars and a flatbed, which carried some sort of vehicle that was covered with a green tarp. A heavily bundled, uniformed guard rode on top of each rail car, cradling their SRG rifles in their arms and a shotgun strapped across their backs to protect the train along the journey to the temporary end of the rail at Eisleben.

As the train disappeared around the bend, Fischer turned to Chalker, who was seated in his wheelchair being hovered over by Georg Fleitner. "Well, Brother Chalker, our first missionary has been dispatched."

Chalker nodded, rubbing his swollen legs. Still solemnly looking down the now empty tracks, he observed, "Praise the Lord, Brother Fischer. The Holy Ghost has chosen well."

"Amen to that, brothers!" Pete chimed in. "You did give him the other copy for Terrell. Didn't you, Fischer?"

Fischer nodded. The copy Pete referred to was the book the church had just published, "A Pentecostal Commentary and Concordance" by Reverend John Chalker as translated to German by Reverend Dieter Fischer. Of the initial press run of one thousand, Chalker had reserved the first thirteen copies for himself and what he liked to call his new apostles. These would be the first twelve ministers to spread the Pentecostal Word to the ends of this new world. Fischer had insisted that Hans, as the newest ordained minister in the faith, should receive the first copy to take with him. The other copy Hans was taking with him was destined for Terrell Nemeth, who had also accepted the call to take up the ministry.

This was the book that Chalker and Fischer had worked on so long and hard since Fischer's arrival in Grantville. With Chalker continuing to conduct his Bible studies as his strength would allow, Fischer scribbled down his notes. Then, he carefully translated them into the common dialect that he and Chalker had selected to best reflect the common Germans to whom they were reaching out.

Meanwhile, a committee of down-timer members had tackled the job of translating the concordance from the up-time Bible that Chalker had brought through the Ring of Fire with him. Since Chalker also added personal notes and struck passages that didn't reflect his beliefs, this was also finely tuned to his faith.

The finished book was filled with the loving humor and keen insight into the human condition Chalker had developed in his years as a country preacher back up-time and now here in the seventeenth century. Wonderful stories, all tied to specific verses of the Bible, all designed to guide the reader into letting go and allowing the Holy Ghost in their own heart to take control of their life.

Nothing quite like this book had existed in this world. Unknown to the Pentecostal ministers, of the remainder that had been put on sale; a Jesuit priest in town had purchased the next dozen and shipped eleven back to Rome. Others were already finding their way to various Imperial cities, electorates, and principalities throughout the Germanies, Paris, Vienna, Denmark, and even Madrid. All in all, the book was about to be read by all the finest people. None of whom were likely candidates for conversion.

Pete walked away accompanying Susannah back to her home. Georg started pushing Chalker's wheelchair back to the church. Fischer followed behind thinking of the dangers that Hans was about to face. Almost unobserved, Constanzia fell in beside him and slipped her hand into his.

* * *

Fischer woke with a start. He felt as if he had been dropped on the bed from some height and his forehead was throbbing. Throwing off the covers, he swung his feet to the floor and felt moisture dripping

down from his scalp line. He wiped his brow then brought his hand down so he could look at it.

Thank God, it isn't blood.

Fischer hadn't had such a vivid dream in some time now. It was something about a rape amid an ocean of blood and violet flames. His heart throbbed just thinking about it. *It's probably just the result of Hans going off to war.*

He tried to remember the details of the dream, but they had mostly escaped his memory. One detail did come to mind. It was the figure raping the girl. He was a large, heavyset man wearing robes, with a mustache and a spindly blond goatee. And he was wearing glasses. How odd.

* * *

"Reverend! Reverend Fischer!"

Fischer looked up from his morning paper to see who was calling for him. He enjoyed this little habit of having a quiet breakfast at the Higgins Hotel Restaurant each Tuesday morning after the Bible study the previous night. Georg Heinrich Vitzthum von Eichstedt, one of the Grantville Pentecostal Church's newest elders walked toward him. Fischer set aside his paper, smiled, and stood up to welcome the elder and invited him to share breakfast.

Eichstedt arranged his napkin on his lap and got right to business. "A wonderful meeting of the Elders last night, Reverend."

"Thank you, Herr von Eichstedt."

"Please," Eichstedt interrupted with a smile. "I will call you Dieter, and you must not feel obligated to use my formal name. I shall be Georg Heinrich. The American way!"

"By all means, the American way. What an amazing culture they must have had up-time. This city was just a back hills afterthought in their world and look at what it's doing to change our entire world in the here and now."

Eichstedt nodded as the waiter came to take his order. "Yes, the meeting last night. I was going over the budget for using the funds from the radio show. It seems to me that we have a dilemma. We can only expand the church so much and you are already conducting all the Sunday services we can expect of you. Even with the new salaries for the cast and crew of the show, our charities contribution is going to have a difficult time spending the surplus in such a way as to not attract more members."

He took another sip of his coffee before continuing. "Now with Hans newly ordained and sent off to war and Terrell making the commitment to becoming a minister of the faith giving us two chaplain missionaries . . . Well, it seems to me the time has arrived that we need to start physically spreading our flock outside the city limits of Grantville."

Fischer looked puzzled, but waited for the Elder to explain.

"You see, your radio devotionals and the Saturday night radio show are creating more and more interest in our practices. I'm constantly being asked about the church back home in Rudolstadt. There are a lot of rumors about our differences and unless we provide the answers, our adversaries will."

"But, until Reverend Chalker can resume his pulpit here, I can't start up any new churches." Fischer gestured with his cup. "You've already pointed out that Hans is off with the army and Terrell is just beginning his formal training. It takes time to find and train ministers for a new church. Even using the mission riders system of the early Methodist church, the Holy Spirit just hasn't provided us the people with the calling to support more churches right now."

"Ah yes! But a minister is not necessary for a church. In Matthew it says, 'Where two or three are gathered together in my name, there am I in the midst of them.' As it turns out, our church has brought back the most wonderful approach to spreading the Word. Two approaches actually."

Fischer looked puzzled, so Eichstedt continued. "First, the weeknight Bible studies. With the new commentary you and Reverend Chalker have provided us, we can set up Bible studies in any town where a member can attract a gathering. We wouldn't even have to be in conflict with the existing religion of that town. Nor do we need to ask for contributions, thanks to the radio show. No doubt, we'd get contributions, but like the devotional, we wouldn't have to emphasize that part.

"In fact, we can actually charge our new believers to get more active in their existing local churches! It's obvious from what I've learned since listening to the Holy Spirit inside me. Our mission is to bring all the Christian churches, whether Lutheran or Catholic, Anabaptist or Calvinist, back to the proper appreciation of the Holy Spirit in their worship. That was the way that the charismatic movement was initially spread back up-time. It will work just as well here."

Fischer was astonished at this new way of looking at growing the Pentecostal faith. But Georg Heinrich was correct, even in the book on Sister Aimee Semple McPherson, during the early days of her ministry she converted existing churches to the power of the Spirit more often than starting new churches of her own. After thinking it through for a moment, he asked, "But you said two?"

Smiling even wider, Geog Heinrich replied, "A traveling revival! Instead of holding our summer revival here in Grantville this year, we can spread it around and help bring new souls to those new Bible study groups forming all over the Germanies.

"As you know, my ancestral family lands are just outside the gates of Rudolstadt. By my father's time, our family fortunes had dwindled to just some rents from here and there and maybe a thousand guilders worth of land. But when the railroad came, the Lord presented me the opportunity to develop the land into a service yard for the further construction of the new lines north to Magdeburg and west to Erfurt. That, in turn, allowed me to persuade other landowners along the line of the value of the new railroad to them and how they might also profit from voluntarily dropping their rights to tolls. And that advice has paid off with a good deal of influence in towns and cities all up and down the rail line.

"In fact, during the last few weeks, I've been making inquiries of some of my friends for the use of their lands near the rail line for a few week nights. I'm confident that we can put on a revival tour unhampered by local authorities so long as we don't try to displace the local church."

Fischer's face lit up. "And thanks to the radio and the correspondence we've been receiving as a response to the talent contest and the other requests for songs and such, we'll even know where we have concentrations of listeners who would be willing to attend our first tour. This is a brilliant idea!"

"Exactly. All the elements are there. But most of all, the Holy Spirit has given us that rarest of gifts, a man with the power to persuade and the power to lead. You, Reverend Dieter Fischer."

Chapter Fourteen

March 1634, Grantville, State of Thuringia, United States of Europe

"Well, long story short," Maria Kurger said to the preachers and elders, and a few good prospective elders when the time came, gathered in the offices of the Grantville Pentecostal Church, "here's the list of the towns from which people have sent either donations or correspondence in response to the radio show or the morning devotionals. I've ranked it by numbers of correspondents with the total contributions and total number of letters noted in separate columns." She handed out copies. Laying a map on the table in front of her, she continued, "I've also noted on the map in yellow the top twenty towns in terms of donations and in blue the top twenty towns in terms of pieces of correspondence. Green represents towns on both lists. The bolder printing of the town name indicates a larger population."

Fischer leaned over Reverend Chalker's shoulder to get a better view of the map. This was the first tangible evidence he'd seen of where his listeners were and it amazed him how widespread his audience was. They ranged from Bavaria to the south and Fulda to the west, to Saxony in the east and Hesse Kassel to the north.

"I discovered a real interesting thing while putting together this report," Maria said. "Starting in late January, we've been receiving a steadily increasing number of letters from people who have not been able to hear the show. They got their hands on a copy of one of the songs we've sent out and are writing us for more songs or information on the Bible lessons we offer on the other side of the broadsheet.

"These second generation requests seem to follow the initial letters by about three to five weeks. That means that we may have really not even begun to find our audience for the shows from January!"

Everyone was quiet for a moment, thinking of the ramifications of this new information.

"Keeping Elder von Eichstedt's suggestion in mind," Pete Enriquez commented, "We need to identify the towns that are on or near enough to the new rail lines with good enough roads so our vehicles can make the journey."

The other members of this year's revival planning committee nodded their heads at this suggestion.

Balthazar Schenk pointed to Meiningen. "It's a shame the rail hasn't been completed there yet. I've made a number of trips to Meiningen purchasing gun parts and have been asked about my new faith. I believe that town is ripe for a revival."

"Plenty of time for the Holy Spirit to lead us all over, Brother Schenk," Chalker replied. "This first tour needs to plant the seeds where we can get back easily to cultivate it. 'And some fell on stony ground, where it had not much earth; and immediately it sprang up, because it had no depth of earth: but when the sun was up, it was scorched; and because it had no root, it withered away.' Mark, Chapter Four, Verse Five.

"Yep, we need to place our seed so we can continue to water it and help it grow the roots it needs to

survive. A regular 'Good News Crusade,' just like back home in West Virginia!" Chalker paused and ran his bony forefinger up the path of the rail line. Brightening, he added, "Well, I'll be! Looky here, Eisleben is marked."

Everyone present already knew the importance of Eisleben. It was the town where Martin Luther himself was born and died, a stronghold of the Lutheran faith ever since.

"Georg Heinrich, do you think we would be able to find a field to set up our tents there?"

Stroking his beard and frowning as he thought the question over, von Eichstedt answered, "I'm not sure, Reverend. I know several large landowners there well, but freedom of worship or not, we are very likely to get a strong reaction from the local authorities. Halle might be a safer choice. The improvements in their coal mining industry there have really opened them up to new ideas.

"Same with Aschersleben where the main rail line splits off to the west. That's becoming quite a boomtown as are Weissenfels and Kahla. Finding where the kaolinized feldspar sand deposits were located near Kahla has led to growth there on the order of Magdeburg."

Nodding, Chalker turned to Slater Dobbs. "Slater, how you coming on getting the vehicles together?"

"Real good, Preacher." Slater grinned. "Phyllis and my sister Doreen convinced Ogden that his fancy RV wasn't doing them any good just sitting under the shed behind their house. So, he agreed to sell it to us.

"Then I pointed out to a couple of old hunting buddies of mine that they couldn't drive to the WVU games any more, so they might as well rent theirs to us. So that's three over-thirty-foot-long RV's with full showers that should be able to sleep fifteen or so. We've also got access to another six fifth-wheel camper trailers. That should take care of the bulk of the choir and crew y'all are planning on taking. We can rig them to tow behind the RV's.

"Between the RV basements and the storage on top of all those units, we shouldn't need more than one or two cargo trailers, but I've found a couple that used to haul mulching that have high sideboards."

Pete interjected, "How hard will it be to switch out their road tires and rail wheels, Slater?"

"Not hard at all, boss. Me and my roadies should be able to switch all four wheels right there on the siding in less than twenty minutes per vehicle. The railroad built their town sidings with that in mind in the first place."

Fischer asked, "Any problems with getting scheduled on the rail, Slater?"

"No, sir. Brother Johann Gunter works over at the dispatcher's office. He said as long as we plan our trips outside the main cargo runs, he can get us clearance all the way up the line."

Chalker leaned back in his wheel chair and smiled. "Looks like everything is working out right smoothly. What we probably need to do is to go ahead and pick one town and test everything out for a three night run, then come back and plan the rest of the summer tour."

Looking around, he asked, "So, what town's going to be the Samaria for our Dieter's Philip and his first mission?"

* * *

"Dieter, I asked you to stay so we could discuss your future."

Even after three years with this old preacher, Fischer still felt uneasy when Chalker called him in for an unknown reason. Chalker slowly got out of his wheelchair, stretching his swollen legs a bit before sitting back down in his rocker, elevating his feet as the doctor fussed at him to do. Fischer sat straight and still, waiting to find Chalker's reason for the meeting.

"My son, this is going to be the first spring revival at a church of mine in over fifty years that I won't be up on the altar. Doc Nichols shows no sign of letting me get active again and I'm starting to feel my age." As Fischer tried to interrupt, Chalker waved him off, "No, no, I'm not saying I think the Lord is ready to take me yet. You can bet that I'll be around for a good while yet, but our plans and our prayers are about to be answered. With this revival tour and three young and healthy preachers, the Pentecostal faith is going to survive and flourish in this world.

"Dieter, you've read enough on the history of the movement to know that our faith tends to fracture pretty easily. Lots of different Pentecostal faiths back up-time, you know. Trust me, the same thing is going to happen here. When it does, and if I'm not around for you to come to, I want you to know that it's the working of the Holy Spirit and nothing against the leadership you're providing the movement."

Fischer had felt a little uncomfortable at the thought of his becoming the central figure in this denomination. He remembered the tendency that Chalker pointed out being mentioned in his reading on Pentecostalism, but having Chalker put it in such a personal way somehow made it seem more real.

"Dieter, keep your arms open to all during this revival. Invite the hurt up on the stage with you and show them God's love in front of the congregation. That will convey our message just as surely as anything else we could do. You've really mastered the art of moving a congregation during your Sunday afternoon services. With a revival, you'll have to step it up a notch to bring the first time attendees into the fold. Remember, every soul is there for a reason which most of them don't yet recognize.

"That's your job. Open them up to their feelings. Pull their emotions out and let them hear that voice. If you do that, the Holy Spirit will take the lead and you'll be fine.

"As the church grows, you'll be the person the new church leaders will look to, not me. Just like the newer Elders and a lot of our congregation members tend to look to you first. That's just the way it is." As the light from the setting sun slowly disappeared over the horizon, Chalker's lessons in church leadership concluded with a long prayer.

Fischer walked home a troubled man that evening. He was now on a course that only faith could guide him along and that remained a very scary proposition.

Special Edition!

Written by Markus Becker

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By Markus Becker

Frankfurt Main, late May 1631, just another street corner:

"Special Edition! Special Edition! Town from the future in Thuringia! Read everything about the year 2000: horseless carriages, lights with no flames, guns that shoot ten times without reloading. Only in the *Allgemeine Zeitung* . Don't miss the woodcuts of scandalously short skirts on page 3!"

Okay, I admit down-timers will probably put the woodcuts on pages one through three, but let's begin this article about down-time media where it started: in the dark middle ages when there were no media. Why? All texts had to be copied by hand and only highly skilled writers could do it, so the process was both slow and very expensive. There was no way to publish a newspaper under such primitive conditions. For that you need to be able to mass produce texts and gather information in a reasonable period of time.

That changed in the sixteenth century. First Johannes Gutenberg invented the printing press in 1490. Now any text could be reproduced in huge numbers, little time and for little money. Printing shops were being built everywhere. Just ten years later 40,000 different books were already being printed in Germany. The first book faire was held in Frankfurt in 1564, Leipzig followed a few decades later, but in the early/mid seventeenth century book fairs had already overtaken Frankfurt.

At the fairs early forms of newspapers were sold: little books with the news of the previous month. Another form of pre-newspapers was fliers. Local printers printed them and traveling merchants distributed them. They were quite inexpensive. The ordinary worker could easily afford a flier.

Also in 1490 the Taxis Family, later Thurn and Taxis started a courier system for the Habsburgs that developed into the Imperial Mail. In 1531 the couriers began to carry private letters and in 1597 the IM got an imperial monopoly for all mail, but it was challenged by local rulers for decades. As late as 1637 the Elector of Saxony did not permit the IM to operate in his province. Nevertheless the network of post offices got denser and of course the IM had its own "Pony Express"-like system of fast couriers.

Publishers got a never ending stream of information from freelance reporters from all over Germany, and could send their papers to the subscribers like Joe Buckley in *1634: The Galileo Affair* . Everything was so quick and reliable that Johan Carolus published the first weekly newspaper in Strasbourg in 1604. He promised the readers of the *Relation* all the latest news from Germany, Europe and the West Indies. As well, the first Dutch weekly was published in 1618, the first French weekly in 1621, the first Scandinavian in 1644 and Spain was a bit of a latecomer(1704). Many newspapers existed for only a short time and the circulation rarely exceeded 300 copies, but they reached a large number of people and a wide range of the society. Subscribers ranged from noblemen to pub owners. Today we have sports bars that attract customers with HDTV and pay TV; in the seventeenth century pubs had a newspaper. Sending newspapers out by mail was too expensive to have more than one newspaper in the inns and bars. Unlike today, a newspaper was not thrown away. Typically it would be resold or given to a friend. This meant the number of readers was ten times higher than the number of subscribers.

The pre-war tensions caused by the Reformation were beneficial to the development of newspapers, for they provided a lot of "news" and a lot of anti-Catholic/anti-Protestant propaganda. Even before the war some towns had more than one newspaper. When the war actually broke out, the papers got even more sensational news for the news hungry readers. We can also see modern trends like partisan reporting, sensationalist reporting and even the news influencing public opinion to a degree where public opinion influenced politics.

Take for example the sack of Magdeburg:

Protestant papers called it a crime of biblical proportion, but the Catholic paper called it just punishment for a rebellion. And in case you think loony conspiracy theories are a modern thing, a paper from Cologne alleged Magdeburg had been destroyed by the Protestants in order to blame the Catholics.

Reports of this and other massacres infuriated the people to a degree that caused even absolutist monarchs to consider public opinion in the decision making process. Speaking of monarchs, guess which one had the best "spin doctors" and "press agents," to use the modern phrases? King Gus of course! He could not prevent the sack of Magdeburg, but he exploited it to the fullest with fliers urging the Protestant Germans to redouble their efforts, along with promises of revenge and self-glorification.

This is the situation on Ring of Fire day minus one. What changes after the Ring of Fire?

Up-timers introduce some modern elements of PR as "press conferences" and "press releases" but the tone of the papers doesn't change. *In 1634: The Bavarian Crisis* we get so see some post-Ring of Fire examples of wild speculations bordering on conspiracy theories.

Down-time newspapers are spreading information very fast. It's quite likely that news about Grantville reaches any major German town within a month since Thurn and Taxis "pony express" needs just three or four days for Frankfurt-Leipzig or Frankfurt-Hamburg and 15 for Frankfurt-Madrid. In the future, news

will be even faster. Radio and telegraph are introduced quickly and infrastructure improvements will also have a major effect on newspapers. High transportation costs limit the circulation in more distant areas, but improved rivers and roads and, especially, the railroad will drastically cut costs, making a wider range of newspapers affordable.

News is a commodity and Grantville has 370 years of news about politics, religion, technology and arts. It must be a reporters dream. And more than publishers even dared of dreaming.

Down-timers had newspapers, but unlike today they were censored. The *Botenmeister-Zeitung* from Protestant Berlin regularly and harshly criticized atrocities committed by Catholic forces until imperial pressure led to the paper being banned in 1631. After King Gus dragooned Brandenburg into an anti-Catholic alliance, the paper could be published again, but it was censored in advance. Indirect censorship, like granting a local newspaper monopoly to one printer, was more effective than direct censorship. The newspaper owner knew very well his lucrative privilege would be taken away if the powers-that-be got bad press. As a result the papers printed "raw" information and refrained from commenting.

But in Grantville they have freedom of speech. It's a place where you can print virtually anything. Even if you irritate the ruling powers 24/7, you can still get watertight legal protection. It must look like paradise and we can expect a lot of publishers will move all or a part of their business to places with freedom of speech.

And last, but not least, if the "tame" down-time press was powerful enough to influence the political decision making of absolute rulers, an uncensored press should have a lot more influence on elected officials.

We better hope the sense of responsibility increases just as much.

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Parsley, Sage, Rosemary and Thyme: Gardening and Growing Food in 1632

Written by Anette Pedersen

Introduction

The benefits of growing usable plants near your sleeping place—as opposed to having to search for them whenever you need them—are so obvious that people must have started the first gardens as soon as they discovered that plants would grow from seeds, and that seedlings could be transplanted. In the Germany of 1632 every household—from the grandest palace to the smallest hovel—would have some kind of fenced plot, garden, or backyard near the house for growing at least the all important kale. This article will try to take a look at these gardens, with special attention to the kind of garden a family settling in Magdeburg or Grantville would be expected to start.

Garden Styles

Three styles of gardens were common in 1632: the formal renaissance garden, the medieval herbal garden, and the ordinary kailyard.

The main purpose of the formal garden was to display the power of the owner by showing how he could control nature. This style of garden with its regular rows of pots or standard trees, its knot gardens of topiary and clipped hedges, and its evenly spaced flowers and bushes wasn't limited to the grand manor houses, but would also be found on a smaller scale around the houses of anyone with social pretensions. If the area available for the garden was big enough, a secluded rose garden, to be visited only during the brief blooming season, was also a status symbol, as was an orangery where tender plants could be kept during the winter. The formal garden wasn't harvested in any way, so the household also needed to have a kitchen garden somewhere near, sometimes with the vegetables growing in orderly rows and patterns in the French *potager* -style, sometimes without any pretense to ornamentation and kept completely out of

sight from the house and the formal walks. One of the most famous potager-style gardens is the Château de Villandry at: http://www.frenchgardening.com/visitez.html?pid=31106784011481.

The herbal gardens were made up of tiny plots of soil laid out in a pattern and separated by narrow paths. Each plot of soil would be planted with a single plant species—annual or perennial—and the plants would all be harvested—either as they were needed or when the entire crop was ready for drying and storage. This type of garden had its origin in the medical gardens at the medieval cloisters, but—at a time when most medicines were locally grown and made—an herbal garden was not something found only at the apothecary, but a type of garden planted by all major or isolated households and with at least one in each village.

The kailyard was originally simply a fenced-in piece of land, where the household grew its kale and any other vegetables and herbs it needed. The area absolutely had to be fenced securely to keep roaming pigs and other animals from eating the household's sole source of winter vitamins, and as this plot of land was so important to people's survival, it was regarded as a part of the house itself, and given the full protection of the law against thievery. By 1632 the simple kailyard was still a common part of the small households, and would remain so for centuries, but a household living above existence minimum would try for something a bit more elaborate.

The Average Garden

The gardening books of 1632 were usually written by gardeners working for royalty or nobility, but a look at the less grandiose schemes found in these books—combined with contemporary journals and diaries—suggests that an average garden in 1632 was likely to have borrowed elements from each of the three styles mentioned above. The main purpose of the garden would be to grow the vegetables needed for the household, but it would be laid out with the main paths in a formal pattern—usually a cross—and its content would include a large number of herbs each growing separately either within clipped box hedges in a kind of knot garden or used as edging and low hedges along the paths.

The contemporary books advised to find a free and open position for a new garden—sheltered from the north wind but with sun for most of the day—and suggested the area south of the house as the most likely place. There should be water either within the garden or nearby—but no chance of flooding in the spring—and the area should preferably be either completely level or gently sloping to aid drainage. If only a steep slope was available for the garden, it had to be terraced to prevent erosion, and sturdy steps should be build for easy access to all levels. If there were no buildings to shelter the garden from the north, one or more rows of trees should be planted there as soon as possible.

Once the position of the garden was decided, the area had to be cleaned of stones and roots, dug carefully, and leveled with the aid of a spirit level. A hedge of young thorny plants should then be planted around the garden in a trench filled with well-rotted manure, and with a brush-work fence on the outside to protect the hedge while it was growing. The books made it quite clear that this part of the garden could not be stinted: the fences had to be absolutely tight before any kind of planting could take place. And since pigs were allowed to run loose and find their own food in the towns as well as in the country, this really was necessary.

For the entrance to the garden one or more portals made of juniper columns—which would not rot in the ground—and willow branches—which were easily bent—was suggested, and a wooden gate should be hung on hinges to close the opening.

The next part of the project would be measuring out the pattern of paths. Most patterns started with a

cross separating the area into four quarters, and if running water was available it was suggested that a narrow water channel be dug along one of the main paths and lined with handsome stones. Having water channels along both main paths and meeting in a fountain where they crossed was a scheme suggested only for the larger and more elaborate gardens, but a well as a central feature was practical and acceptable in even the most humble kitchen garden.

If a well already existed by the house, a central feature for the garden was still wanted. If the main paths were to be a formal walk lined with pots and ornamental plants, the central feature could be a pavilion or portal covered in climbing roses and vines, but even in what was to be entirely a working garden with all plants grown for food, it was still suggested that the center be marked with, for example, an urn or large clay pot planted with a small tree or large shrub. The basic for this layout was the biblical description of paradise, and was also used in the Muslim-style gardens still found in Spain.

Once the main paths were dug out and filled with white sand or pea-sized gravel, the secondary paths were measured out. Unless the garden was so small that the entire area could be reached from the main paths, there should be a path along the hedge—either right inside or some three feet within to create extra beds along the margin of the garden.

If further division of each of the four main quarters were needed for easy access, the obvious choice would be to split each quarter in four by secondary paths also laid out as crosses, but the gardening books provided a large number of drawings of various geometrical patters to choose from. To strengthen the pattern made by the paths, and shelter the new sprouts from the wind, it was the custom to line each bed in some way. Low fences of ox bones or painted brushwork were recommended for not interfering with the growth of the plants within the bed, but edging with clipped box, lavender, or herbs such as thyme, sage, and rue was also mentioned.

The Basic Vegetables

The preparations described above were most easily done in winter, but once a final layer of fine compost or old manure had been spread over the beds and worked into the soil, the garden was ready for planting in spring. Exactly what would be grown would of course vary from garden to garden, but some vegetables were grown by everybody with even the smallest piece of land.

Kale

The most important plant in the garden would be the winter-hardy kale, an originally wild European plant, and one of the oldest cultivated vegetables in the world. Kale was the only reliable source of fresh greens during the winter, and to be without it often meant scurvy for anyone not rich enough to own a forcing-house or at least buy sauerkraut. Kale doesn't keep long once harvested, and the leaves bruise and break easily during transport, so while it was grown everywhere, and sometimes filled most of a small garden, it was not planted in the fields or grown for more than local sale.

The most common way of serving kale was as a thick soup made by boiling the chopped leaves in the broth made from boiling salted pork, sometimes along with some chopped onions, and often with oats or barley added to further thicken the soup. In many households this dish would be served most days in the week with a bit of the pork, mustard and some rye-bread.

Swedes and Turnips

This group of vegetables was probably more popular in Germany than in any other country, and both Teltow in Brandenburg and Bortfeld in Braunschweig gave name to popular varieties. In these areas the big autumn and winter types were sometimes a field crop as well as a garden vegetable, but as with all winter vegetables they had to be either grown behind fences or harvested before the pigs and other animals were allowed to roam the fields in the autumn. Still, they stored very well, and many gardeners grew a few extra rows to sell, which made turnips the cheapest winter vegetable you could buy in most of Germany.

Winter turnips were often boiled to a puree or added to the kale stew, but could also be fried or even honey-glazed.

The fast-growing spring turnips, on the other hand, were ready for harvest early in the summer, and were very popular garden vegetables. They didn't keep well, and thus were not grown for export, but they were considered a delicacy and often served with roast or boiled duck.

Head Cabbage

The head cabbage had been bred by the Dutch and spread from Holland by their traders some decades before 1632, and it was thus a fairly new cultivar in the German gardens. It wasn't as hardy as the kale, but in a cool and airy place the harvested heads could keep for months, and when made into sauerkraut they could last all year without problems. Head cabbage was much easier to store and transport than kale, but sauerkraut was easier than either, and in some areas—one of them Magdeburg—head cabbage became a field crop, and an actual sauerkraut production took place for selling to ships and armies.

Sauerkraut was made by layering finely sliced white cabbage in barrels with salt and spices such horseradish and caraway seeds. After a while the cabbage juice brine would start fermenting, and once this process was finished, the product was ready for use.

Sauerkraut needed no further preparation before eating, but the un-fermented head cabbage was prepared in much the same way as the kale.

Kale, turnips and cabbage are all members of the same family of vegetables, and as the gardeners of the time were quite aware of the importance of crop rotation, it was the custom to use one quarter of the available vegetable beds for this family and change to a different quarter every year.

Peas

Next to the grains, rye and barley, it was the peas that were the most important source of nutrients. Not the fresh green garden peas (in Latin: Pisum sativus), but the hard and dry field peas (in Latin: P. arvense). Field peas were grown in several different varieties, all of which could keep for years once dried, and—as with the sauerkraut—some areas grew enough for an actually production for export.

Preparing a meal from dried peas took time: first they needed soaking at least overnight, and then the spoiled peas had to be picked out before they were boiled in water until tender. Once tender they would normally be mashed to a puree and strained through a colander to remove the tough pea-skins. The puree could then be mixed with the same salty meat broth as used for the kale, and boiled again with vegetable such as onions, leeks, carrots and parsnips plus herbs such as thyme or marjoram.

The succulent green garden peas, which are what most people today think of as peas, would be grown in cane-supported rows only in the gardens. They had to be eaten straight after being picked, and were a treasured summer delicacy to be gently steamed—to preserve the fresh color—and served either with a bit of butter or in a rich cream sauce. Mixing the peas with small, tender carrots, or steamed lettuce and pearl onions, are summer dishes that have remained popular from medieval times until today.

Beans

In 1632 the long green garden beans had barely arrived from America, and in many areas the European broad bean types were considered suitable for animal fodder only. In Italy, Sweden, the Low Countries and the UK broad beans were grown for the kitchen, but in Germany these would have been eaten only in the poorest households.

Peas and beans are from the same family, and as both have the added benefit of adding nitrogen to the soil, they were normally grown on a third or fourth of all fields as part of the crop-rotation. A similar rotation was recommended in the garden, and if filling a quarter of the vegetable beds with garden peas wasn't possible—and beans were not wanted even to feed the servants—it wasn't unusual to sow the rest of that quarter with field peas simply to improve the soil. These field peas could just be whatever kind was grown locally, but seeds of special types such as the large Grey Russian could also be acquired.

The Flavor Vegetables

A steady winter diet of rye bread, beer, yellow peas, and kale—plus salted pork and herrings—grew boring very, very quickly, and people tried to vary the dishes with small amounts of strongly flavored vegetables and herbs. So, if one quarter of the garden was filled with vegetables from the cabbage family and one from the bean family, then the third was likely to be filled with roots and members of the onion family.

Onions and Garlic

Regardless of the variety the taste of an onion depend on the climate in which it is grown, and a cold climate produce a much stronger flavor than a warm. Onions in Germany were therefore—like garlic—used more as a spice to flavor other dishes than as the independent vegetable it was considered in Southern Europe. Onions and garlic were commonly grown, but rarely as a commercial crop, and many made do with wild garlic gathered in the forests.

Leeks

Leeks could—with a bit of protection—keep in the garden during a mild winter, but they needed more care and fertilizer than the hardy kale, and in most areas leeks were used mainly in soups and to vary the flavor of the kale and pea dishes.

Carrots and Other Roots

The common carrots in 1632 were not the orange-red roots, we known today, but rather dirty-white or pale yellow. The Dutch had developed quite a few varieties, all of which were used in soups and stews, for garnishing, and as side-dishes—very much like we use carrots today.

Yet another Dutch root, the parsnip, was popular in vegetable dishes all over central Europe in medieval times. By 1632, however, it was considered only fit for animal fodder in the south, where the Italian influence was strong, while in the west, where the connection to France was strong, it was used mainly in soups. Only in the northern areas did the parsnip maintain its popularity, and was served as separate vegetable dishes in the Dutch and English style.

The beetroot was grown in both a red and a white version, and despite it storing well during the winter, the most popular use in Germany was to pickle it in sour wine with caraway seeds and horseradish. The eastern European beetroot soups still popular today were known and mentioned in German cookery books, but it was not a common dish.

Other roots such as the radishes, the black and the white salsify, and the hamburger parsley (a type of parsley where it is the winter hardy roots that are used) were grown from time to time by those who liked them, but played no large role in the common kitchen.

The Manor Vegetables

In addition to the common vegetables the big kitchen gardens at the estates would grow quite a lot of the more delicate and rare vegetables, as well as the newest arrivals from America and Italy. The seeds for most of these rarities could, with a bit of effort, also be obtained by owners of more moderate gardens, and would be grown either in the fourth quarter of the garden or be tucked in among the plants in the

other quarters. The big glass windows needed for an orangery or forcing house would be far beyond the means of most garden owners, but the construction of a few cold frames was perfectly possible for most. The contemporary gardening books describe very carefully how a flat hole should be dug within a frame of wooden boards, and filled with fresh horse manure covered with a layer of good soil and several woven grass mats in January. Come spring the soil in these frames would be much warmer than the surrounding ground, and tender vegetables such as the Mediterranean artichokes (often served elaborately garnished), cucumbers (mainly eaten pickled), fennel (mainly used as a spice), melons (a rare treat) and pumpkins (very rare) could get an early start—and a covering mat of woven grass in case of a late freeze.

Other vegetables not found in all gardens included the loose-leaf lettuce, which had been known since ancient Egypt, but was being bred to the more popular head lettuce by the Dutch. The bitter salads of the chicory and endive types sometimes grew in the wild, and could be gathered during the summer, but gardeners were also beginning to dig up endive roots in autumn, and make them grow pale, new heads in darkness for the winter tables. These various green leaves weren't normally eaten raw in Germany, but were braised or stewed the way spinach often is today. Whole heads of lettuce could also be stuffed and steamed, and the forced endives were very popular braised with a little honey or served as part of a pie-filling.

The popular cabbage family also had some rare members. The cauliflower and the broccoli were just beginning to spread from Italy to the rest of Europe in 1632, and would be found only in the gardens of the keenest gardeners. Brussels sprouts from the Low Countries (now Belgium) had been around as spruyten/sprouts since medieval times, but they had not yet been bred into producing the small, round balls we know today, and were not very common.

By 1632 asparagus had been grown for about a century in the manor gardens, and could also be gathered in the wild. The wild asparagus was very popular and one of the few plants that even people with major gardens of their own gathered—or rather, had their servants gather—in nature, but gardeners would also harvest the seeds and sow them in their own permanent beds.

Celeriac and celery were only just being developed in Italy, and probably didn't reach Germany for at least a couple of decades after 1632. Potatoes, tomatoes, corn and Jerusalem artichokes had reached Europe from America, but were not yet grown in Germany except as rarities—and then usually considered ornamental plants only.

The Perennials

In addition to the annual vegetables started from seeds every year, most gardens also had some perennials needing a permanent location. In addition to the asparagus mentioned above these plants included most herbs, rhubarbs, artichokes, berry-bushes and fruit trees.

In a small garden it was possible to use the fourth quarter for such a perennial collection, but if the garden was big enough for marginal beds just within the outer fence, then these were the recommended place for plants outside the annual rotation.

The Herbs

A wide range of herbs had been spread all over Europe from the herbal gardens of the cloisters, and by 1632 a average kitchen garden in Germany would contain not just the native horseradish, dill, cress, chives, angelica, caraway, lovage, marjoram and mint, but also the parsley, chervil, thyme, sage,

tarragon, and fennel originally imported from—mainly—the Mediterranean area. Those capable of starting plants indoors could also grow basil, and if winter storage was possible also bay and rosemary.

All of the herbs had originally been considered medical plants, but while thyme tea might still be prescribed for a sore throat or caraway seeds for an upset stomach, by 1632 their main use was in the kitchen.

A single herb, the mustard, was used so much that it was grown in small fields, and many herbs could also be gathered in the wild, but to vary the monotone diet even the smallest garden would have a few plants of something flavorful tucked in somewhere. If nothing else there would at least be a few pots or boxes with chives, sage and thyme standing by the kitchen door, but while hanging baskets and window-boxes would certainly have been possible, such were not mentioned in the gardening books, and do not appear on contemporary paintings.

Many of the herbs—such as chives, parsley, chervil and thyme—could be used as edgings for the annual quarters in a small garden, but in a garden with marginal beds it was more common to reserve one or two of these for at least the perennial herbs. Such herbal beds were often laid out to resemble the original beds in the cloisters with each herb having its own little plot surrounded by a narrow row of stepping stones, but it was also common to have one bed with the coarse horseradish, borage, angelica and lovage, and another with rows or plots for the more delicate types. Mints—then as now—were best kept in pots to prevent them from spreading out of control.

In households not able to afford many of the imported spices the importance of the locally grown herbs was so much larger than today, and while some herbs dried very well, there were also a large interest in extending the season of the fresh herbs. Thyme, sage and winter savory would keep their leaves for most of the winter if their position was even slightly sheltered, and the same would rosemary and bay if kept indoors in a cool room with a window. Chives could be planted in pots in the autumn, and moved indoors for forcing in February, while the season for the succulent chervil and parsley could—with some protection—be extended so it lasted for chervil from the end of March to the end of November and for parsley all year round except February. Watercress was also much in demand, as its season started in November and ended in May, but its demand for moisture, and dislike of snow cover, made it difficult to grow.

Fruits and Berries

Other perennials preferably planted in the margin beds included rhubarbs, berry bushes and fruit trees.

Rhubarbs had recently been imported from the Orient, but had quickly grown popular for the early harvest it provided. It was also considered a remedy for the very common gout, but for the gardener its main benefit was that it could be harvested in April-May when the garden produced little else. In the kitchen it was used for savory dishes as often as for sweets.

Berry bushes could either grow free along the outer fences with just a light pruning from time to time, or they could be trained to wires strung between low posts to present a more orderly appearance. Black currant, red currant and gooseberry were the most common bushes, but young plants of raspberries and blackberries could also be dug up in the forests and transplanted into the garden.

The big, succulent modern strawberries had not yet been bred by crossing with the American types, but the small, wild types would be growing wild in the forests, and could be gathered for summer treats by everybody. In the gardens strawberries would spread a bit too willingly to be used as edging, but did fine beneath bushes and trees as an ornamental ground-cover.

Sowing seeds from fruits rarely results in plants producing the same quality as the original fruit, so until hybridizing and grafting became common practice for fruit growing, the quality of the fruit grown around the farms and in town backyards was rather hit or miss. Still, some apple and pear types—such as several Borsdorf and Reinette variations plus the Bergamotte pear—were already being grafted and sold all over central Europe.

The common fruit trees—whether grafted or seed grown—would be on a seed-grown root, and could therefore be expected to grow one or more feet per year, unless kept low by pruning. Such big trees take years to start blooming, but need less protection and nurturing than those grown on a weaker root. And once they do start bearing fruit, a single tree could be expected to produce several barrels of cider.

Apples were by far the most common fruits, and most gardens would have at least one tree. The modern separation into cooking apples, and apples meant to be eaten fresh, wouldn't have made any sense as raw fruit was considered unhealthy, and nearly all apples would be prepared in some way. Instead the apples would be separated into summer apples, that didn't keep for long and were mainly used for cider, and storage apples that could keep well and were either dried or stored in cool cellars and attics.

The most common apple in the German area was the small, round, yellow, red-cheeked Borsdorf from near Meissen in Saxony, a crisp cooking apple with a fresh taste, harvested in October and lasting in storage until after Christmas. Even longer lasting was the larger, pale yellow Reinette Platte from Holstein, also used almost entirely for cooking, but harder, and lasting until spring if stored correctly. Juicier and thus better for cider were the three French apples: Corpen d'Rouge, Orlean's Reinette and Calleville Rouge d'Automne.

If the garden was big enough for more than a single tree, there might be a quince, a mulberry, a prune or a plum tree for more fruits to store fresh or dried for the winter. A row of cherry trees, some pear trees and a walnut tree were also possible, but would take up too much space in most town gardens. A grape vine, on the other hand, could be twining around a post or trained to a trellis, and would be found in vine-growing areas as well as in a sheltered spot in colder areas. Medlars, damsons, hazels and hip-bearing roses were sometimes used as windbreaks, but those fruits could also be gathered from the ordinary field hedges where they had self-seeded.

The Ornamental Features

If the garden wasn't to be devoted entirely to growing vegetables, the most popular ornamental feature would be a path suited for walking in fine shoes and edged with ornamental pots and flowers. Unless the garden was so small that it would look silly—and sometimes also if it did—a small pavilion could be placed in the middle of the path, so that you could sit and look at the flowers. Having a caged songbird hanging in the pavilion would be suited for really impressing the Joneses.

Small trees in handsome pots set at regular intervals along the main path were the most popular and fashionable garden feature. Almond trees and orange trees were the most prized choice, but the gardening books also suggested plants like rosemary shaped to small trees, bay trees, pomegranate, and oleander. If indoor winter-storage wasn't possible then hardy plants like roses trained to small trellises, cherries, or lilacs were suggested instead.

Behind or beneath the row of pots there would be either an entire border of flowers or at the least an edging of the vegetable beds. Among the flowers mentioned snowdrops, crocus, lily-of-the-valley, hyacinths, tulips, daffodils, Lenten roses, irises, cannas, martagon lilies, snapdragons, gladiolus, marigolds and larkspurs were especially recommended, but for those who had to make do with what seeds they could gather in the wild violets, daisies, feverfew, columbines, lupines, foxgloves, cornflowers and poppies would also make a good display.

A central seating area was supposed to have a roof or at least a canopy to provide some shade. There should also be climbing plants such as sweet peas, clematis or morning glory, or best of all, climbing roses which could be bought from special nurseries or local estates. This would also be the place where the first tomatoes and red-flowered runner beans would have been grown, but if nothing else was available then an ordinary grape vine would do. Using the poles around a seating area to support the long stems of the hops grown for beer making was, however, not a good idea, as the abrasive surface of the stems tended to cause a rash.

If a seating area was not wanted in the formal walk, then a medieval knot garden would be a popular choice. A knot garden is a pattern of low clipped box hedges, planted and cut to resemble rope tied as a loose knot. The spaces in between the hedges would originally be filled with finely raked colored sand, rather than herbs or roses as later became the fashion, but letting the box-plants on the corners grow

larger than the rest and cut them to topiary shapes remained popular.

The Non-hardy Plants

In the estate gardens the gardeners would be growing melon plants and cucumbers, and—if a new orangery had been build—also oranges and lemons in containers to be moved inside for the winter. In the more common gardens an adventurous gardener might try for the melons in a cold frame, and sow some snapdragon seed in a cool window, and if a cool cellar—preferably with a window—with room for plants were available, it might also be possible to keep some of the highly popular small almond trees. Orange and lemon trees don't shed their leaves and go dormant during the winter, so to grow those successfully a room with a glazed window was necessary. Fig, apricot, and peach trees usually grew too big to move around, but it was possible to get them to survive in a sheltered corner by winter-wrapping them in old blankets.

Tools and the Basic Work-Schedule

The basic tools available to 1632 gardeners were fairly much the same as found in a garden shed today. There would be rakes of wood and metal, hoes, strong spades, dandelion irons, small hand trowels, secateurs, saws, knives, hammers, strings, sticks, and watering cans with shower spouts. The main difference—aside from the absence of any power tools—would be that as many tools as possible were carved out of wood, rather than being made of metals.

The basic work would also be fairly much the same. There would be preparing the soil by digging and fertilizing the beds, pruning and grafting, sowing and planting, watering, weeding and pest control, and finally harvesting. The differences would be that fertilizing would be entirely organic and use both human and animal waste, that all grafting would probably be done by somebody local who happened to have the skill, that sowing would be done according to tables linked to the moon-phases, and that pest control would be limited to substances like nettle-water and tobacco tea. In other words: the kind of gardening now called organic, biodynamic, etc.

There would probably also be a much higher tolerance for what is today considered weeds. In the earliest spring when the tired kale and perhaps a few turnips were the only remaining vegetables, the first new green sprouts and leaves were most eagerly awaited by everyone. In the kailyards fresh leaves of parsley and chervil might be gathered, and the young sprouts of hop were tender enough to eat, but most of the earliest eatable plants were weeds such as dandelions, nettles, ground elder and dock, and however much they were hated during the summer, they were valued in spring for the early edible greens they produced. Angelica, wild asparagus, wild garlic, and watercress were also quick to sprout, and while they could be gathered in forests and meadows, some gardeners also dug up the roots and gave them a corner or a marginal bed for easy access.

American Changes

During the centuries between 1632 and 2000 much has been discovered about plants and their cultivation, many new plants have been bred, and many new gardening styles and methods invented. Despite Grantville having no specialty seed store, it is certain that many new plants would have come with the town, and eventually spread across Europe. Modern knowledge about hybridizing and grafting techniques would also have been accepted by local gardeners, and once artificial fertilizers, biocides, and lighter, more durable tools went into production, these would have been bought by those who could afford them.

The purely theoretical knowledge about plants, their anatomy, genetics, and systematic classification, would at first seem of interest only to a few European scholars. However, sooner or later most keen gardeners try crossing a few plants, and even that most basic genetic knowledge: that the best new results often don't occur until the second generation, would have been a major discovery. Knowing why crop-rotations worked, and why grafting sometimes didn't, would also be of interest to especially head-gardeners at castles and manor houses—many of whom had a side-business producing plants such as roses and fruit trees for sale.

Changes in gardening styles would probably have come about very slowly, as the main purpose of most gardens was production with any stylish concerns coming a very distant second. A few of the wealthiest royals and nobilities might have redone a garden in French or Italian baroque style, or tried for an English landscape garden, but to most people their garden had to produce the vegetables they needed with as little time and money spent as possible.

Some of the intensive methods popular in modern times, with raised beds, etc., are likely to gain a following—especially as industrialization gains speed and both truck-gardening and allotments became relevant. University students and other people without an independent household had generally rented rooms without kitchen access and eaten their meal in taverns, but an infrastructure able to support the families of industrial workers living in apartment blocks would not be something just occurring overnight. There would also be the more psychological aspect of how a "proper" household was defined, and that would to the large majority of the new workers include at least a rented plot of land for a kailyard.

A few plants were likely to spread far and fast, and first, last and always would have been the potato. Potatoes along with many other American plants had already arrived in Europe, but they were being regarded as curiosa or grown as ornamental plants in manor gardens. To have an entire group of influential new people spread all over Europe taking potatoes for granted as a part of their daily diet, missing them when not available, and mentioning how easy and reliable a crop they made, was bound to have gardeners and farmers wanting to try growing them. Potatoes obviously would have potential as a field crop—especially on poor soil—but few gardeners would be able to resist growing a tasty vegetable, which would reliably produce a crop from midsummer onwards to the autumn, and could be stored without problems all winter.

The second fastest group of plants to spread would probably have been the modern continuously-blooming roses. Roses were hugely popular and a major status symbol, but the only types available were those now called historical roses. Historical roses have wonderful fragrances, but they blooms only for about a month every year, and their color-scale is fairly much limited to pink, red and white. An owner of a modern bright yellow climbing rose would literally be able to set any price he wanted on his spring cuttings. Rose cuttings must be grafted immediately after cutting and transported as whole living plants, which would be expensive, but once the wealthiest household in an area had a rose, it was of course much easier for the rose to spread to the entire region.

Fruit trees were already being grafted all over Europe, and while most gardeners made do with the locally available types, there was also a certain amount of international trading going on. That the cuttings used for grafting are cut in winter or very early spring, while the trees are still dormant, means that there are a few months every year where a bundle of fruit tree cuttings may be wrapped in burlap and transported easily by wagon. At their destination, the cuttings would be grafted onto a locally grown root and eventually become a French pear in Germany or a German apple in France. That the fruit tree cutting could be moved so easily, meant that they were available also to people of only moderate means—such as village parsons or small town craft masters—and at least some of the traders leaving Grantville around the month of March would certainly have a bundle of cuttings tucked beneath their wagon seat to sell

along their route.

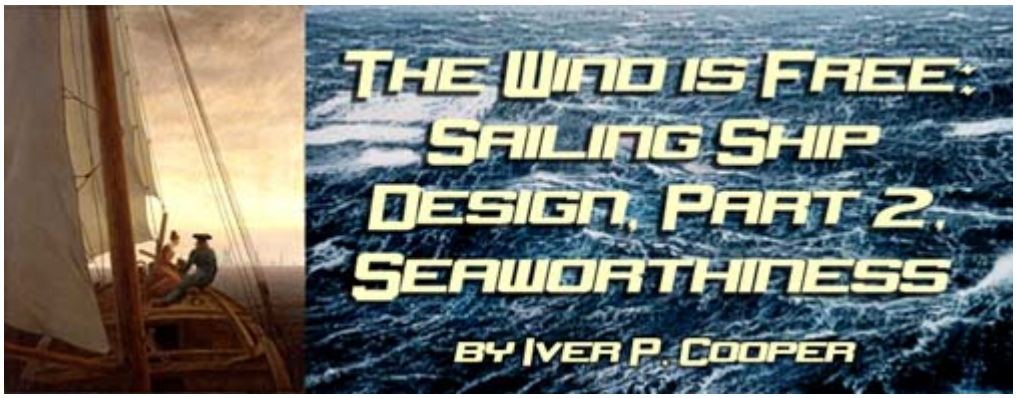
Other vegetables, herbs and ornamental plants would eventually spread from Grantville as well, but as with the potatoes the main impact would probably come simply from Americans mentioning them abroad, and thus creating a demand. The Grantville plant stock would of course have had several centuries of breeding for improvement, but without people to advocate the growing of, for example, tomatoes, corn, peanuts, chiles, and pumpkins, these would have remain curiosa for decades if not centuries.

How soon and how many items intended for especially for gardens would go into production is anybody's guess, but as in our world it would probably follow the farming items. Artificial fertilizers and more efficient pesticides would immediately have a market, but Victorian glass cloches and mobile watering wagons would also set local gardeners drooling. In fact anything able to increase a garden's yield or—as servants became industrial workers—save labor, would have a market.

* * *

The Wind is Free: Sailing Ship Design, Part 2, Seaworthiness

Written by Iver P. Cooper



Part II: Goals of Sailing Ship Design

The designer of a sailing ship must give it sufficient capacity and speed to carry out its mission, yet without unduly compromising its seaworthiness. And seaworthiness itself is a complex concept, embracing watertightness, buoyancy, stability, hull strength, weatherliness, handiness, and freedom to

enter shallow or constricted waters.

Capacity and Displacement

The ship buyer, be he king or commoner, doesn't specify the hydrodynamic parameters. Instead, he says, "I want a warship of 100 guns" or "I want a merchant ship, capable of voyages to the Indies, which will carry 500 tons of cargo".

Capacity ("burden") is the ability to cram in crew, passengers, provisions, cargo, cannon (and their shot and powder) and miscellaneous supplies (e.g., spare sails). It's limited both in terms of volume (by the dimensions and layout of the ship) and weight (too much, and the ship sinks). Until the nineteenth century, it was probably the single most important desideratum for a ship (other than staying afloat). The different demands on capacity compete with each other; for example, putting on more cannon (and the crews to man them) increases fighting ability but reduces the space for cargo and crew provisions.

The formula developed (1582) by the Elizabethan shipwright Matthew Baker, and one of several formulae in use in the 1630s, was

keel length X maximum beam X depth of hold, all in feet, divided by 100.

The result was a value in tuns burden; a tun was a volume measurement, a container of 252 gallons of wine, about 40 cubic feet, weighing about one English long ton (2240 pounds). Thus, the original meaning of "burden" was the number of tuns of wine that the ship could carry.

There was also something called "tons and tonnage." That added to the burden ("tons") an estimate (typically, one-third of the burden) of the miscellaneous goods ("tonnage") which could be carried. A ship with a burden of 300 tons has a "tons and tonnage" of 400. (BakerCV, 25-6). When "burden" is quoted in the literature it often really means "tons and tonnage," the total cargo capacity (modern "net tonnage").

The largest of the seventeenth-century merchant ships were the Portuguese *nao* , which were rated as high as 2000 tons burden. (Brigadier 12).

Passenger capacity can be estimated from burden. The tendency was to stuff the ship for maximum profit. A 1534 Spanish ordinance limited New World-bound ships to 60 passengers per 100 tons burden, but some carried almost one per ton (Perez-Mallaina, 130). In the Irish emigration to America, the average was 0.4/ton in 1769-70, and 0.66 in 1771 (Wokeck 185). In 1819, US ships were limited to 0.40/ton. (Blunt 314). Bear in mind that these ships carried cargo, too.

Of course, slave ships were packed even more densely. The average was reportedly 4 slaves/ton for 1600-1650 (Thornton 118). A 1684 Portuguese ordinance limited carriage to 2.5-3.5 slaves/ton (depending on portholes). (Rawley 252).

Displacement is a somewhat slippery concept, as it can be expressed in both weight and volume terms. The sum of the lightship weight (hull, rigging, armament, superstructure) and the deadweight (crew, provisions, stores, and cargo) is the load, which causes the ship to sink until the underwater portion has displaced a volume of water of equal weight. If that comes at a point at which the ship's deck is still above water, then the ship is floating (and if not, you need a new designer). Multiply the burden of a down-time ship by 1.67 (Wikipedia/BOM) or 1.3-5 (warships; Glete 529) to crudely estimate its

displacement.

For a ship to be buoyant, the designer has to limit the ratio of its mass to its volume so that its overall density less than that of water. And that means that a steel hulled ship has to have a greater volume than a wooden hulled one of the same surface area, to compensate for the greater density of the hull. Even so, they tend to ride lower in the water. (McCutchan 110).

A battleship by definition must have a large displacement, and that would also be typical of a long-distance trader. There was a tendency to overload long-distance traders to increase profitability. Matters were exacerbated by the nonchalant distribution of weight; heavy cargo often ended up on the upper deck. The Cosmographer Royal said that overloading was one of the reasons the nao *Santo Alberto*(sunk 1593) "and many others lie buried at the bottom of the sea." (Brigadier 13). Warships also were victims of overloading; excessive armament contributed to the capsizing of the *Vasa* .

In nineteenth-century wooden warships, about half of the load displacement was attributable to the hull. For merchantmen, the hull was only 35-45% (wood) or 30-35% (iron) displacement. (White 384).

The development of integral calculus in the second half of the seventeenth century made possible the calculation of the underwater volume corresponding to various waterlines and thus the calculation of the waterline corresponding to a particular load. (Glete 50ff), and for that matter, the location of the center of buoyancy for a particular angle of heel.

In Weber's "In the Navy" (*Ring of Fire*), Eddie tells Mike, "I don't have the least idea how to figure displacements or allow for stability requirements, and I know the designers screwed up the displacement calculations big time for a lot of the real ironclads built during the Civil War. There was one class of monitor that would've sunk outright if they'd ever tried to mount their turrets!"

Draft and Freeboard

The ship's draft (distance from waterline to bottom of the keel), and also the waterline length and breadth, will change depending on how heavily it's loaded, and how salty and warm the water is. Shallowness of draft is desirable if the captain wants to negotiate rivers and coastal waters (perhaps to escape a deep-drafted pursuer which would, if it followed, run aground). The great draft of the *Constitution* -class ships limited which ports they could use. (ChapelleHASN 130). But a deep draft ship can sail closer to the wind, and is less likely to drift to leeward (Anderson 88; ChapelleHASS 46). And it's less susceptible to wave action (Walton 168).

A ship with high freeboard (distance from waterline to deck) will suffer from windage, and be driven to leeward, but one with low freeboard is also easier for hostiles in small craft to board, and will be more likely to take on water if the sea state is high. (The Egyptians have the colorful term, "sailing with your coffin.") (Hollander 58). Freeboard on early nineteenth century British frigates was usually 6-9', with drafts of 15-20'. (Gardiner 143). Lloyd's rule was to provide 2-3 inches freeboard per foot of depth (White 33).

Speed and Resistance

The wind exerts a force on the sails, which cause the ship to accelerate. But there are forces which oppose the motion of the ship through the water (and air).

Frictional resistance, which is dominant at low speeds, is the result of friction between the hull and the water it contacts, and is proportional to the "wetted surface" of the hull, and the hull roughness. It increases as the square, or nearly so, of the speed (Baker 19ff). It's usually 80-90% of total resistance for ships at 6-8 knots; 50-60% at twice that speed. (White 448).

*Form (pressure) resistance*is the result of the hull pushing water out of its way, and the water returning to form a turbulent wake (eddies). It is proportional to the cross-sectional area of the underwater portion of the hull, and affected by the shape of the bow and stern. For ships with easy curves at bow and stern, eddymaking resistance is about 8% of the frictional resistance (White 449).

*Air resistance*is the result of the ship's above-water structure pushing air out of the way, and thus is akin to form resistance, but much weaker. The resistance is increased if there is a headwind.

*Wavemaking resistance*is simple in concept but difficult to quantify. As it moves through the water, the ship makes waves, which cost energy. In general, the faster the ship is going, the greater the resistance, roughly as the square of the speed.

However, there is also a periodic fluctuation in resistance, depending on speed. The bow waves and stern wave systems interact, and, depending on the speed, they may reinforce each other or partially cancel each other out. The distance (wavelength) between the waves increases as the square of the ship speed, and when the wavelength is near the waterline length, the waves reinforce each other. The wavelength equals the waterline length when the ship is traveling at "hull speed" (in knots, 1.34 times the square root of the waterline length). At speeds near the hull speed; this reinforcement means that the resistance increases faster than the square of the ship speed—indeed, as the third, fourth or fifth power.

Wave (added) resistance, as the name implies, is the result of ocean wave action. It is roughly proportional to the square of the wave height. (Nabergoj), which in turn depends on the wind speed and fetch. The direction of wave motion is also important, with "head seas" being the worst. Long, heavy ships are less affected. (Prpic-Orsic).

Stability

A ship can heel over as a result of wind or wave action, making a turn, or firing a broadside. What

happens next depends on the relative positions of the center of gravity (whose position is dependent on how the ship is loaded, and whether it carries ballast) and the center of buoyancy (which depends on the hull form). The ship can right itself, remain at a "list," or be driven over further until it passes the "angle of vanishing stability" (AVS) and capsizes. The effect of the design parameters on stability can be complex.

Sailing ships typically had a maximum safe heel of 45-65°, depending on hull form, loading, and the possibility of flooding. (ChapelleSSUS 213).

A ship can be stiff, that is, have too high an initial stability. If there is a sudden gust, and it doesn't timely reduce sail, then since the ship doesn't heel much, the sails take the full force of the wind, and "the topsails are often carried away, or the sails torn to shreds." (Walton, 215). Worse, if the ship heels and then rights itself too quickly, it could be dismasted (as happened repeatedly with the 1800 *Akbar* —Gardiner 137). Stiffness can be reduced by "winging" weights out to the ship's sides or raising the center of gravity. (Walton 168).

For a warship, you want a slow and easy roll, limited in angle, to make it easy to aim.(ChapelleHASN 24).

Stability predictions are inherently more difficult to make for wooden ships because of the great variation in the specific gravity of wood. (Reed 360).

The Swedish crown had an unpleasant reminder that even kings are subject to the laws of physics. The pride of the Swedish navy, the *Vasa* , sank in 1628, on its maiden voyage, blown over by a gentle wind gust estimated as being just eight knots. Fairley says that according to modern calculations, four knots would have been enough to capsize it. Its maximum angle of heel was just ten degrees.

The basic problem was that the *Vasa* was top-heavy. It was the first Swedish warship with two enclosed gundecks. This was not part of the original plans, but rather a last minute development in the Swedish-Danish arms race. There were also several upward revisions, during construction, of the number and weight of the cannon. All this meant that the ship was not only taller, but wider. Since the *Vasa* 's keel had already been laid, the width had to be added mostly in the upper part of the hull, which further raised the center of gravity. The keel was found to be a bit thin for supporting all the added weight so additional braces were added in the hold. With space reduced, *Vasa* could only carry about 120 tons of ballast, and Fairley says it would have needed more than twice that amount to be stable. (But it was impossible to add more since the gunports were already only 3.5 feet above the waterline—Franzen 19)

It is interesting to note that the *Vasa* underwent a crude stability ("lurch") test. Thirty men ran side to side three times. The result? The ship rocked back and forth like crazy. The outcome was not reported to the shipyard or the king. Curiously, the admiral who witnessed the experiment concluded that the ship was carrying too *much* ballast because the gunports were close to the water.

Hull Strength

The hull of a ship has to be strong enough to withstand the stresses imposed by the opposing forces of gravity and buoyancy, as well as those added, once it ventures out of harbor, by wind and wave. It is obvious that a warship must also be able to endure enemy gunfire. But the warship's own broadside can deliver a considerable recoil shock. (Glete 35).

The resistance to these stresses is the compound effect of the ship's frames, decks, deck supports (beams and knees) and longitudinal or diagonal stiffeners.

The hull bends as a result of variations in the local ratio of weight to buoyancy along the length of the hull. When a ship hogs, the center droops; when it sags, its ends droop. In the hogged state, the main deck is compressed and the bottom is stretched; sagging has the opposite effect.

Hogging and sagging can occur even in still water because of the narrowing of the ends (reducing buoyancy) and the non-uniform loading of the ship. Hogging and sagging is even more pronounced when a ship encounters waves, because buoyancy is increased at the crests and reduced at the troughs. The worst situation is when the waves have a wavelength equal to the hull length. (Thearle 312). Moreover, as the center of the ship passes from crest to trough, its state changes from sagging to hogging, at a frequency of perhaps a few seconds (315). Obviously, this challenges hull integrity. If the bending is too great, the ship snaps. Goodbye ship. Even if the stress isn't catastrophic, the strains tend to reduce the speed and increase leakage. (Glete 36).

Once the relationship of hull length to speed potential was recognized, there was an incentive to build longer hulls. (ChapelleSSUS 412). But hogging and sagging stresses are typically proportional to the *square* of the hull length.

However, lengthening the hull has compensations. In the nineteenth century, designers took advantage of longer hulls by repositioning the foremast further aft, reducing the bow load and thus reducing hogging. (McCuchan 36). Also, a very long hull might not often encounter waves whose wavelength equals the hull length.

Increasing breadth and depth increases the weight, and therefore the tendency to bend, but also the ability of the hull to resist the bending forces.

The usual antidote to bending was reinforcement. The thickness of the main deck and the keel could be increased (McCutchan 37). The French frigate *L'Oiseau* (1772) had diagonal planking (ChapelleSSUS 207), and the *USS Constitution* (1797) had diagonal risers (Otton) , both to inhibit hogging. This became common in early nineteenth century. (ChapelleHASN 365).

Since hogging was feared more than sagging, from time to time, builders experimented with laying the keel with a slight sag in the middle. This expedient was recommended by Griffith in the 1850s. (ChappelleSSUS 366).

Handiness

The longer the ship, the slower it turns (Laing 32) and the larger its turning radius. A ship half the length is probably about four times as maneuverable. It also helps to have fine ends, and weight concentrated amidships. (Atwood).

Weatherliness

When the force of the wind upon the sail is not parallel to the keel, the ship will be pushed, not just in the direction its bow is pointing, but also laterally. This undesirable lateral motion is called leeway and a ship with minimal leeway when traveling upwind is said to be weatherly. The resistance to leeway increases

with the draft and underwater length of the hull.

Windage (the force of the wind other than on the sails) is also important, and it is strongest when the wind is on the beam. In general, the ship with the higher freeboard or greater superstructure is going to suffer more leeway. If a single and a double decker were both making five knots close-hauled, in an hour the former might be pushed two miles to leeward, and the latter three. (Laing 75).

Weatherliness is especially important for fighting ships because it determines who obtains the weather gage. (ChapelleHASS 47).

Hull Dimensions.

The basic dimensions of the hull are its length, breadth (beam), and depth, all of which vary as a result of the curves of the hull.

Length. Seventeenth-century sources generally quote the keel length. The length of the gun deck limits the number of guns which can be carried upon it. (MurrayS 6). A late seventeenth-century naval regulation required a minimum spacing of 6.5 feet between gunports to accommodate the gun crew. (Grieco 110). Based on data for nineteenth-century British warships (Creuze 53), the length on the gun deck is perhaps 20% greater than the keel length. For the waterline length, which affects wavemaking resistance and pitch stability, I would split the difference.

Raleigh advised against building ships much longer than 100 feet (Creuze 17). For large warships launched between 1600 and 1640, a typical keel length would be 100-130 feet (Temmu). A first rate in Nelson's navy might have a 175 foot keel. (Longridge 7).

Breadth. For large warships launched between 1600 and 1640, a typical maximum beam (B) would be 35-45 feet, usually closer to 35.

Length/Breadth Ratio. This ratio determines the overall shape. Chapelle says that a ship with too wide a hull was slow, and one too narrow was an unsteady gun platform and couldn't carry sail well, presumably because of lack of stability. (ChapelleHASS 46). *Vasa* had a ratio of about 4:1. (Franzen 74ff).

The Portuguese *nao* had a length:beam ratio of 3:1 (Brigadier 11; Konstam 7). William Burroughs, the controller of the British Royal Navy, around 1596 suggested relative proportions for three "orders" of ships: (1) pure merchant ship, keel length twice breadth amidships, depth in hold half breadth; (2) all-purpose, length 2-2.25 times breadth, depth 11/24ths breadth; and (3) warship, length three times breadth, depth 0.4 times breadth. Looking at seven merchantmen (1582-1627) of 130-200 tons "burden" (see Capacity, below), these had length/breadth ratios of 2.14-2.92, and depth/breadth of 0.42-0.5. (BakerNM 8-9; Myers 106). The anonymous *Treatise on Shipbuilding* (c1620) called for length to be 2-3 times breadth, and depth 0.33-0.5 times breadth, and said the ideal warship was KL/B 2.78, D/B 0.43 (107).

"By 1634 it was very difficult to find a [British war]ship with a keel/beam ratio of less than 2.90, and there were several higher than 3.00." (Myers) In 1841, the typical length/breadth ratio for an English warship was 3.15, whereas in America, even merchant ships averaged 4.6. The extreme clippers which developed later in the nineteenth century reached a ratio of 5.7. (Laing 54).

Depth/breadth ratio. The depth determines the number of decks (Glete 52), the height of the gun deck, and the amount of freeboard. Duhamel (1764) says that the depth of a warship is usually 0.5B; but in the list of warships he provides, it is usually a bit less than that (4-6). In nineteenth-century British ships, depth was 0.55B for sloops and smacks, 0.58-0.75B for schooners and brigs, and 0.66-0.75B for large schooners and ships. This evolved under tonnage rules which penalized breadth and ignored depth. (Creuze 36).

Body

The body of the ship consists of the hull, deck, and any superstructures other than rigging. The hull is the backbone of the ship. It's partly out of sight, beneath the waves, but it should never be out of mind. Without a hull, you're swimming!

Frame vs. Monocoque Construction

In the classic truss frame construction, an internal skeleton carries the load, and the skin of the structure just keeps out wind and water. In a monocoque ("single shell") construction, it is the skin that bears all or most of the load.

Generally speaking, the truss frame is superior (on weight and cost basis) for resisting compression and bending, and the monocoque shell for resisting shear and torsion. In the Thirties, airplanes got large enough and fast enough for the monocoque strategy to prevail. (Gordon 311-3).

While classical ships were monocoque, their construction was labor- and timber-intensive, and hence this construction strategy was gradually abandoned. By the seventeenth century, the transition to frame construction was almost complete. The principal exception was that the Dutch used a hybrid process in building flutes; a few bottom strakes were attached to the keel before doing any framing. (Unger 124).

Chinese junks have been characterized as monocoques because they lack the keel, stem and sternpost, but their strength is not attributable just to their skin; they are reinforced by transverse bulkheads. (Thomas). Modern European monocoques are mostly open boats made of plywood or fiberglass, but there are also some monocoque minesweepers.

The backbone of the framed ship was formed by the keel, stem and sternpost. The length of these pieces determined the length and depth of the ship. Beginning in the early eighteenth century, there was a false keel under the true one. The idea was that if the ship ran aground, the false keel would absorb the impact, like the bumper on an automobile. (Mondfeld 74).

If a ship has a strongly tapered stern profile, it may have "deadwood," a vertical extension of the keel, to connect the aft end of the keel to the buttock of the ship. (After 1860, the bow was tapered enough so deadwood was needed in front, too.) The sternpost is connected to the aft end of the deadwood and the rudder mechanism is attached to the sternpost. Both the stem and sternpost are likely to be made of a single log of first class oak. (Longridge 11). Deadwood reduces leeway but increases frictional resistance. (Winters).

Transverse vs. Longitudinal Framing

There are two basic framing methods. In transverse framing, curved ribs run up from the keel, forming the load-bearing elements of the sides of the ship, and then deck beams bridge the tops of the ribs. It is called transverse because the ribs are (viewed from above) perpendicular to the keel.

The alternative is longitudinal framing, in which the sides of the ship are established by longitudinal (parallel to the keel) stiffeners. This was introduced in the nineteenth century (Young).

Bear in mind that a ship would not be purely transversely or purely longitudinally framed. Even if a ship has transverse ribs, they are attached to a longitudinal keel. And if a ship has longitudinal girders, then these must be linked by transverse "webs."

In wooden sailing ships, and early steel ships, transverse framing predominated. However, that meant that most of the structure did not offer any resistance to longitudinal bending. (NavArchWeb). That's fine for an accordion, but not good for a ship.

Bulkheads

These divide the ship into watertight compartments, and also increase its hull strength and its stability after being damaged. However, they also make it more time-consuming to load and unload cargo. Both transverse and longitudinal bulkheads were used regularly in Chinese junks since at least the second century (Temple 190), but prior to the nineteenth century, their use in European ships appears to have been spottier. Bulkheads were initially made of wood, but iron ones were introduced in the 1830s. (Young; Gould 79).

Planking

The framing must be covered with wooden planks or iron plates. There are two basic construction methods. In both, the planks run fore-and-aft. Carvel construction, invented in the ancient Mediterranean, fitted the planks or plates so they met edge to edge, forming a smooth surface. In clinker (lapstrake) building, used in northern Europe and in China, the planks or plates overlap their edges. (Svensson, 8). Clinker is not as streamlined as carvel, but it is stronger, and hence the planks can be made thinner.

Gould contends that the adoption of gunports favored the adoption of carvel planking (Gould 215). In the seventeenth century, the English used carvel planking everywhere, but the Dutch used clinker for their upper works. (Anderson 153).

John Smith's *Sea Grammar* (1627) says that a ship of 400 tuns requires four inch planking; one of 300, three inch; and smaller ships two inch.

Waterproofing

Wooden ships are made watertight by caulking them. Traditionally European ships were caulked by filling the seams with oakum (fibers from old ropes) soaked in pitch. The pitch can be distilled from pine resin, or from asphalt. Lime was sometimes used in place or in addition to pitch. The Chinese instead used tung oil or fish oil. Modern sealants include silicone and polyurethane.

Deck

In profile, the deck of a ship may be flush (horizontal), or it may have a sheer (upward curve) toward either or both ends. Judging from contemporary illustrations, seventeenth-century vessels will most likely have a very pronounced stern sheer. The sheer was gradually flattened out over the course of the eighteenth century. (Anderson 176).

Viewed from the front, the deck will usually be either flat or slightly cambered (convex upward). Camber slightly increases the structural strength, and reduces the recoil distance of the cannon (Dodds 89). Sheer and camber both permit water to drain away.

Hull Material

Wood has the advantage of being naturally buoyant; wrought iron and steel, that of considerably greater tensile strength and stiffness, both absolutely and in proportion to weight. Wood is vulnerable to biological attack; metal, to corrosion.

Wood. The deck could be made of any of variety of woods, such as pine (BakerCV 95). The materials requirements for the hull were more stringent. The official march of the eighteenth century British Navy proclaimed, "Heart of oak are our ships. . . ." Oak was the principal hull wood for European navies in the seventeenth century, too. Pine was used, especially in the cost-conscious Dutch flutes, when oak was unavailable or deemed too pricey. (Unger), but it was definitely inferior.

However, beginning in the sixteenth century, Portuguese ships built in Goa shipyards used teak. The teak hulls lasted a decade longer than those made of oak or pine, perhaps because of its resistance to teredo worms. (Brigadier). Moreover, oak contains tannic acid, which corrodes iron, and teak doesn't (Jordan). Teak requires less seasoning than oak, it doesn't expand significantly when heated, and it is extremely

durable. (Bowen 143). The British displaced the Portuguese, but it wasn't until the early nineteenth century that the British permitted warship construction in India. Soon thereafter, the British use of teak surpassed that of oak. (Schlich, 578).

Mahogany was used by the Spanish in the New World, it being readily available in Cuba and the Honduras. It is more buoyant than oak, easy to bend and carve, and resistant to dry rot. It also doesn't burn or splinter as easily as oak. (Glete 31; Fine Woodworking 25).

As commemorated by a Bermuda postage stamp, native Red cedar (*Juniperus bermudiana*) was used to build the *Deliverance* and *Patience* , which went to the rescue of the Jamestown colony in 1610. Many sloops for the West Indian and African trade were constructed from this wood. (ChapelleSSUS 65).

Long, straight timbers are used for the keel, and are also sawn to make planking. For large ships, several pieces had to be "scarfed" together; *HMS Thunderer* needed seven baulks, each 26' (Dodds 58).

There is also a demand for "compass" (curved) timber for use in framing. Foresters would survey forests and mark the trees which had branches of a particular desired curve. In like manner, they looked for "knee" (angled) timber, taking it from the junction of branch and trunk. The knee timbers secured the deck beams to the frame (BakerCV 95). Warships had a particular need for crooked timber for reinforcement (Glete 52).

Wooden planking can be curved, but the curves must be gentle. If the curve is too sharp, the wood will break rather than bend. (Henderson 118). In the seventeenth century, "green planks were often scorched or heated in wet sand to render them pliable enough to be fitted around the customary bluff bows. . . ." (BakerCV 31).

The natural supply of compass and knee timber was gradually depleted, and hence means were sought to produce it artificially. Unfortunately, the heavier the timber, the harder it is to bend. According to Baker, "the steam bending of frames was unknown" in the seventeenth century, and Griffiths (16) says, "from time immemorial shipbuilders have bent their *planks* by a due application of heat and moisture but it is not . . . until the present [nineteenth] century, that any of them discovered how to bend *frame timbers* and *knees* ."

Another issue was how to attach the planking to the frame, and indeed the various frame elements to each other. Baker says that in the early seventeenth century, there was extensive use of "treenails" (wooden pegs), with iron nails being used mainly in fastening down the planking of the superstructure. (BakerCV 33). However, the Portuguese apparently just used iron nails in the hull, and the Spanish *San Martin* (sunk 1618) used both kinds on the same planking (Crisman). Treenails were cheaper than iron ones even in the mid-eighteenth century (Dodds 24).

The great enemy of the wooden ship was dry rot. (Dodds 13). Three expedients were used to minimize it. First, shipbuilders selected resistant woods. Teak and greenheart are good for perhaps twelve years but weren't used by Europeans (except as noted) in the early seventeenth century. Oak is durable if seasoned (English practice was three years), lasting perhaps a decade, but unseasoned oak can be destroyed in a few months. (Which didn't stop the American colonists from using unseasoned wood for smugglers and privateers, ChapelleSSUS 13.) The heartwood was preferred even though that meant that the tree had to be allowed to grow longer to get enough of it. Elm doesn't rot if it's constantly immersed in water and hence it was used for the keel and the lowest planks. (Dodds 18; Murray 72). The *Sparrowhawk* (wrecked 1626) had an elm keel (Riess 71).

Secondly, at least by the nineteenth century, they experimented with various preservatives. Metallic salts didn't work well, but cresoted timber was resistant to both rot and marine worms. (161).

Finally, they grudgingly recognized that they needed to hold down the moisture level in the wood by forced ventilation. (162). In the nineteenth century, steam fans were available (Lewis 112).

* * *

Iron. Iron use in seventeenth-century ships was mostly in cannon, bolts, hinges, chainplates, hooks and the like. (ChapelleSSUS 14). Iron knees were used in the first rate *Royal James* in the 1670s, but weren't routinely used in England until after 1800. At first the knees were a hybrid of iron and wood. The complete iron knee appeared in the *Unicorn* (1824). (Goodwin) By the end of the eighteenth century, iron had also been used in the cross-bracings of warships. (Dodds 7).

An iron-hulled pleasure boat was built as early as 1777, but little is known about it. Wilkinson's *Trial* (1787) weighed eight tons yet drew only eight inches empty. Unfortunately, it and the three additional barges he constructed in 1788 cost at least three times as much as its wooden counterparts. (Barker)

In 1810, Sir Samuel Bentham unsuccessfully urged the Admiralty to switch to iron-hulled warships, in view of the shortage of timber. (It took 2-3 loads, each fifty cubic feet or one "standard" oak tree, per ton of ship, to build a warship, and 1-1.5 for a merchant ship, and the cost even in the 1750s was almost 10£/load. Dodds 13). .

Nonetheless, iron hulls started popping up a few decades later. The *Aaron Manby* , a wrought iron steamship, was built in 1820, and the 218 ton bark *Ironsides* in 1838 (McCutchan 111; Young). *Ma Roberts* (1858) was the first steel paddle steamer, and the 1271 ton *Formby* (1863) the first steel square-rigger. It cost twenty pounds to the ton. (McCutchan 36). The first iron warship was *HMS Warrior* (1860).

Iron had advantages other than availability, of course. It was stronger than wood, and hence could be used to build longer (hence faster) ships. While iron was more costly per unit volume, its strength meant that less was needed, so 19c iron ships were 10-25% cheaper. Iron hulls also lasted two or three times longer than wood ones (White 412).

Iron ships usually came in two basic flavors, the all-iron ship, and the composite, which had an iron frame and wooden planking and decking. (Svensson 62). Composites were favored for tropical waters, where copper sheathing was necessary to protect against marine borers; iron set against copper would experience bimetallic corrosion (Lewis 117). Another variation was seen in the *Great Republic* (1853), 335' long; it was mainly wood, but its hull was reinforced with diagonal strips of iron.

It is important to recognize that there wasn't a rapid transition from wooden to iron ships; the two types co-existed for decades. Iron ships were not only more expensive to construct than unsheathed wooden ships, they had nasty effects on ship's compasses. The bottom of the all-iron ship was a haven for barnacles and seaweed, increasing skin drag if not cleaned frequently. So their maintenance cost was higher than for sheathed wooden ships. And iron corroded three times as fast as copper. (McCutchan 110, Atwood 299, White 415).

An advantage of iron plating, over wood planking and decking, was that the iron plates could be bent easily. But of course the iron added more weight to the hull.

Mild steel was 25-30% stronger than iron, allowing a saving of 20% in weight of scantling and 13-15%

overall, but in 1880 it was 50% more expensive (White 429ff).

Hull Form

As the ship moves, water is parted by the bow, and passes around and under the hull, rejoining at the stern. If there is separation of the flow from the hull, eddies will form where the water returns. The energy to form these eddies comes from the ship's propulsion, so these flow disturbances are felt as "form resistance". Separation tends to occur where there is an abrupt change in underwater hull form. (ChapelleSSUS 49).

The choice of hull shape isn't easy. For example, the 3D shape which would yield the minimum wetted surface for a given volume, and thus the least skin drag for its displacement, would be a hemisphere. However, the fluid flow at the fore and aft "ends" would be kinked, creating significant form drag. (Gougeon 32).

To reduce form drag, water must be moved out of the way and back again more gently, i.e., the ship needs a streamlined shape. Fish bodies have offered inspiration to ship designers for centuries (and there are old plans which actually depict a fish body beneath the hull diagram).

Tapered shapes reduce form drag and frictional resistance, but also reduce both capacity and the ratio of capacity to resistance.

Midship Section Position. Imagine that the ship is sliced into vertical sections, like a loaf of bread. The section with the largest beam is called, somewhat misleadingly, the "midship section."

A good ship, old salts said, should have a "cod's head and a mackerel's tail" (a teardrop shape, with the midship section forward). In keeping with the adage, the seventeenth-century midship section was actually located about one-third keel length from the fore end of the keel. That yielded a short full (broad) bow and a long fine (narrow) stern. (BakerCV 20-21). A Dutch merchantman shown in Furttenbach's *Architectura Navalis* (1629) exemplifies this shape. I would estimate that quarter-length from the bow, it is a third broader than a quarter-length from the stern. (Landstrom 146). On the *Mayflower* replica, based on Matthew Baker's manuscript, the midship section was placed 21 feet from the forward end of the 58 foot keel. (BakerNM 80).

In later centuries, the midship section was moved aft, to true midships, or even somewhat aft (the "wedge" shape), the latter being touted by EB11 "Yachting." For our purposes, the key point is that the position of the midship section is something that the designers are going to argue about.

Midship Section Shape. On a ship plan, the sectional view of the ship is the view from the front. We

need to consider both the underwater portion (the bottom) and the abovewater lines (the sides).

Bottom. A semicircular underwater section requires the least "wetted area" (which determines frictional drag) for a given capacity, and this was recognized by Georges Fournier (1595-1652) in his treatise *Hydrographie* (1643)(Laing 162). Unfortunately, it provides no stability, and hence is practical only on a multihull or if there is substantial ballast. Rounding makes the hull "tender"; a small degree of tilt produces only a small righting tendency so the hull heels easily and recovers slowly. However, if deep-ballasted (see below), then its resistance to heeling will increase as the angle of heel becomes larger.

The bottom may instead have one or more chines (angles). A simple-V bottom has one chine, a square bottom two, and a shallow-V has three. A square (flat) bottom maximizes capacity and also makes it easier to shelve the ship on a beach, if need be. Additionally, if the bottom is flat (or a shallow-V), the hull is "stiff"; the center of buoyancy moves sharply in the direction of a small tilt and thus creates a strong righting moment. However, if the tilt continues to increase, the righting moment will decrease once more. (Gougeon 39-42). Generally speaking, flat bottomed hulls experience more leeway than V-shaped ones.

In the early seventeenth century, most "blue water" ships had a short flat portion at the bottom (the floor), then a nearly circular underbody. (BakerCV 20; BakerNM 31). The Dutch merchantman shown in Furttenbach's *Architectura Navalis* (1629) had a more pronounced flat bottom, almost as wide as the maximum beam (Langstrom 146) . Square bottoms were found on colonial workboats since they made the boats easier for neophytes to build.

However, there were ships, such as the Dufyken (1595), whose bottoms were partially V-shaped, not flat. The slope and rise of the "V" is called deadrise, and in later years there was much disagreement as to how much was desirable. (Duhamel 7, ChapelleHASN 406). Deadrise reduced resistance, but at the cost of stability.

The sides of the ship may be vertical (wall-sided), or, as they near the top, they may creep in (tumblehome) or out (flare).Tumblehome reduces topside weight, and also might make the ship more difficult to board (Millar 20). If taxes are based on breadth on deck, then tumblehome gives you a bit of "free" cargo capacity. It lowers the center of gravity (Millar 20), but it reduces the reserve of buoyancy and the "righting arm" at large angles of heel (Walton 144ff). The curved section also increases strength in compression, which may be helpful in supporting heavy guns. (Harland 44). Flare has the reverse effects. Both tumblehome and flare increase the cost of the hull.

In the early seventeenth century, the ships usually had, starting above the level of maximum beam, itself a little above the load waterline, a straight tumblehome at about twenty degrees from the vertical. (Baker).

Eighteenth-century British warships also had substantial tumblehome. After the Napoleonic wars, the British found themselves short of compass timber suitable for curved futtocks (or at least of the funds for buying such timber), and switched to "wall-sided" ships. (Kirby 98). Modern ships, while made of metal, also tend to have vertical walls. However, icebreakers curve inward both above and below the waterline, to protect them from ice pressure. (Rogers 28).

Full and Sharp Ends. To reduce form resistance, the hull tapers as you move from the midship section to the ends. The seventeenth-century shipbuilder determined what taper to use where by a combination of geometrical rising and narrowing algorithms, and judgment by eye (the latter assisted, in so-called "whole moulding," by the use of flexible wooden ribbands to ensure that the curves were smooth and plankable).

The combination of the bow (and stern) shape (horizontal) and profile (vertical) determines whether the

ends are "full" (boxy) or "sharp" ("fine", tapered). The sharpness reduces form drag but also reduces local buoyancy; the ends will sag if local buoyancy is inadequate to support their weight. (ChapelleHASS 44; Darcangelo 1-3; Villiers 105). As to stability, a wall-sided ship with a diamond shape would have half the buoyancy, but only one quarter the metacentric height (and thus, roughly, initial stability) of a ship of rectangular shape. (Simpson 36ff). Sharpness of profile likewise reduces stability.

The sharpness of the design may be summarized in terms of the midship section coefficient (ratio of actual underwater area of midship section to that of the corresponding rectangle), prismatic coefficient (ratio of underwater volume to that of a prism with the same midship section and length, but without any taper), and block coefficient (ratio of actual underwater volume to that of the corresponding block).

We know that the wargamers in Grantville have several of Chappelle's books. They aren't identified, but given the nature of their hobby, they almost certainly own *The History of the American Sailing Navy* (ChapelleHASN) and *The Search for Speed Under Sail* (ChapelleSSUS). These books are valuable in that they detail the "lines" of numerous successful sailing ships, both warships and merchantmen.

While the designers of the 1632verse will no doubt be fascinated by the data in this book, it is hard to extract from them any overarching principles. A fast ship can have a full midsection (high midship coefficient), and relatively fine ends (low prismatic coefficient), or the reverse.

Looking at the fast ships of ChapelleSSUS chapters 6-8, which include clippers and their predecessors, the block coefficients are .30-.76, the midship section coefficients .53-.93, and the prismatic coefficients .56-.82 (ChapelleSSUS 406ff). The *Surprise* (1850), despite a .82 prismatic, was considered a "fast sailor." The *Eckford Webb* (1855), with a .72 prismatic, is known to have made 16 knots. (385), for an SLR of 1.43! (411), although it might have been blessed with a light load at the time. The most that can be said is that the short-term speed champs *Sovereign of the Seas* , *Lighting* and *Sweepstakes* had lower prismatics: .62, .61 and .64, respectively. (409).

ChapelleSSUS teaches that for fast sailing downwind, a low prismatic coefficient (implying a ship with relatively fine ends) is desirable, but on other points of sail, a higher prismatic is better. (45ff). And the effective hull length of the ship, for computing hull speed, is the product of the actual hull length and the prismatic coefficient, implying that with enough wind power, ships with full ends will go faster.

The displacement volume can be estimated if the length ("between perpendiculars"), beam and draft are known; multiply these by an assumed block coefficient (.6-.7 for a merchant, .5-.6 for a battleship, .4-.6 for a cruiser; White 4; Ridler 62).

Bow Shape. A curious practice, lasting the entire seventeenth and eighteenth centuries, was a cutoff upper bow. The lower bow was round, but above the beakhead, the upper deck had a square Which should have carried a sign which read "Shoot Me!" since it was a weak point, vulnerable to raking. Nelson's flagship, the *Victory* , when brought in for repairs, was much more heavily damaged in its upper bow than its lower bow (Fincham 203). The English shipwrights smacked their collective foreheads, and English ships constructed after 1811 featured a complete round bow. (Anderson 181).

Stern Shape. In medieval times, big ships had rounded sterns. Beginning around 1500, such ships were given a flat, square, "transom" stern, which the Dutch called *spiegel* (looking-glass), perhaps because of the reflection from the windows set in the stern cabin.

Hydrodynamically speaking, the transom stern was inferior to its predecessor, the round stern. The water pushed out of the way by the bow reunited abruptly behind the stern, creating a turbulent wake. This increased drag, reducing speed. Moreover, part of the rudder was in the area of turbulence, and

hence steering was impaired. (As a palliative, at some point the aft edge of the rudder was thickened.)(BakerCV 19).

In the seventeenth century, the English created a hybrid stern, in which the lower part was rounded and the upper part square. This can be seen in *Sovereign of the Seas* (1637) , whose stern flattened out about ten feet above the waterline, but it wasn't common on English ships until the 1650s (Anderson 144; Langstrom 152; Millar 17). The hybrid stern solved the hydrodynamic problem, but bear in mind that the transom upper stern was probably a weak point in combat. The English made the final step to a round stern in the 1820s. (Millar 20), and the Americans followed suit. Besides being stronger, the round stern offered the prospect of placing gunports in the rear quarters, eliminating that blind spot.

Unfortunately, the change also eliminated the traditional quarter galleries for the ship's officers, and this wasn't borne (especially by senior officers) in silence. The plans for the early round stern warships were revised so as to mask the new sterns with quarter galleries. (ChapelleHASN 365).

Bow Profile. Usually, the bow and stern overhang, that is, they rake outward as you go upward. Compared to a ship of the same deck length but without an overhang, the raked ship will have less frictional drag because the water flows under it more readily, but also less resistance to leeway, reserve buoyancy, and cargo capacity. A ship with an excessively raked stern or bow might not be able to carry guns at those ends (ChappelleBC 43).

Bow profiles may be plumb (vertical), "V" (straight; slanting outward); clipper ("concave"; "hollow"; starts vertical and arcs outward); spoon ("convex"; starts horizontal and arcs upward) or tumblehome (spoon bow which ultimately curves inward).

John Smith wrote in 1627, "fore Rake is that which gives the ship good way, and makes her keep a good wind, but if she have not a full Bow, it will make her pitch her head much into the Sea; if but a small Rake forward, the sea will meet her so fast upon the Bowes, she will make small way. . . ." (226).

The seventeenth-century bow was typically a "V" bow terminating in a beakhead, a structure similar in appearance to the ram of the ancient galley. It wasn't used for ramming, of course, but rather to provide a platform for sailors working on the bowsprit. It also "shattered the seas at each plunge and kept them from sweeping fore and aft." (Masefield; AndersonRS xvi, xvii) You could also find spoon bows (xv).

As ships got longer, a pronounced rake became problematic from a strength standpoint. Rake went out of fashion in the 1820s and 1830s, and packet ships sometimes had almost vertical stem and sternpost. (ChapelleHASN 423).

The clipper bow was popularized by John Griffiths, who argued that such bows would have minimal

head-on resistance, and would resisting burying when the ship plunged in a heavy sea. He tested his ideas in tank experiments, but the proof of the pudding was his *Rainbow* (1845), which made the round trip from New York to China in 7 months, 17 days. (Laing 170-9).

A twentieth-century variation is the bulbous bow. Above the water line, you have a clipper bow. Below it, there is a protruding bulb which creates its own bow wave. If properly designed, it reduces the normal bow wave at speeds near the hull speed (GlobalSecurity).

Unfortunately, it's more useful on powered ships, since they can consistently maintain the right speed. A sailing ship is at the mercy of the winds, and at speeds much different from the "design speed," the bulb increases drag. For a Napoleonic era warship (say, 170'LWL, hull speed 13 knots, 0.60 block coefficient), you would need to reach a speed of 10 knots to see a 10% reduction in resistance. (Sterling 12).

With short ships, there will also be increased pitching at high speeds, and the bulb does no good when it's out of the water and actually creates drag on each reentry.

Finally, at all speeds, the bulb increases turning resistance. (Killing 37-9), and frictional resistance, so light wind performance will be poorer.

Stern Profile. In the seventeenth century, the most common stern profiles were rounded or slightly vee'd sterns (AndersonRS xv, xvii), and one which angled or curved outward and then turned vertical to create a transom (xvi).

Subsequently, shipbuilders constructed ships with "finer" sterns, the theory being that this reduced the turbulence behind the ship and thus reduced form drag. The trend was reversed by Griffiths, who favored matching his sharp bow with a blunt stern (leading detractors to suggest that his ship would sail better backward).(Laing 176).

Girdling. As early as 1622, the English added an extra layer of planking (girdling, furring) at the waterline to increase stability. (BakerNM 6; OED). For example, the 76-gun *Royal Katherine* (1664) had a normal beam of 39'8" and a girdled beam of 41' (Temmu). Lewis (200) says that this substantially increases stability while adding "very little" to the draft.

Ballast

The height of the center of gravity is determined not by how much weight is being carried, but where it is located. In general, the lower the center of gravity, the greater the stability of the ship. Merchant vessels have the luxury of stowing heavy cargo deep in the hold. Warships have the problem that guns are heavy, and needed to be high enough on the hull to be above the wave action. They therefore need to carry ballast to compensate; ballast and water was typically 12-14% displacement (White 84).

Ballasting lowers the center of gravity, and thus increases stability, but at the cost of increased mass and thus reduced speed. Also, too much ballast will make the ship too stiff. (Walton 168ff). Ballast is most effective when deep in the hull, and so as more ballast is added, the return in stability diminishes.

The most commonly used ballasts were gravel, coarse shingle, sand and rock. (ChapelleHASS 247). They had the advantage that they could be laid wherever desired.

Iron and lead were only rarely used as ballast in the seventeenth century, most likely on account of their cost (Lavery 186). In the late eighteenth century; cast iron ballast cost £27-5s/ton (Dodds 23). The most efficient ballast would be lead, because of its high density, but on account of its cost it was then limited to royal yachts.

In 1796, Samuel Bentham had iron ballast bolted**outside** the hull, beside the protruding keel. That moved the CoG more than the same weight of internal ballast would have. This deep ballasting eventually evolved into the uncapsizable hull. (This has a deep fin with ballast attached at the end; a completely watertight hull is uncapsizable if the external ballast moves the CoG *below* the center of buoyancy.)(Gougeon 39, 51; ChapelleHASN 236).

The crew's water and victuals may also be placed low in the hull, to augment the ballast, but of course they diminish over the course of the cruise. *HMS Endymion* (1797) carried 120 tons iron, 26 shingle, and 124 water. (Gardiner 145).

Cargo can also serve as ballast, if dense enough, and has the advantage of earning revenue. The Portuguese found Chinese porcelain to be a useful ballast for their East Indiamen. (Brigadier 54). Madeira is a fortified wine, and in the eighteenth century it was recognized that unlike other wines, its taste is improved if it spends, say, three months "cooking" as ballast for a ship traversing the tropics. (NewScientist 114). The improved Madeira was called *vinho da roda* ("wine of the round trip").The nineteenth century frozen water trade from New England to the American South, the Caribbean, and even India, was profitable because the ice served in place of stone ballast (which had to be paid for).

1911EB "Ballast" notes that "in modern vessels the place of ballast is taken by water-tanks which are filled more or less as required to trim the ship." For example, a tank in the bottom of the screw-propelled icebreaker *Ermack* (1898) held 800 tons of water. Pumps could be used to shift this water to tanks fore, aft, port or starboard. (Rogers 29-30). Simpson's ironclads appear to have a similar feature. (*1633* , Chap. 4; *1634:TBW* , Chaps. 31, 44, 48, 60, 61)

With water ballasting, it is very important to keep the tanks full; any partially full tank of liquid is subject to the "free surface effect"; the liquid sloshes in the direction of the tilt and moves the center of gravity in the "wrong" direction. Likewise, solid ballast, whether sand or cargo, must be kept from shifting.

Fins

You can increase lateral resistance by placing a fin below the main body of the hull. The fin increases the lateral area and simultaneously lowers the center of lateral resistance. This improves resistance to leeway. Unfortunately, fins increase wetted area (thus, skin drag) and draft.

These disadvantages are somewhat muted by use of retractable fins. Seventeenth-century Dutch coasters were equipped with leeboards. These were fins which hung on either side of the boat and could be let down as needed. A centerboard is a retractable fin mounted in a (hopefully) watertight cabinet inside the hull. It could slide up and down (daggerboard, drop keel) or pivot on a bolt at one end (pivot keel). (Gougeon 33-6). The centerboard first appeared in 1774 (ChappelleHASS 166-8), and the pivoted type around 1809 (360), but wasn't really popular until the nineteenth century.

Chapelle says that the centerboard made it possible for a coaster to sail well when light. (ChapelleSSUS

279). He is also of the opinion that "extremely high speed-length ratios became possible only after the centerboard was introduced (412). Simpson's ironclads have two big centerboards (1634:TBW, Chap. 44).

Bilge keels are fins which are mounted at the boundary between the bottom and the sides. When the ship heels, the leeward bilge keel is submerged, and then resists further rolling. However, the submerged keel also increases resistance to forward motion.

Hydrodynamic Lift

If the underwater form of the ship is chosen appropriately, it can behave somewhat like an airplane wing, generating lift as it picks up speed. This lift, in turn, reduces frictional resistance, permitting the ship to travel even faster.

The necessary hydrodynamic structure can be the shape of the ship's hull itself (a "planing hull"), or a fin-like device ("hydrofoil") below the hull.

Unfortunately, this "planing" becomes significant only when the ship reaches very high speeds—an SLR of 2.5. (Teale 7). The only sailing hulls which reach that kind of speed are those with very large sail areas and very low displacement—essentially, high-performance racers. That kind of performance can't be expected from a pure sailing ship carrying substantial cargo or armament. We could nonetheless see it in a military courier ship, or a ship which has auxiliary power.

Hull Protection

Wood was coated with various substances to ward off marine borers (which damaged the ship) and fouling organisms (which slowed it down). Fouling can double or even triple the frictional resistance of a ship. (Baker, Ship Form 30; White 449; Millar 21).

One such coating was a mixture of tallow and sulfur (sometimes also including ground glass)(BakerCV 98). If this were insufficient, the hull could be scraped or singed to remove the nautical nasties. In the late sixteenth century, Sir Richard Hawkins advocated double planking with a layer of hair and tar in-between. The teredo worm won't tunnel through tar. (Millar 21).

Lead sheathing has a confusing history. It was used on Mediterranean hulls, as early as the fourth century B.C., to make the hulls watertight, but of course also afforded some protection from marine parasites. It fell into disuse after the first century A.D. (except for patching), but it made a comeback after the Europeans had their first Close Encounter with Teredo Worms. As early as 1513, Spanish caravels plated their bottoms with one or two tons of lead. (Crisman 261; BakerCV 97). The 480-ton galleon *Santa Margarita* (lost 1622) had 325 square meters of lead sheathing, less than 1 mm thick, yet weighing 4706 pounds (Malcolm).

Hawkins didn't think much of the idea; the lead was heavy, costly and easily damaged (especially if the ship got grounded). Nonetheless, the British used it on some warships in the mid-seventeenth century. Milled sheet lead, which was thinner and thus lighter than the earlier plates, was patented in 1670. Unfortunately, it was soft, and also tended to cause corrosion of the rudder irons. (GlobalSecurity)

Nonetheless, British use continued for another century.

Another concept was sacrificial planking, that is, put a cheap wood over the good wood; Hawkins liked to put elm over tarred oak. The Dutch East Indiaman *Mauritius* (1601-9) went to the extreme of having sacrificial pine over lead, but that was to protect the lead from rocks. While sacrificial wood conserves the structural strength of the hull, the hull surface still gets fouled.

Copper sheathing was introduced in the 1760s and was initially disastrous (the iron parts, such as rudder hinges, disintegrated)(Millar 21; ChapelleSSUS 207ff). By the 1770s, the problem had been solved; bronze or copper fastenings were used. (Dodds 18). Copper sheathing was used in thicknesses which weighed 22-32 ounces per square foot, depending on the ship and the location. *HMS Victory* had 3500 4' x 14" sheets, weighing almost 13 tons. (Callcut) .

Cost was also an issue, at least until after the War of 1812. (ChapelleSSUS 277).

The cost of sheathing the 1890 *Edgar* , 7350 tons displacement, was 17,000£ (Atwood, Warships 145).

The development of copper sheathing encouraged the use of detailed plans, so that the cost of sheathing could be estimated accurately. (ChapelleHASN 21).

De Roche's *Moonraker* (Karen Bergstralh's story, *Grantville Gazette* , Volume 9), is copper clad. The timing is a bit vague; Karen told me to assume 1634-35. In 163x OTL, the price of copper in Amsterdam was 60 guilders per 100 pounds (Posthumus).

Copper is gradually corroded by seawater (Brigadier 12). Cathodic protection (that is, the sacrificial use of a more active and hopefully cheaper metal) was introduced in the early nineteenth century . . . tin, iron and zinc were used to protect copper. (Morgan). Zinc was also used as a sheathing in its own right, but it was even more vulnerable than copper.

Naturally, copper or zinc sheathing can't be used directly with an iron hull (or for that matter with iron nails and fittings), because there would be an electrochemical reaction between them, mediated by the salt water. One trick used in the British navy after 1887 was to use an inner sheathing of teak and an outer one of copper. (Atwood, Warships 143). There was even experimentation with rubber sheathing (Hebert).

Sheathing didn't merely protect the hull from fouling organisms, it also could increase smoothness and thus lower resistance. However, copper-sheathed hulls weren't as smooth as you might expect; "the plates were laid over tarred felt and the fastening nails dented the whole surface in a manner best described as 'quilting.'" (ChappelleSSUS 402).

Rudder and Steering

When the rudder is pivoted to one side, it creates a drag force that acts perpendicularly to the rudder surface. That drag force acts partially to slow the ship down, and also to cause the ship to turn. The ship will also heel over. (Sinisi).

Small ships were steered with a tiller, which is simply a lever connected to a pivotable rudder post, which in turn bears the rudder. The tiller was swung horizontally, clockwise or counter-clockwise. Flint, *1634: The Baltic War* , Chap. 31 comments, "Unfortunately, the length of the tiller had to be in direct proportion to the forces required to shift the rudder, and its maximum length was restricted by the width of the ship itself."

On larger, multi-decked ships, the tiller needed to be worked from above. In the seventeenth century, this was done using a rather improbable contrivance known as a whipstaff. The whipstaff was a long pole which reached down through a small slot, which acted as a pivot point, to the level of the tiller, where it fitted into a ring fastened to the end of the tiller. To turn the tiller in one direction, the helmsman had to push the upper end of the whipstaff the other way, and also push downward. (Anderson 156-7). (While Flint says the helmsman stood on the quarter-deck, Anderson said that "the helmsman was still below-deck as a general rule," just not at the tiller level.)

Flint continues, the whipstaff "provided the helmsmen with a powerful mechanical advantage, but meant that the rudder's range of movement was even more sharply restricted. As a result, a large sailing ship . . . found it impossible to apply more than five or six degrees of rudder." (Cp. Phillips-Birt 155).

Because of the limitation of the rudder angle, to make a sharp course change, the sails had to be trimmed accordingly. (Landstrom 122).

The earliest evidence of a steering wheel is in the English *Ossory* (1711). Naval historians aren't entirely sure how long the whipstaff survived after that, but there is reason to believe that it was still in use in the mid-eighteenth century (Anderson 169).

The steering wheel is connected by two opposed pulley systems to the tiller. Turn the wheel one way, and one pulley system tightens while the other slackens, moving the tiller in the appropriate direction.

In the Baltic War, Admiral Simpson insisted that all of his ships be equipped with steering wheels (actually, a more modern form than the one described above). "The use of a geared quadrant system to shift the rudder not only permitted him to build in a much greater mechanical advantage for the helmsman, but also offered a substantially greater amount of maneuverability. . . . Simpson's ships . . . could apply up to eighty degrees of rudder. . . ."

Superstructures

Sixteenth-century warships had fort-like towers, the forecastle and aftcastle, to serve much like the towers of a castle on land. They were essentially infantry platforms, which gave their inhabitants a height advantage for missile and melee combat, and also some shielding from hostile fire. The problem, of course, was that they reduced the ship's speed, weatherliness, and stability. (Although Glete 38 says that they were of rather light construction, and thus not as adverse to stability as their height suggested.)

Raleigh warned against the "high charging" of ships, which "brings them all ill quality." They were phased out over the course of the seventeenth century (ChapelleSSUS 80), but it was a halting process. There was a concern that with most of the crew below deck manning the guns, the enemy could board amidships and trap the crew. Keeping the "castles" meant that the crew would have rallying points for launching counterattacks. (GleteWS, 30). These concerns ebbed, presumably as a result of both the steady increase in firepower and the provision of fighting platforms in the masts.

The three-deck battleship *Sovereign of the Seas* (1637) was in service until 1696, but at some point the superstructure was cut down because otherwise her draft was so great that in even a light air she couldn't open the lowest leeward gunports. (Langstrom 153).

Even merchant ships had substantial superstructure. Typically, the afterbody had two levels above the main deck, the half deck and the quarterdeck. (BakerCV 29). The poop deck is part of, aft of, or above the quarter deck, depending on the period.

Monohulls vs. Multihulls

The conventional sailing ship has a single hull. However, multihulls—two or more hulls joined together by a deck or struts—can be found in the seventeenth century in both the Indian Ocean and the South Pacific. The *catamaran* has two hulls, and the *trimaran* has three.

European experiments with catamaran designs date back at least to 1662.

According to canon (*1633*, Chap. 4), the timberclads used in the Baltic War campaign are catamarans, with paddle wheels positioned in-between their hulls. While these were steamships, their success will give the catamaran design a certain degree of credibility that it would not have possessed previously.

I intend to discuss the advantages and disadvantages of multihulls, and the problems peculiar to multihulls in a later article.

Shipbuilding

Plans. The first known printed plans for ships appeared in *Instrucion Nautica*(1587)(BakerSS 8). In 1650, the British Admiralty began requiring the preservation of warship plans but it took until 1675 to achieve compliance (ChapelleHASS 17). Plans weren't used in merchant shipbuilding until the mid-nineteenth century (McGee).

If you "take off the lines" of a ship (usually a captured vessel whose sailing performance impressed you), it means you reverse-engineer a plan for it. This required a specially-fitted dry dock (ChapelleSSUS 38).

Models. The English shipwright Pett is known to have made ship models as early as 1596. Ship models could be made, before the ship was built, for a variety of purposes—to please a customer (a model of the Prince Royal was given to Prince Henry in 1607), to persuade an prospective customer to approve the construction, as a teaching tool for apprentice shipwrights, or as a guide to the actual construction. . Reading multiview ship plans is something of an art, and the models no doubt had a more visceral impact

on laymen.

In Britain, the Lords of the Admiralty were aristocrats and civil servants, not shipwrights, and they couldn't read plans. Hence, they demanded models, as well as plans, before engaging a contractor, and Admiralty models from the 1650s have survived. Their standard scale is 1:48, and they show the hull in detail. Decks were sometimes omitted so that the deck beams could be seen. (Anderson 145, 159; King 113; Davis 17; Grimwood 20). The lift model (layers of wood, held together by dowels, showing successive waterlines) appeared at the end of the eighteenth century. (Edwin 266; ChapelleSSUS 150ff).

Lofting. In the mold loft, thin pieces of wood were laid down to show, full size, the curve of the principal pieces of the hull. The purpose of this was to facilitate selection of which timbers to use where, and to guide the cutting of those timbers. Lofting is described in Fernandez' *Livro de traças de carpinataria* (1616)(Schwarz) and Sutherland's *Shipbuilder's Assistant* (1711)(OED), and I suspect lofting predates the use of formal plans.

Cost and Time. The shipyard you pick makes a big difference. In 1669, Dutch cargo ships cost 40% less than English. (Unger 125). By building its own ships at Deptford, the East India Company reduced its costs in 1607 from £45 to £10/ton. (Gardner 29).

The Transportation Costs Addendum (1632.org) provides costs/ton for ships of various periods. In 163x, a 40-gun warship might cost 6000 pounds (Langstrom 149).

Ridler (62) suggests that for mid-nineteenth century warships, the number of man-days work required to build it and equip it for sea can be estimated by the formula 0.4*B3*L/100, and the cost in dollars by multiplying the number of days by four. The cost breakdown, he says, is 72% hull, 5.4% spars, 4.6% sails, 4.8% rigging, 2.5% boats, 3.5% gun carriages, 0.5% outfits and sea stores, and 2.2% furniture. But Laing (54) says that as you increase the length/breadth ratio, while keeping capacity constant, the cost of construction increases.

Revenue. A merchant ship might reasonably hope to recover its cost in two trading voyages (Millar 3). Long-distance traders of course would need to carry more valuable cargoes for this to be the case.

Lifespan. Rot was the main enemy of the wooden ship, but of course navigational hazards, storms and hostile vessels also took their toll. On the Lisbon-Goa route, about one-sixth of the ships were lost, in either passage (Brigadier 14). The typical lifespan for a merchantman was 5-20 years, but some ships were flimsily built in the expectation that they would be used for just a few high profit, high risk voyages. Warships had a longer life, but required expensive rebuilds (at least half the original cost) every decade or so. (ChappelleHASN 47).

Up-Time Knowledge

In terms of books, the public and school libraries don't have much (see Addendum). But the "Four Musketeers," the teenage wargamers, were able to assemble "two tall piles" of books on naval history. In particular, we know Eddie Cantrell has "Chapelle's books on American sailing ship designs." And that "Chapelle's books had been pounced upon by the Swedish shipwrights as if Eddie had been Galahad, returning to King Arthur with Holy Grail in hand," and used to design a new sloop-of-war (*1633*, Chaps. 4, 28). EB11 "Shipbuilding" describes basic stability calculations.

Practical knowledge is important, but hard to find in a town that is over two hundred miles from the nearest ocean. Fortunately, we have John Chandler Simpson, a Naval Academy graduate with a bachelor's degree in engineering, and combat experience in Vietnam. Who was able to look at Eddie's plans for a riverine ironclad, and immediately realize that the displacement estimate was way too low, and that the ship would have twice the draft Eddie hoped for. (Weber, "In the Navy," *Ring of Fire*).

We also have Jack Clements, a retired Coast Guard boat pilot) who owns a large power boat (Century 3200), and Louie Tillman, a thirty year Navy veteran with another (Cris Craft). (*1633*, Chap. 35). Then there's Ernie Trelli, who served with the Navy in the Gulf War (Grid), but hasn't yet appeared in a story.

While there aren't many "old salts" in Grantville, the new USE navy is going to need physicists, engineers and mathematicians to reconstruct the sciences of aerodynamics and hydrodynamics, and to modernize construction methods and materials, and there at least we have a respectable pool of talent.

Experimentation

Even if some engineers or physicists have basic texts on aerodynamics and hydrodynamics, there are going to be a lot of gaps in their knowledge. Those gaps will need to be filled by experimentation, at first with models and then with full-scale ships.

Early hydrodynamic experiments included towing wooden blocks (Christian Huygens and collaborators, 1668), simple geometric solids (Samuel Fortrey, 1675; Fredrik Chapman, 1775, 1794), planks cut to the waterlines of actual ships (Henry Sheeres and Anthony Dean, 1685; Pieter van Zwijndregt, 1750s), models constructed by joining circular sections to facilitate changes in shape (Bird, 1750s), and finally three-dimensional ship models (William Shipley, 1758-63).

There were several pitfalls. The first was ensuring that the models were towed at a constant speed, and accurately timing their performance. Another problem was avoiding blockage. Finally, for ship model studies to bear any relevance to the real world, they must be scaled properly. Usually, the scaling is chosen so the model accurately duplicates real-world wavemaking resistance, and the frictional resistances for ship versus model are determined by calculation.

In the 1820s, the British went so far as to invite competitive designs and assemble the resulting full-scale ships into experimental squadrons which underwent sailing trials. However, the competition rules didn't prohibit "tuning-up," and that limited what could be learned. (ChapelleHASN 369).

PART III: IMPACT OF THE RING OF FIRE

The impact of the Ring of Fire will depend on what the down-timers and up-timers know, the advantages potentially conveyed by the up-time innovations they can reconstruct, and the ability (and willingness) of the down-timers to implement those concepts.

Classification of Up-Time Innovations

The possible up-time innovations fall into three categories. First, there are the ideas which can be implemented as soon as you convince the down-timers that they are worth putting into practice. These

include (but won't all be implemented on the same ship!):

—increasing waterline length (to limits imposed by wood construction)
—reduced superstructures
—stability calculations
—steering wheels
—additional and stronger bulkheads
—diagonal and longitudinal stiffeners
—accelerated use of teak, mahogany, etc.
—steam bending of timber
—multihulls
—copper or zinc sheathing of hulls
—centerboards (drop or pivot)
—fin keels
—better ballasting (external lead; water tank)
—bulbous bows (with hybrid propulsion)

In the second category we have ideas which require a cheaper or more abundant supply of some raw material (e.g., steel) before you can carry them forward, but which are nonetheless consistent with nineteenth century practice:

—wrought iron or steel framing
—steam winches
—forced ventilation of wooden hulls

When the infrastructure catches up to the OTL twentieth century, we may additionally see

—fiberglass hulls (for small ships)
—hydrofoils (with hybrid propulsion)

Change is not going to come easily. In *1634: The Baltic War* , Chap. 31, Admiral Simpson muses about how "it had taken his seventeenth-century officers a while to make [the] mental adjustment [to the increased maneuverability provided by the steering wheel], and then to make the necessary counter-adjustment and learn to respect the limitations that still existed." Significantly, he likened the "counter-adjustment" to riding with Hans Richter when he was first learning how to drive a car.

There are going to be a lot of Richter-style adjustments to the new sailing ship technology.

Conclusion

Our new ship is ready for its maiden voyage. Perhaps it has made subtle use of up-time ideas, which landlubbers might overlook—reefed topsails or internal bulwarks or copper sheathing. Or perhaps it is truly exotic, such as a catamaran with junk sails and gun turrets. Either way, the shipyard has decided to launch it in accordance with down-time tradition.

The ship's sponsor will toast the ship from a gilt cup, spill a little wine on the deck as he names it, and then heave the cup into the water. Some hardy swimmer will dive in after it and sell it back to the master shipwright. (BakerNM 126-8).

In the crowd, there will no doubt be some old salts muttering that the new ship is the work of madmen and will be lucky to make it out of the harbor.

The master shipwright will signal his men, and, chanting, the shipwrights will drive in wedges to push the ship off the keel blocks and onto the launching way. Once it is secure, the blocks will be knocked away, and the gate opened. The new vessel will slide down, and splash into the water.

Godspeed.

* * *

Effects of Selected Design Parameters		
Increasing	Beneficial Effect	Harmful Effect
Length(L)	Capacity, # Gunports	Weight, Hull Strength, Weatherliness, Turning Ability, Construction Cost
. . Waterline(LWL)	Wavemaking Resistance, Initial Pitch Stability, Weatherliness	Frictional Resistance
Breadth(B)	Capacity, Hull Strength	Weight, Construction Cost
. . Waterline (BWL)	Initial Roll Stability	Resistance
Depth(D)	Capacity, Hull Strength, Freeboard, Ballast Efficiency, # Gundecks	Weight, Freeboard, Form Resistance, Construction Cost
Freeboard	Ultimate Roll Stability, Gun Height	Weatherliness
Weight	(Guns/Cargo/Crew)	Draft, Hull Strain, Acceleration
Draft (H)	Weatherliness	Stability, Form Resistance, Shoal Navigation
Fineness of Ends	Form Resistance	Capacity, Local Buoyancy (Hogging), Stability
Ballast	Stability	Weight (harmful only)

THE END