EXCERPT FROM CRYPTONOMICON

PROLOGUE

Two tires fly. Two wail.

A bamboo grove, all chopped down

From it, warring songs

....IS THE BEST THAT CORPORAL BOBBY SHAFTOE CAN DO ON short notice--he's standing on the running board, gripping his Springfield with one hand and the rearview mirror with the other, so counting the syllables on his fingers is out of the question. Is ``tires'' one syllable or two? How about ``wail?'' The truck finally makes up its mind not to tip over, and thuds back onto four wheels. The wail--and the moment--are lost. Bobby can still hear the coolies singing, though, and now too there's the gunlike snicking of the truck's clutch linkage as Private Wiley downshifts. Could Wiley be losing his nerve? And, in the back, under the tarps, a ton and a half of file cabinets clanking, code books slaloming, fuel spanking the tanks of Station Alpha's electrical generator. The modern world's hell on haiku writers: ``Electrical generator'' is, what, eight syllables? You couldn't even fit that onto the second line!

"Are we allowed to run over people?'' Private Wiley inquires, and then mashes the horn button before Bobby Shaftoe can answer. A Sikh policeman hurdles a night soil cart. Shaftoe's gut reaction is: Sure, what're they going to do, declare war on us? but as the highest-ranking man on this truck he's probably supposed to be using his head or something, so he doesn't blurt it out just yet. He takes stock of the situation:

Shanghai, 1645 hours, Friday, the 28th of November 1941. Bobby Shaftoe, and the other half-dozen Marines on his truck, are staring down the length of Kiukiang Road, onto which they've just made this careening high-speed turn. Cathedral's going by to the right, so that means they are, what? two blocks away from the Bund. A Yangtze River Patrol gunboat is tied up there, waiting for the stuff they've got in the back of this truck. The only real problem is that those particular two blocks are inhabited by about five million Chinese people.

Now these Chinese are sophisticated urbanites, not suntanned yokels who've never seen cars before--they'll get out of your way if you drive fast and honk your horn. And indeed many of them flee to one side of the street or the other, producing the illusion that the truck its moving faster than the forty-three miles an hour shown on its speedometer.

But the bamboo grove in Bobby Shaftoe's haiku has not been added just

to put a little Oriental flavor into the poem and wow the folks back home in Oconomowoc. There is a lot of heavy bamboo in front of this truck, dozens of makeshift turnpikes blocking their path to the river, for the officers of the U.S. Navy's Asiatic Fleet, and of the Fourth Marines, who dreamed up this little operation forgot to take the Friday Afternoon factor into account. As Bobby Shaftoe could've explained to them, if only they'd bothered to ask a poor dumb jarhead, their route took them through the heart of the banking district. Here you've got the Hong Kong and Shanghai Bank of course, City Bank, Chase Manhattan, the Bank of America, and BBME and the Agricultural Bank of China and any number of crappy little provincial banks, and several of those banks have contracts with what's left of the Chinese Government to print currency. It must be a cutthroat business because they slash costs by printing it on old newspapers, and if you know how to read Chinese, you can see last year's news stories and polo scores peeking through the colored numbers and pictures that transform these pieces of paper into legal tender.

As every chicken-peddler and rickshaw operator in Shanghai knows, the money-printing contracts stipulate that all of the bills these banks print have to be backed by such-and-such an amount of silver; i.e., anyone should be able to walk into one of those banks at the end of Kiukiang Road and slap down a pile of bills and (provided that those bills were printed by that same bank) receive actual metallic silver in exchange.

Now if China weren't right in the middle of getting systematically drawn and quartered by the Empire of Nippon, it would probably send official bean counters around to keep tabs on how much silver was actually present in these banks' vaults, and it would all be quiet and orderly. But as it stands, the only thing keeping these banks honest is the other banks.

Here's how they do it: during the normal course of business, lots of paper money will pass over the counters of (say) Chase Manhattan Bank. They'll take it into a back room and sort it, throwing into money boxes (a couple of feet square and a yard deep, with ropes on the four corners) all of the bills that were printed by (say) Bank of America in one, all of the City Bank bills into another. Then, on Friday afternoon they will bring in coolies. Each coolie, or pair of coolies, will of course have his great big long bamboo pole with him--a coolie without his pole is like a China Marine without his nickel-plated bayonet--and will poke their pole through the ropes on the corners of the box. Then one coolie will get underneath each end of the pole, hoisting the box into the air. They have to move in unison or else the box begins flailing around and everything gets out of whack. So as they head towards their destination--whatever bank whose name is printed on the bills in their box--they sing to each other, and plant their feet on the pavement in time to the music. The pole's pretty long, so they are that far apart, and they have to sing loud to hear each other, and of course each pair of coolies in the street is singing their own particular song, trying to drown out all of the others so that they don't get out of step.

So ten minutes before closing time on Friday afternoon, the doors of many banks burst open and numerous pairs of coolies march in singing, like the curtain-raiser on a fucking Broadway musical, slam their huge boxes of tattered currency down, and demand silver in exchange. All of the banks do this to each other. Sometimes, they'll all do it on the same Friday, particularly at times like 28 November 1941, when even a grunt like Bobby Shaftoe can understand that it's better to be holding silver than piles of old cut-up newspaper. And that is why, once the normal

pedestrians and food-cart operators and furious Sikh cops have scurried out of the way, and plastered themselves up against the clubs and shops and bordellos on Kiukiang Road, Bobby Shaftoe and the other Marines on the truck still cannot even see the gunboat that is their destination, because of this horizontal forest of mighty bamboo poles. They cannot even hear the honking of their own truck horn because of the wild throbbing pentatonic cacophony of coolies singing. This ain't just your regular Friday P.M. Shanghai bank-district money-rush. This is an ultimate settling of accounts before the whole Eastern Hemisphere catches fire. The millions of promises printed on those slips of bumwad will all be kept or broken in the next ten minutes; actual pieces of silver and gold will move, or they won't. It is some kind of fiduciary Judgment Day.

``Jesus Christ, I can't--'' Private Wiley hollers.

"The captain said don't stop for any reason whatsofuckinever,'' Shaftoe reminds him. He's not telling Wiley to run over the coolies, he's reminding Wiley that if he refrains from running over them, they will have some explaining to do--which will be complicated by the fact that the captain's right behind them in a car stuffed with Tommy Gun-toting China Marines. And from the way the captain's been acting about this Station Alpha thing, it's pretty clear that he already has a few preliminary strap marks on his ass, courtesy of some admiral in Pearl Harbor or even (drumroll) Marine Barracks, Eight and Eye Streets Southeast, Washington, D.C.

Shaftoe and the other Marines have always known Station Alpha as a mysterious claque of pencil-necked swabbies who hung out on the roof of a building in the International Settlement in a shack of knot-pocked cargo pallet planks with antennas sticking out of it every which way. If you stood there long enough you could see some of those antennas moving, zeroing in on something out to sea. Shaftoe even wrote a haiku about it:

Antenna searches

Retriever's nose in the wind

Ether's far secrets

This was only his second haiku ever--clearly not up to November 1941 standards--and he cringes to remember it.

But in no way did any of the Marines comprehend what a big deal Station Alpha was until today. Their job had turned out to involve wrapping a ton of equipment and several tons of paper in tarps and moving it out of doors. Then they spent Thursday tearing the shack apart, making it into a bonfire, and burning certain books and papers.

``Sheeeyit!'' Private Wiley hollers. Only a few of the coolies have gotten out of the way, or even seen them. But then there is this fantastic boom from the river, like the sound of a mile-thick bamboo pole being snapped over God's knee. Half a second later there're no coolies in the street anymore--just a lot of boxes with unmanned bamboo poles teeter-tottering on them, bonging into the streets like wind-chimes.

Above, a furry mushroom of grey smoke rises from the gunboat. Wiley shifts up to high gear and floors it. Shaftoe cringes against the truck's door and lowers his head, hoping that his campy Great War doughboy helmet will be good for something. Then money-boxes start to rupture and explode as the truck rams through them. Shaftoe peers up through a blizzard of notes and sees giant bamboo poles soaring and bounding and windmilling toward the waterfront.

The leaves of Shanghai:

Pale doorways in a steel sky.

Winter has begun.

BARRENS

Let's set the existence-of-god issue aside for a later volume, and just stipulate that in some way, self-replicating organisms came into existence on this planet and immediately began trying to get rid of each other, either by spamming their environments with rough copies of themselves, or by more direct means which hardly need to be belabored. Most of them failed, and their genetic legacy was erased from the universe forever, but a few found some way to survive and to propagate. After about three billion years of this sometimes zany, frequently tedious fugue of carnality and carnage, Godfrey Waterhouse IV was born, in Murdo, South Dakota, to Blanche, the wife of a Congregational preacher named Bunyan Waterhouse. Like every other creature on the face of the earth, Godfrey was, by birthright, a stupendous badass, albeit in the somewhat narrow technical sense that he could trace his ancestry back up a long line of slightly less highly evolved stupendous badasses to that first self-replicating gizmo--which, given the number and variety of its descendants, might justifiably be described as the most stupendous badass of all time. Everyone and everything that wasn't a stupendous badass was dead.

As nightmarishly lethal, memetically programmed death-machines went, these were the nicest you could ever hope to meet. In the tradition of his namesake (the Puritan writer John Bunyan, who spent much of his life in jail, or trying to avoid it) the Rev. Waterhouse did not preach in any one place for long. The church moved him from one small town in the Dakotas to another every year or two. It is possible that Godfrey found the lifestyle more than a little alienating, for, sometime during the course of his studies at Fargo Congregational College, he bolted from the fold and, to the enduring agony of his parents, fell into worldy pursuits, and ended up, somehow, getting a Ph.D. in Classics from a small private university in Ohio. Academics being no less nomadic than Congregational preachers, he took work where he could find it. He became a Professor of Greek and Latin at Bolger Christian College (enrollment 322) in West Point, Virginia, where the Mattaponi and Pamunkey Rivers came together to form the estuarial James, and the loathsome fumes of the big paper mill permeated every drawer, every closet, even the interior pages of books. Godfrey's young bride, nee Alice Pritchard, who had grown up following her itinerant-preacher father across the vastnesses of eastern Montana--where air smelt of

snow and sage--threw up for three months. Six months later she gave birth to Lawrence Pritchard Waterhouse.

The boy had a peculiar relationship with sound. When a fire engine passed, he was not troubled by the siren's howl or the bell's clang. But when a hornet got into the house and swung across the ceiling in a broad Lissajous, droning almost inaudibly, he cried in pain at the noise. And if he saw or smelled something that scared him, he would clap his hands over his ears.

One noise that troubled him not at all was the pipe organ in the chapel at Bolger Christian College. The chapel itself was nothing worth mentioning, but the organ had been endowed by the paper mill family and would have sufficed for a church four times the size. It nicely complemented the organist, a retired high school math teacher who felt that certain attributes of the Lord (violence and capriciousness in the Old Testament, majesty and triumph in the New) could be directly conveyed into the souls of the enpewed sinners through a kind of frontal sonic impregnation. That he ran the risk of blowing out the stained-glass windows was of no consequence since no one liked them anyway, and the paper mill fumes were gnawing at the interstitial lead. But after one little old lady too many staggered down the aisle after a service, reeling from tinnitus, and made a barbed comment to the minister about the exceedingly dramatic music, the organist was replaced.

Nevertheless, he continued to give lessons on the instrument. Students were not allowed to touch the organ until they were proficient at the piano, and when this was explained to Lawrence Pritchard Waterhouse, he taught himself, in three weeks, how to play a Bach fugue, and signed up for organ lessons. Since he was only five years old at the time, he was unable to reach both the manuals and the pedals, and had to play standing--or rather strolling, from pedal to pedal.

When Lawrence was twelve, the organ broke down. That paper mill family had not left any endowment for maintenance, so the math teacher decided to have a crack at it. He was in poor health and required a nimble assistant: Lawrence, who helped him open up the hood of the thing. For the first time in all those years, the boy saw what had been happening when he had been pressing those keys.

For each stop--each timbre, or type of sound, that the organ could make (viz. blockflote, trumpet, piccolo)--there was a separate row of pipes, arranged in a line from long to short. Long pipes made low notes, short high. The tops of the pipes defined a graph: not a straight line but an upward-tending curve. The organist/math teacher sat down with a few loose pipes, a pencil, and paper, and helped Lawrence figure out why. When Lawrence understood, it was as if the math teacher had suddenly played the good part of Bach's Fantasia and Fugue in G Minor on a pipe organ the size of the Spiral Nebula in Andromeda--the part where Uncle Johann dissects the architecture of the Universe in one merciless descending ever-mutating chord, as if his foot is thrusting through skidding layers of garbage until it finally strikes bedrock. In particular, the final steps of the organist's explanation were like a falcon's dive through layer after layer of pretense and illusion, thrilling or sickening or confusing depending on what you were. The heavens were riven open.

Lawrence glimpsed choirs of angels ranking off into geometrical infinity.

The pipes sprouted in parallel ranks from a broad flat box of compressed air. All of the pipes for a given note--but belonging to different stops--lined up with each other along one axis. All of the pipes for a given stop--but tuned at different pitches--lined up with each other along the other, perpendicular axis. Down there in the flat box of air, then, was a mechanism that got air to the right pipes at the right times. When a key or pedal was depressed, all of the pipes capable of sounding the corresponding note would speak, as long as their stops were pulled out.

Mechanically, all of this was handled in a fashion that was perfectly clear, simple, and logical. Lawrence had supposed that the machine must be at least as complicated as the most intricate fugue that could be played on it. Now he had learned that a machine, simple in its design, could produce results of infinite complexity.

Stops were rarely used alone. They tended to be piled on top of each other in combinations that were designed to take advantage of the available harmonics (more tasty mathematics here!). Certain combinations in particular were used over and over again. Lots of blockflo[autes, in varying lengths, for the quiet Offertory, for example. The organ included an ingenious mechanism called the preset, which enabled the organist to select a particular combination of stops--stops he himself had chosen--instantly. He would punch a button and several stops would bolt out from the console, driven by pneumatic pressure, and in that instant the organ would become a different instrument with entirely new timbres.

The next summer both Lawrence and Alice, his mother, were colonized by a distant cousin--a stupendous badass of a virus. Lawrence escaped from it with an almost imperceptible tendency to drag one of his feet. Alice wound up in an iron lung. Later, unable to cough effectively, she got pneumonia and died.

Lawrence's father Godfrey freely confessed that he was not equal to the burdens now laid on his shoulders. He resigned from his position at the small college in Virginia and moved, with his son, to a small house in Moorhead, Minnesota, next door to where Bunyan and Blanche had settled. Later he got a job teaching at a nearby normal school.

At this point, all of the responsible adults in Lawrence's life seemed to arrive at a tacit agreement that the best way to raise him--certainly the easiest--was to leave him alone. On the rare occasions when Lawrence requested adult intervention in his life, he was usually asking questions that no one could answer. At the age of sixteen, having found nothing in the local school system to challenge him, Lawrence Pritchard Waterhouse went off to college. He matriculated at Iowa State College, which among other things was the site of a Naval ROTC installation in which he was forcibly enrolled.

The Iowa State Naval ROTC had a band, and was delighted to hear that Lawrence had an interest in music. Since it was hard to drill on the deck of a dreadnought while playing a pipe organ, they issued him a glockenspiel and a couple of little dingers.

When not marching back and forth on the flood plain of the Skunk River

making loud dinging noises, Lawrence was majoring in mechanical engineering. He ended up doing poorly in this area because he had fallen in with a Bulgarian professor named John Vincent Atanasoff and his graduate student, Clifford Berry, who were building a machine that was intended to automate the solution of some especially tedious differential equations.

The basic problem for Lawrence was that he was lazy. He had figured out that everything was much simpler if, like Superman with his X-ray vision, you just stared through the cosmetic distractions and saw the underlying mathematical skeleton. Once you found the math in a thing, you knew everything about it, and you could manipulate it to your heart's content with nothing more than a pencil and a napkin. He saw it in the curve of the silver bars on his glockenspiel, saw it in the catenary arch of a bridge and in the capacitor-studded drum of Atanasoff and Berry's computing machine. Actually pounding on the glockenspiel, riveting the bridge together, or trying to figure out why the computing machine wasn't working were not as interesting to him.

Consequently he got poor grades. From time to time, though, he would perform some stunt on the blackboard that would leave his professor weak in the knees and the other students baffled and hostile. Word got around.

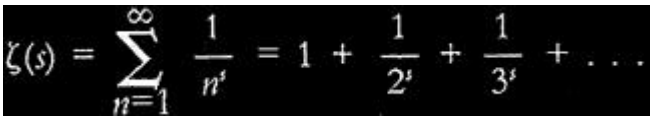
At the same time, his grandmother Blanche was invoking her extensive Congregational connections, working the angles on Lawrence's behalf, totally unbeknownst to him. Her efforts culminated in triumph when Lawrence was awarded an obscure scholarship, endowed by a St. Paul oat-processing heir, whose purpose was to send Midwestern Congregationalists to the Ivy League for one year, which (evidently) was deemed a long enough period of time to raise their IQs by a few crucial points but not long enough to debauch them. So Lawrence got to be a sophomore in Princeton.

Now Princeton was an august school and going there was a great honor, but no one got around to mentioning either of these facts to Lawrence, who had no way of knowing. This had bad and good consequences. He accepted the scholarship with a faintness of gratitude that infuriated the oat lord. On the other hand, he adjusted to Princeton easily because it was just another place. It reminded him of the nicer bits of Virginia, and there were some nice pipe organs in town, though he was not all that happy with his engineering homework of bridge-designing and sprocket-cutting problems. As always, these eventually came down to math, most of which he could handle easily. From time to time he would get stuck, though, which led him to the Fine Hall: the headquarters of the Math Department.

There was a motley assortment of fellows wandering around in Fine Hall, many sporting British or European accents. Administratively speaking, many of these fellows were not members of the Math Department at all, but a separate thing called IAS, which stood for Institute for Advanced something-or-other. But they were all in the same building and they all knew a thing or two about math, so the distinction didn't exist for Lawrence.

Quite a few of these men would pretend shyness when Lawrence sought their advice, but others were at least willing to hear him out. For example: he had come up with a way to solve a difficult sprocket tooth shape problem that, as normally solved by engineers, would require any

number of perfectly reasonable but aesthetically displeasing approximations. Lawrence's solution would provide exact results. The only drawback was that it would require a quintillion slide-rule operators a quintillion years to solve. Lawrence was working on a radically different approach that, if it worked, would bring those figures down to a trillion and a trillion respectively. Unfortunately, Lawrence was unable to interest anyone at Fine Hall in anything as prosaic as gears, until all of a sudden he made friends with an energetic British fellow, whose name he promptly forgot, but who had been doing a lot of literal sprocket-making himself lately. This fellow was trying to build, of all things, a mechanical calculating machine--specifically a machine to calculate certain values of the Riemann Zeta Function.



where s is a complex number.

Lawrence found this zeta function to be no more and no less interesting than any other math problem until his new friend assured him that it was frightfully important, and that some of the best mathematicians in the world had been gnawing on it for decades. The two of them ended up staying awake until three in the morning working out the solution to Lawrence's sprocket problem. Lawrence presented the results proudly to his engineering professor, who snidely rejected it, on grounds of practicality, and gave him a poor grade for his troubles.

Lawrence finally remembered, after several more contacts, that the name of the friendly Brit was Al something-or-other. Because Al was a passionate cyclist, he and Al went on quite a few bicycle rides through the countryside of the Garden State. As they rode around New Jersey, they talked about math, and particularly about machines for taking the dull part of math off their hands.

But Al had been thinking about this subject for longer than Lawrence, and had figured out that computing machines were much more than just labor-saving devices. He'd been working on a radically different sort of computing mechanism that would work out any arithmetic problem whatsoever, as long as you knew how to write the problem down. From a pure logic standpoint, he had already figured out everything there was to know about this (as yet hypothetical) machine, though he had yet to build one. Lawrence gathered that actually building machinery was looked on as undignified at Cambridge (England, that is, where this Al character was based) or for that matter at Fine Hall. Al was thrilled to have found, in Lawrence, someone who did not share this view.

Al delicately asked him, one day, if Lawrence would terribly mind calling him by his full and proper name, which was Alan and not Al. Lawrence apologized and said he would try very hard to keep it in mind.

One day a couple of weeks later, as the two of them sat by a running

stream in the woods above the Delaware Water Gap, Alan made some kind of an outlandish proposal to Lawrence involving penises. It required a great deal of methodical explanation, which Alan delivered with lots of blushing and stuttering. He was ever so polite, and several times emphasized that he was acutely aware that not everyone in the world was interested in this sort of thing.

Lawrence decided that he was probably one of those people.

Alan seemed vastly impressed that Lawrence had paused to think about it at all and apologized for putting him out. They went directly back to a discussion of computing machines, and their friendship continued unchanged. But on their next bicycle ride--an overnight camping trip to the Pine Barrens--they were joined by a new fellow, a German named Rudy von something-or-other.

Alan and Rudy's relationship seemed closer, or at least more multilayered, than Alan and Lawrence's. Lawrence concluded that Alan's penis scheme must have finally found a taker.

It got Lawrence to thinking. From an evolution standpoint, what was the point of having people around who were not inclined to have offspring? There must be some good, and fairly subtle, reason for it.

The only thing he could work out was that it was groups of people--societies--rather than individual creatures, who were now trying to out-reproduce and/or kill each other, and that, in a society, there was plenty of room for someone who didn't have kids as long as he was up to something useful.

Alan and Rudy and Lawrence rode south, anyway, looking for the Pine Barrens. After a while the towns became very far apart, and the horse farms gave way to a low stubble of feeble, spiny trees that appeared to extend all the way to Florida--blocking their view, but not the headwind. ``Where are the Pine Barrens I wonder?'' Lawrence asked a couple of times. He even stopped at a gas station to ask someone that question. His companions began to make fun of him.

``Vere are ze Pine Barrens?'' Rudy inquired, looking about quizzically.

``I should look for something rather barren-looking, with numerous pine trees,'' Alan mused.

There was no other traffic and so they had spread out across the road to pedal three abreast, with Alan in the middle.

``A forest, as Kafka would imagine it,'' Rudy muttered.

By this point Lawrence had figured out that they were, in fact, in the Pine Barrens. But he didn't know who Kafka was. ``A mathematician?'' he guessed.

``Zat is a scary sing to sink of,'' Rudy said.

``He is a writer,'' Alan said. ``Lawrence, please don't be offended that I ask you this, but: do you recognize any other people's names at all? Other than family and close friends, I mean.''

Lawrence must have looked baffled. ``I'm trying to figure out whether it all comes from in here,'' Alan said, reaching out to rap his knuckles on the side of Lawrence's head, ``or do you sometimes take in new ideas from other human beings?''

``When I was a little boy, I saw angels in a church in Virginia,'' Lawrence said, ``but I think that they came from inside my head.''

``Very well,'' Alan said.

But later Alan had another go at it. They had reached the fire lookout tower and it had been a thunderous disappointment: just an alienated staircase leading nowhere, and a small cleared area below that was glittery with shards of liquor bottles. They pitched their tent by the side of a pond that turned out to be full of rust-colored algae that stuck to the hairs on their bodies. Then there was nothing left to do but drink schnapps and talk about math.

Alan said, ``Look, it's like this: Bertrand Russell and another chap named Whitehead wrote Principia Mathematica...''

``Now I know you're pulling my leg,'' Waterhouse said. ``Even I know that Sir Isaac Newton wrote that.''

``Newton wrote a different book, also called Principia Mathematica, which isn't really about mathematics at all; it's about what we would today call physics.''

``Then why did he call it Principia Mathematica?''

``Because the distinction between mathematics and physics wasn't especially clear in Newton's day--''

``Or maybe even in zis day,'' Rudy said.

``--which is directly relevant to what I'm talking about,'' Alan continued. ``I am talking about Russell's P.M., in which he and Whitehead started absolutely from scratch, I mean from nothing, and built it all up--all mathematics--from a small number of first principles. And why I am telling you this, Lawrence, is that--Lawrence! Pay attention!''

``Hmmm?''

``Rudy--take this stick, here--that's right--and keep a close eye on Lawrence, and when he gets that foggy look on his face, poke him with it!''

``Zis is not an English school, you can't do zese kind of sing.''

``I'm listening,'' Lawrence said.

``What came out of P.M., which was terrifically radical, was the ability to say that all of math, really, can be expressed as a certain ordering of symbols.''

``Leibniz said it a long time before zen!'' protested Rudy.

``Er, Leibniz invented the notation we use for calculus, but--''

``I'm not talking about zat!''

``And he invented matrices, but--''

``I'm not talking about zat eezer!''

``And he did some work with binary arithmetic, but--''

``Zat is completely different!''

``Well, what the hell are you talking about, then, Rudy?''

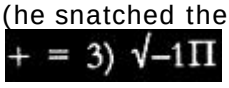
``Leibniz invented ze basic alphabet--wrote down a set of symbols, for expressing statements about logic.''

``Well, I wasn't aware that Herr Leibniz counted formal logic among his interests, but--''

``Of course! He wanted to do what Russell and Whitehead did, except not just with mathematics, but with everything in ze whole world!''

``Well from the fact that you are the only man on the planet, Rudy, who seems to know about this undertaking of Leibniz's, can we assume that he failed?''

``You can assume anything that pleases your fancy, Alan,'' Rudy responded, ``but I am a mathematician and I do not assume anything.''

Alan sighed woundedly, and gave Rudy a Significant Look which Waterhouse assumed meant that there would be trouble later. ``If I may just make some headway, here,'' he said, ``all I'm really trying to get you to agree on, is that mathematics can be expressed as a series of symbols,'' (he snatched the Lawrence-poking stick and began drawing things like  the dirt) ``and frankly I could not care less whether they happen to be Leibniz's symbols, or Russell's, or the hexagrams of the I Ching....''

``Leibniz was fascinated by the I Ching!'' Rudy began.

``Shut up about Leibniz for a moment, Rudy, because look here: You--Rudy--and I are on a train, as it were, sitting in the dining car, having a nice conversation, and that train is being pulled along at a terrific clip by certain locomotives named The Bertrand Russell and Riemann and Euler and others. And our friend Lawrence is running alongside the train, trying to keep up with us--it's not that we're smarter than he is, necessarily, but that he's a farmer who didn't get a ticket. And I, Rudy, am simply reaching out through the open window here, trying to pull him onto the fucking train with us so that the three of us can have a nice little chat about mathematics without having to listen to him panting and gasping for breath the whole way.''

``All right, Alan.''

``Won't take a minute if you will just stop interrupting.''

``But there is a locomotive too named Leibniz.''

``Is it that you don't think I give enough credit to Germans? Because I am about to mention a fellow with an umlaut.''

``Oh, would it be Herr Turing?'' Rudy said slyly.

``Herr Turing comes later. I was actually thinking of Godel.''

``But he's not German! He's Austrian!''

``I'm afraid that it's all the same now, isn't it?''

``Ze Anschluss wasn't my idea, you don't have to look at me that way, I think Hitler is appalling.''

``I've heard of Godel,'' Waterhouse put in helpfully. ``But could we back up just a sec?''

``Of course Lawrence.''

``Why bother? Why did Russell do it? Was there something wrong with math? I mean, two plus two equals four, right?''

Alan picked up two bottlecaps and set them down on the ground. ``Two. One-two. Plus--'' He set down two more. ``Another two. One-two. Equals four. One-two-three-four.''

``What's so bad about that?'' Lawrence said.

``But Lawrence--when you really do math, in an abstract way, you're not counting bottlecaps, are you?''

``I'm not counting anything.''

Rudy broke the following news: ``Zat is a very modern position for you to take.''

``It is?''

Alan said, ``There was this implicit belief, for a long time, that math was a sort of physics of bottlecaps. That any mathematical operation you could do on paper, no matter how complicated, could be reduced--in theory, anyway--to messing about with actual physical counters, such as bottlecaps, in the real world.''

``But you can't have two point one bottlecaps.''

``All right, all right, say we use bottlecaps for integers, and for real numbers like two point one, we use physical measurements, like the

length of this stick.'' Alan tossed the stick down next to the bottlecaps.

``Well what about pi, then? You can't have a stick that's exactly pi inches long.''

``Pi is from geometry--ze same story,'' Rudy put in.

``Yes, it was believed that Euclid's geometry was really a kind of physics, that his lines and so on represented properties of the physical world. But--you know Einstein?''

``I'm not very good with names.''

``That white-haired chap with the big mustache?''

``Oh, yeah,'' Lawrence said dimly, ``I tried to ask him my sprocket question. He claimed he was late for an appointment or something.''

``That fellow has come up with a general relativity theory, which is sort of a practical application, not of Euclid's, but of Riemann's geometry--''

``The same Riemann of your zeta function?''

``Same Riemann, different subject. Now let's not get sidetracked here Lawrence--''

``Riemann showed you could have many many different geometries that were not the geometry of Euclid but that still made sense internally,'' Rudy explained.

``All right, so back to P.M. then,'' Lawrence said.

``Yes! Russell and Whitehead. It's like this: when mathematicians began fooling around with things like the square root of negative one, and quaternions, then they were no longer dealing with things that you could translate into sticks and bottlecaps. And yet they were still getting sound results.''

``Or at least internally consistent results,'' Rudy said.

``Okay. Meaning that math was more than a physics of bottlecaps.''

``It appeared that way, Lawrence, but this raised the question of was mathematics really true or was it just a game played with symbols? In other words--are we discovering Truth, or just wanking?''

``It has to be true because if you do physics with it, it all works out! I've heard of that general relativity thing, and I know they did experiments and figured out it was true.''

``Ze great majority of mathematics does not lend itself to experimental testing,'' Rudy said.

``The whole idea of this project is to sever the ties to physics,'' Alan said.

``And yet not to be vanking ourselves.''

``That's what P.M. was trying to do?''

``Russell and Whitehead broke all mathematical concepts down into brutally simple things like sets. From there they got to integers, and so on.''

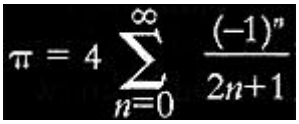
``But how can you break something like pi down into a set?''

``You can't,'' Alan said, ``but you can express it as a long string of digits. Three point one four one five nine, and so on.''

``And digits are integers,'' Rudy said.

``But no fair! Pi itself is not an integer!''

``But you can calculate the digits of pi, one at a time, by using certain formulas. And you can write down the formulas like so!'' Alan scratches this in the dirt:



``I have used the Leibniz series in order to placate our friend. See, Lawrence? It is a string of symbols.''

``Okay. I see the string of symbols,'' Lawrence said reluctantly.

``Can we move on? Godel said, just a few years ago, `Say! If you buy into this business about mathematics being just strings of symbols, guess what?' And he pointed out that any string of symbols--such as this very formula, here--can be translated into integers.''

``How?''

``Nothing fancy, Lawrence--it's just simple encryption. Arbitrary. The number `538' might be written down instead of this great ugly ?, and so on.''

``Seems pretty close to wanking, now.''

``No, no. Because then Godel sprang the trap! Formulas can act on numbers, right?''

``Sure. Like 2x.''

``Yes. You can substitute any number for x and the formula 2x will double it. But if another mathematical formula, such as this one right here, for calculating pi, can be encoded as a number, then you can have another formula act on it. Formulas acting on formulas!''

``Is that all?''

``No. Then he showed, really through a very simple argument, that if formulas really can refer to themselves, it's possible to write one down saying `this statement cannot be proved.' Which was tremendously startling to Hilbert and everyone else, who expected the opposite result.''

``Have you mentioned this Hilbert guy before?''

``No, he is new to this discussion, Lawrence.''

``Who is he?''

``A man who asks difficult questions. He asked a whole list of them once. Go[audel answered one of them.''

``And Turing answered another,'' Rudy said.

``Who's that?''

``It's me,'' Alan said. ``But Rudy's joking. `Turing' doesn't really have an umlaut in it.''

``He's going to have an umlaut in him later tonight,'' Rudy said, looking at Alan in a way that, in retrospect, years later, Lawrence would understand to have been smoldering.

``Well, don't keep me in suspense. Which one of his questions did you answer?''

``The Entscheidungsproblem,'' Rudy said.

``Meaning?''

Alan explained, ``Hilbert wanted to know whether any given statement could, in principle, be found true or false.''

``But after Godel got finished, it changed,'' Rudy pointed out.

``That's true--after Godel it became `Can we determine whether any given statement is provable or non-provable?' In other words, is there some sort of mechanical process we could use to separate the provable statements from the nonprovable ones?''

`` `Mechanical process' is supposed to be a metaphor, Alan....''

``Oh, stop it, Rudy! Lawrence and I are quite comfortable with machinery.''

``I get it,'' Lawrence said.

``What do you mean, you get it?'' Alan said.

``Your machine--not the zeta-function calculator, but the other one.

The one we've been talking about building--''

``It is called Universal Turing Machine,'' Rudy said.

``The whole point of that gizmo is to separate provable from nonprovable statements, isn't it?''

``That's why I came up with the basic idea for it,'' Alan said. ``So Hilbert's question has been answered. Now I just want to actually build one so that I can beat Rudy at chess.''

``You haven't told poor Lawrence the answer yet!'' Rudy protested.

``Lawrence can figure it out,'' Alan said. ``It'll give him something to do.''

Soon it became clear that Alan really meant: It'll give him something to do while we're fucking. Lawrence shoved a notebook into the waistband of his trousers and rode his bicycle a few hundred yards to the fire tower, then climbed up the stairs to the platform at the top and sat down, back to the setting sun, notebook propped up on his knees to catch the light.

He could not collect his thoughts, and then he was distracted by a false sunrise that lit up the clouds off to the northeast. He thought at first that some low clouds were bouncing fragments of the sunset back to him, but it was too concentrated and flickering for that. Then he thought it was lightning. But the color of the light was not blue enough. It fluctuated sharply, modulated by (one had to assume) great, startling events that were occulted by the horizon. As the sun went down on the opposite side of the world, the light on the New Jersey horizon focused to a steady, lambent core the color of a flashlight when you shine it through the palm of your hand under the bedsheets.

Lawrence climbed down the stairs and got on his bicycle and rode through the Pine Barrens. Before long he came to a road that led in the general direction of the light. Most of the time he could not see anything, not even the road, but after a couple of hours the glow bouncing off the low cloud layer lit up flat stones in the road, and turned the barrens' wandering rivulets into glowing crevices.

The road began to tend in the wrong direction and so Lawrence cut directly into the woods, because he was very close now, and the light in the sky was strong enough that he could see it through the sparse carpet of scrubby pines--black sticks that appeared to have been burned, though they hadn't. The ground had turned into sand, but it was damp and compacted, and his bicycle had fat tires that rode over it well. At one point he had to stop and throw the bike over a barbed-wire fence. Then he broke out of the sticks and onto a perfectly flat expanse of white sand, stitched down with tufts of beach grass, and just then he was dazzled by a low fence of quiet steady flames that ran across a part of the horizon about as wide as the harvest moon when it sinks into the sea. Its brightness made it difficult to see anything else--Lawrence kept riding into little ditches and creeks that meandered across the flats. He learned not to stare directly at the flames. Looking off to the sides was more interesting anyway: the table-land was marked at wide intervals by the largest buildings he had ever seen, cracker-box structures built by Pharaohs, and in the mile-wide plazas between them, gnomons of

triangulated steel were planted in wide stances: the internal skeletons of pyramids. The largest of these pierced the center of a perfectly circular railway line a few hundred feet in diameter: two argent curves scored on the dull ground, interrupted in one place where the tower's shadow, a stopped sundial, told the time. He rode by a building smaller than the others, with oval tanks standing next to it. Steam murmured from valves on the tops of the tanks, but instead of rising into the air it dribbled down the sides and struck the ground and spread out, coating the sea-grass with jackets of silver.

A thousand sailors in white were standing in a ring around the long flame. One of them held up his hand and waved Lawrence down. Lawrence came to a stop next to the sailor and planted one foot on the sand to steady himself. He and the sailor stared at each other for a moment and then Lawrence, who could not think of anything else, said, ``I am in the Navy also.'' Then the sailor seemed to make up his mind about something. He saluted Lawrence through, and pointed him towards a small building off to the side of the fire.

The building looked only like a wall glowing in the firelight, but sometimes a barrage of magnesium blue light made its windowframes jump out of the darkness, a rectangular lightning-bolt that echoed many times across the night. Lawrence started pedaling again and rode past that building: a spiraling flock of alert fedoras, prodding at slim terse notebooks with stately Ticonderogas, crab-walking photogs turning their huge chrome daisies, crisp rows of people sleeping with blankets over their faces, a sweating man with Brilliantined hair chalking umlauted names on a blackboard. Finally coming around this building he smelled hot fuel oil, felt the heat of the flames on his face and saw beach-glass curled toward it and desiccated.

He stared down upon the world's globe, not the globe fleshed with continents and oceans but only its skeleton: a burst of meridians, curving backwards to cage an inner dome of orange flame. Against the light of the burning oil those longitudes were thin and crisp as a draftsman's ink-strokes. But coming closer he saw them resolve into clever works of rings and struts, hollow as a bird's bones. As they spread away from the pole they sooner or later began to wander, or split into bent parts, or just broke off and hung in the fire oscillating like dry stalks. The perfect geometry was also mottled, here and there, by webs of cable and harnesses of electrical wiring. Lawrence almost rode over a broken wine bottle and decided he should now walk, to spare his bicycle's tires, so he laid the bike down, the front wheel covering an aluminum vase that appeared to have been spun on a lathe, with a few charred roses hanging out of it. Some sailors had joined their hands to form a sort of throne, and were bearing along a human-shaped piece of charcoal dressed in a coverall of immaculate asbestos. As they walked the toes of their shoes caught in vast, ramified snarls of ropes and piano-wires, cables and wires, creative furtive movements in the grass and the sand dozens of yards every direction. Lawrence began planting his feet very thoughtfully one in front of the other, trying to measure the greatness of what he had come and seen. A rocket-shaped pod stuck askew from the sand, supporting an umbrella of bent-back propellers. The duralumin struts and catwalks rambled on above him for miles. There was a suitcase spilled open, with a pair of women's shoes displayed as if in the window of a downtown store, and a menu that had been charred to an oval glow, and then some tousled wall-slabs, like a whole room that had dropped out of the sky--these were decorated, one with a giant map of the world, great circles arcing away from Berlin to pounce on cities near and far, and another with a photograph of a

famous, fat German in a uniform, grinning on a flowered platform, the giant horizon of a new Zeppelin behind him.

After a while he stopped seeing new things. Then he got on his bicycle and rode back through the Pine Barrens. He got lost in the dark and so didn't find his way back to the fire tower until dawn. But he didn't mind being lost because while he rode around in the dark he thought about the Turing machine. Finally he came back to the shore of the pond where they had camped. The dawn-light shining on the saucer of calm reddish water made it look like a pool of blood. Alan Mathison Turing and Rudolf von Hacklheber were lying together like spoons on the shore, still smudged a little bit from their swim yesterday. Lawrence started a little fire and made some tea and they woke up eventually.

``Did you solve the problem?'' Alan asked him.

``Well you can turn that Universal Turing Machine of yours into any machine by changing the presets--''

``Presets?''

``Sorry, Alan, I think of your U.T.M. as being kind of like a pipe organ.''

``Oh.''

``Once you've done that, anyway, you can do any calculation you please, if the tape is long enough. But gosh, Alan, making a tape that's long enough, and that you can write symbols on, and erase them, is going to be sort of tricky--Atanasoff's capacitor drum would only work up to a certain size--you'd have to--''

``This is a digression,'' Alan said gently.

``Yeah, okay, well--if you had a machine like that, then any given preset could be represented by a number--a string of symbols. And the tape that you would feed into it to start the calculation would contain another string of symbols. So it's Go[audel's proof all over again--if any possible combination of machine and data can be represented by a string of numbers, then you can just arrange all of the possible strings of numbers into a big table, and then it turns into a Cantor diagonal type of argument, and the answer is that there must be some numbers that cannot be computed.''

``And ze Entscheidungsproblem?'' Rudy reminded him.

``Proving or disproving a formula--once you've encrypted the formula into numbers, that is--is just a calculation on that number. So it means that the answer to the question is, no! Some formulas cannot be proved or disproved by any mechanical process! So I guess there's some point in being human after all!''

Alan looked pleased until Lawrence said this last thing, and then his face collapsed. ``Now there you go making unwarranted assumptions.''

``Don't listen to him, Lawrence!'' Rudy said. ``He's going to tell you that our brains are Turing machines.''

``Thank you, Rudy,'' Alan said patiently. ``Lawrence, I submit that our brains are Turing machines.''

``But you proved that there's a whole lot of formulas that a Turing machine can't process!''

``And you have proved it too, Lawrence.''

``But don't you think that we can do some things that a Turing machine couldn't?''

``Godel agrees with you, Lawrence,'' Rudy put in, ``and so does Hardy.''

``Give me one example,'' Alan said.

``Of a noncomputable function that a human can do, and a Turing machine can't?''

``Yes. And don't give me any sentimental nonsense about creativity. I believe that a Universal Turing Machine could show behaviors that we would construe as creative.''

``Well, I don't know then... I'll try to keep my eye out for that kind of thing in the future.''

But later, as they were riding back towards Princeton, he said, ``What about dreams?''

``Like those angels in Virginia?''

``I guess so.''

``Just noise in the neurons, Lawrence.''

``Also I dreamed last night that a zeppelin was burning.''

Soon, Alan got his Ph.D. and went back to England. He wrote Lawrence a couple of letters. The last of these stated, simply, that he would not be able to write Lawrence any more letters ``of substance'' and that Lawrence should not take it personally. Lawrence perceived right away that Alan's society had put him to work doing something useful--probably figuring out how to keep it from being eaten alive by certain of its neighbors. Lawrence wondered what use America would find for him.

He went back to Iowa State, considered changing his major to mathematics, but didn't. It was the consensus of all whom he consulted that mathematics, like pipe-organ restoration, was a fine thing, but that one needed some way to put bread on the table. He remained in engineering and did more and more poorly at it until the middle of his senior year, when the university suggested that he enter a useful line of work, such as roofing. He walked straight out of college into the waiting arms of the Navy.

They gave him an intelligence test. The first question on the math part had to do with boats on a river: Port Smith is 100 miles upstream of Port Jones. The river flows at 5 miles per hour. The boat goes through water at 10 miles per hour. How long does it take to go from Port Smith to Port Jones? How long to come back?

Lawrence immediately saw that it was a trick question. You would have to be some kind of idiot to make the facile assumption that the current would add or subtract 5 miles per hour to or from the speed of the boat. Clearly, 5 miles per hour was nothing more than the average speed. The current would be faster in the middle of the river and slower at the banks. More complicated variations could be expected at bends in the river. Basically it was a question of hydrodynamics, which could be tackled using certain well-known systems of differential equations. Lawrence dove into the problem, rapidly (or so he thought) covering both sides of ten sheets of paper with calculations. Along the way, he realized that one of his assumptions, in combination with the simplified Navier-Stokes equations, had led him into an exploration of a particularly interesting family of partial differential equations. Before he knew it, he had proved a new theorem. If that didn't prove his intelligence, what would?

Then the time bell rang and the papers were collected. Lawrence managed to hang onto his scratch paper. He took it back to his dorm, typed it up, and mailed it to one of the more approachable math professors at Princeton, who promptly arranged for it to be published in a Parisian mathematics journal.

Lawrence received two free, freshly printed copies of the journal a few months later, in San Diego, California, during mail call on board a large ship called the U.S.S. Nevada. The ship had a band, and the Navy had given Lawrence the job of playing the glockenspiel in it, because their testing procedures had proven that he was not intelligent enough to do anything else.

The sack of mail carrying Lawrence's contribution to the mathematical literature arrived just in the nick of time. Lawrence's ship, and quite a few of her sisters, had until then been based in California. But at just this moment, all of them were transferred to some place called Pearl Harbor, Hawaii, in order to show the Nips who was boss.

Lawrence had never really known what he wanted to do with his life, but he quickly decided that being glockenspiel player on a battleship in Hawaii during peacetime was a long way from the worst life you could possibly have. The harshest part of the job was sometimes having to sit or march in very warm conditions, and enduring occasional fluffed notes by other band members. He had abundant free time, which he spent working on a series of new theorems in the field of information theory. The field had been invented and pretty much encompassed by his friend Alan, but there was much detail work to be done. He and Alan and Rudy had sketched out a general plan of what needed to be proved or disproved. Lawrence tore through the list. He wondered what Alan and Rudy were up to in Britain and Germany, but he couldn't write to them and find out, so he kept his work to himself. When he wasn't playing the glockenspiel or working out theorems, there were bars and dances to go to. Waterhouse did some penis work of his own, got the clap, had it cured,* bought condoms. All of the sailors did this. They were like three-year olds who shove pencils in their ears, discover that it hurts,

and stop doing it. Lawrence's first year went by almost instantly. Time just blazed by. Nowhere could be sunnier, more relaxing, than Hawaii.

*1940 being a good year to begin experimenting with venereal diseases in that the new injectable penicillin was just becoming available

NOVUS ORDO SECLORUM

``Filipinos are a warm, gentle, caring, giving people,'' avi says, ``which is a good thing since so many of them carry concealed weapons.''

Randy is in Tokyo's airport, ambling down a concourse with a slowness that is infuriating to his fellow travelers. They have all spent the last half-day strapped into bad chairs, stuffed into an aluminum tube aslosh with jet fuel. Over the safety-engineered nubs molded into the jetway floor, their rolling suitcases drone like fighter planes. They graze the backs of his knees as they bank around his husky columnar body. Randy is holding his new GSM phone to the side of his head. Supposedly it works anywhere in the world, except for the United States. This is his first chance to try it out.

``You sound clear as a bell,'' Avi says. ``How was the flight over?''

``All right,'' Randy says. ``They had one of those animated maps up on the video screen.''

Avi sighs. ``All the airlines have those now,'' he announces monotonically.

``The only feature between San Francisco and Tokyo was Midway Island.''

``So?''

``It kind of hung there for hours. MIDWAY. Mute embarrassment all around.''

Randy reaches the departure gate for Manila, and pauses to admire a five-foot-wide high-definition TV set bearing the logo of a major Nipponese consumer-electronics company. It is running a video in which a wacky cartoon professor and his adorable canine sidekick cheerfully tick off the three transmission routes of the AIDS virus.

``I have a fingerprint for you,'' Randy says.

``Shoot.''

Randy stares at the palm of his hand, on which he has written a string of numbers and letters in ballpoint pen. ``AF 10 06 E9 99 BA 11 07 64 C1 89 E3 40 8C 72 55.''

``Got it,'' Avi says. ``That's from Ordo, right?''

``Right. I e-mailed you the key from SFO.''

``The apartment situation is still resolving,'' Avi says. ``So I just reserved you a suite at the Manila Hotel.''

``What do you mean, it's still resolving?''

``The Philippines is one of those post-Spanish countries with no clear boundaries between business and personal relationships,'' Avi says. ``I don't think you can secure lodgings there without marrying into a family with a major street named after it.''

Randy takes a seat in the departure area. Perky gate attendants in jaunty, improbable hats zero in on Filipinos with too many carry-ons, and subject them to a public ritual of filling out little tags and surrendering their possessions. The Filipinos roll their eyes and stare longingly out the windows. But most of the waiting passengers are Nipponese--some businessmen, mostly vacationers. They are watching an educational video about how to get mugged in foreign countries.

``Huh,'' Randy says, looking out the window, ``got another 747 down to Manila.''

``In Asia, no decent airline bothers to dick around anything smaller than a 747,'' Avi snaps. ``If someone tries to pack you on board a 737 or god forbid an Airbus, run, don't walk, away from the boarding lounge, and call me on my Sky Pager and I'll send in a chopper to evacuate you.''

Randy laughs.

Avi continues. ``Now, listen. This hotel you're going to is very old, very grand, but it's in the middle of nowhere.''

``Why would they build a grand hotel in the middle of nowhere?''

``It used to be a happening place--it's on the waterfront, right on the edge of Intramuros.''

Randy's high-school Spanish is enough to translate that: Inside the Walls.

``But Intramuros was annihilated by the Nipponese in 1945,'' Avi continues. ``Systematically. All of the business hotels and office buildings are in a new neighborhood called Makati, much closer to the airport.''

``So you want to put our office in Intramuros.''

``How'd you guess?'' Avi says, sounding a little spooked. He prides himself on unpredictability.

``I'm not an intuitive guy generally,'' Randy says, ``but I've been on a plane for thirteen hours and my brain has been turned inside out and hung up to dry.''

Avi rattles off canned justifications: office space is much cheaper in

Intramuros. Government ministries are closer. Makati, the gleaming new business district, is too isolated from the real Philippines. Randy pays no attention to it.

``You want to work out of Intramuros because it was systematically annihilated, and because you're obsessed with the Holocaust,'' Randy finally says, quietly and without rancor.

``Yeah. So?'' Avi says.

Randy stares out the window of the Manila-bound 747, sipping on a fluorescent green Nipponese soft drink made from bee extracts (at least, it has pictures of bees on it) and munching on something that a flight attendant handed him called Japanese Snack. Sky and ocean are the same color, a shade of blue that makes his teeth freeze. The plane is so high that, whether he looks up or down, he sees foreshortened views of boiling cumulonimbus stacks. The clouds erupt from the hot Pacific as if immense warships were exploding all over the place. The speed and power of their growth is alarming, the forms they adopt as bizarre and varied as those of deep-sea organisms, and all of them, he supposes, are as dangerous to an airplane as punji stakes to a barefoot pedestrian. The red-orange meatball painted on the wingtip startles him when he notices it. He feels like he's been thrown into an old war film.

He turns on his laptop. Electronic mail from Avi, encrypted to a fare-thee-well, has been piling up in his in-box. It is a gradual accumulation of tiny files, thrown at him by Avi whenever a thought popped into his head over the last three days; it would be obvious, even if Randy didn't know it, that Avi owns a portable e-mail machine that talks to the Internet by radio. Randy fires up a piece of software that is technically called Novus Ordo Seclorum but that everyone calls Ordo for short. It is a fairly strained pun based on the fact that Ordo's job, as a piece of cryptographic software, is to put a message's bits in a New Order and that it will take Centuries for nosy governments to decrypt it. A scanned image of a Great Pyramid appears in the middle of his screen, and a single eye gradually materializes at its apex.

Ordo can handle this in one of two ways. The obvious way is to decrypt all of the messages and convert them into plaintext files on his hard disk, which he can then read any time he wants. The problem with this (if you are paranoid) is that anyone who gets his hands on Randy's hard disk can then read the files. For all he knows, the customs officials in Manila will decide to ransack his computer for child pornography. Or, fogged by jet lag, he'll leave his laptop in a taxi. So instead he puts Ordo into a streaming mode where it will decrypt the files just long enough for him to read them and then, when he closes the windows, expunge the plaintext from the computer's memory and from its hard drive.

The subject heading of Avi's first message is: ``Guideline 1.''

We look for places where the math is right. Meaning what? Meaning that pop. is about to explode---we can predict that just by looking at age histogram---and per capita income is about to take off the way it did in Nippon, Taiwan, Singapore. Multiply those two things together and you get the kind of exponential growth that should get us all into fuck-you money before we turn forty.

This is an allusion to a Randy/Avi conversation of two years ago wherein Avi actually calculated a specific numerical value for ``fuck-you money.'' It was not a fixed constant, however, but rather a cell in a spreadsheet linked to any number of continually fluctuating economic indicators. Sometimes when Avi is working at his computer he will leave the spreadsheet running in a tiny window in the corner so that he can see the current value of ``fuck-you money'' at a glance.

The second message, sent a couple of hours later, is called ``Guideline 2.''

Two: pick a tech where no one can compete with us. Right now, that=networking. We're kicking the crap out of everyone else in the world when it comes to networking. It's not even funny.

The next day, Avi sent a message called, simply, ``More.'' Perhaps he had lost track of the number of guidelines he'd issued so far.

Another principle: this time we retain control of the corporation. That means that we keep at least fifty percent of the shares---which means little to no outside investment until we've built up some value.

``You don't have to convince me,'' Randy mumbles to himself, as he reads this.

This shapes the kinds of businesses we can get into. Forget anything that requires a big initial investment.

Luzon is green-black jungle mountains gouged with rivers that would appear to be avalanches of silt. As the navy-blue ocean verges on its khaki beaches, the water takes on the shocking iridescent hue of a suburban swimming pool. Farther south, the mountains are swidden-scarred--the soil beneath is bright red and so these parts look like fresh lacerations. But most is covered with foliage that looks like the nubby green stuff that model railroaders put over their papier-mache hills, and in vast stretches of the mountains there are no signs whatsoever that human beings have ever existed. Closer to Manila, some of the slopes are deforested, sprinkled with structures, ribboned with power-line cuts. Rice paddies line the basins. The towns are accretions of shanties, nucleated around large cross-shaped churches with good roofs.

The view gets blurry as they belly down into the pall of sweaty smog above the city. The plane begins to sweat like a giant glass of iced tea. The water streams off in sheets, collects in crevices, whips off the flaps' trailing edges.

Suddenly they are banking over Manila Bay, which is marked with endless streaks of brilliant red--some kind of algal bloom. Oil tankers trail long time-delayed rainbows that flourish in their wakes. Every cove is jammed with long skinny boats with dual outriggers, looking like brightly painted water skaters.

And then they are down on the runway at NAIA, Ninoy Aquino International Airport. Guards and cops of various stripes are ambling around with M-16s or pistol-handled pump shotguns, wearing burnooses fashioned from handkerchiefs clamped to the head with American baseball caps. A man dressed in a radiant white uniform stands below

the ragged maw of the jetway holding his hands downwards with fluorescent orange sticks in them, like Christ dispensing mercy on a world of sinners. Sulfurous, fulminating tropical air begins to leak in through the jumbo's air vents. Everything moistens and wilts.

He is in Manila. He takes his passport out of his shirt pocket. It says, RANDALL LAWRENCE WATERHOUSE.

This is how Epiphyte Corporation came into existence:

``I am channeling the bad shit!'' Avi said.

The number came through on Randy's pager while he was sitting around a table in a grubhouse along the coast with his girlfriend's crowd. A place where, every day, they laser-printed fresh menus on 100% recycled imitation parchment, where oscilloscope tracings of neon-colored sauces scribbled across the plates, and the entrees were towering, architectonic stacks of rare ingredients carved into gemlike prisms. Randy had spent the entire meal trying to resist the temptation to invite one of Charlene's friends (any one of them, it didn't matter) out on the sidewalk for a fistfight.

He glanced at his pager expecting to see the number of the Three Siblings Computer Center, which was where he worked (technically, still does). The fell digits of Avi's phone number penetrated the core of his being in the same way that 666 would a fundamentalist's.

Fifteen seconds later, Randy was out on the sidewalk, swiping his card through a pay phone like an assassin drawing a single-edged razor blade across the throat of a tubby politician.

``The power is coming down from On High,'' Avi continued. ``Tonight, it happens to be coming through me--you poor bastard.''

``What do you want me to do?'' Randy asked, adopting a cold, almost hostile tone to mask sick excitement.

``Buy a ticket to Manila,'' Avi said.

``I have to talk it over with Charlene first,'' Randy said.

``You don't even believe that yourself,'' Avi said.

``Charlene and I have a long-standing relationsh--''

``It's been ten years. You haven't married her. Fill in the fucking blanks.''

(Seventy-two hours later, he would be in Manila, looking at the One-Note Flute.)

``Everyone in Asia is wondering when the Philippines is finally going to get its shit together,'' Avi said, ``it's the question of the nineties.''

(The One-Note Flute is the first thing you see when you make it through passport control.)

``I flashed on this when I was standing in line at Passport Control at Ninoy Aquino International Airport,'' Avi said, compressing that entire name into a single, sharply articulated burst. ``You know how they have different lanes?''

``I guess so,'' Randy said. A parallelpiped of seared tuna did a barrel roll in his gullet. He felt a perverse craving for a double ice-cream cone. He did not travel as much as Avi, and had only a vague idea of what he meant by lanes.

``You know. One lane for citizens. One for foreigners. Maybe one for diplomats.''

(Now, standing there waiting to have his passport stamped, Randy can see it clearly. For once he doesn't mind the wait. He gets in a lane next to the OCW lane and studies them. They are Epiphyte Corp.'s market. Mostly young women, many of them fashionably dressed, but still with a kind of Catholic boarding-school demureness. Exhausted from long flights, tired of the wait, they slump, then suddenly straighten up and elevate their fine chins, as if an invisible nun were making her way up the line whacking their manicured knuckles with a ruler.)

But seventy-two hours ago he hadn't really understood what Avi meant by lanes, so he just said, ``Yeah, I've seen the lane thing.''

``At Manila, they have a whole lane just for returning OCWs!''

``OCWs?''

``Overseas Contract Workers. Filipinos working abroad--because the economy of the Philippines is so lame. As maids and nannies in Saudi. Nurses and anesthesiologists in the States. Singers in Hong Kong, whores in Bangkok.''

``Whores in Bangkok?'' Randy had been there, at least, and his mind reeled at the concept of importing prostitutes to Thailand.

``The Filipino women are more beautiful,'' Avi said quietly, ``and have a ferocity that makes them more interesting, to the innately masochistic business traveler, than all those grinning Thai bimbos.'' Both of them knew that this was complete bullshit; Avi was a family man and had no firsthand experience whereof he spoke. Randy didn't call him on it, though. As long as Avi retained this extemporaneous bullshitting ability there was a better than even chance of all of them making fuck-you money.

(Now that he's here, it is tempting to speculate as to which of the girls in the OCW lane are hustlers. But he can't see that going anywhere but wrong, so he squares his shoulders and marches toward the yellow line.

The government has set up glass display cases in the concourse leading from passport control to the security barrier. The cases contain artifacts demonstrating the glories of pre-Magellan Filipino culture. The first one of these contains the piece de resistance: a rustic hand-carved musical

instrument labeled with a long and unreadable name in Tagalog. Underneath that, in smaller letters, is the English translation: ONE-NOTE FLUTE.)

``See? The Philippines is innately hedged,'' Avi said. ``You know how rare that is? When you find an innately hedged environment, Randy, you lunge into it like a rabid ferret going into a pipe full of raw meat.''

A word about Avi: his father's people had just barely gotten out of Prague. As Central European Jews went, they were fairly typical. The only thing about them that was really anomalous was that they were still alive. But his mother's people were unbelievably peculiar New Mexican crypto-Jews who had been living on mesas, dodging Jesuits, shooting rattlesnakes and eating jimson weed for three hundred years; they looked like Indians and talked like cowboys. In his relations with other people, therefore, Avi dithered. Most of the time he was courtly and correct in a way that was deeply impressive to businesspeople--Nipponese ones expecially--but there were these eruptions, from time to time, as if he'd been dipping into the loco weed. Randy had learned to deal with it, which is why Avi called him at times like this.

``Oh, calm down!'' Randy said. He watched a tanned girl rollerblade past him, on her way up from the beach. ``Innately hedged?''

``As long as the Philippines don't have their shit together, there'll be plenty of OCWs. They will want to communicate with their families--the Filipinos are incredibly family-oriented. They make Jews look like a bunch of alienated loners.''

``Okay. You know more about both groups than I do.''

``They are sentimental and affectionate in a way that's very easy for us to sneer at.''

``You don't have to be defensive,'' Randy said, ``I'm not sneering at them.''

``When you hear their song dedications on the radio, you'll sneer,'' Avi said. ``But frankly, we could take some pointers from the Pinoys on this front.''

``You are so close to being sanctimonious right now--''

``I apologize,'' Avi said, with absolute sincerity. Avi's wife had been pregnant almost continuously for the four years they'd been married. He was getting more religiously observant daily and couldn't make it through a conversation without mentioning the Holocaust. Randy was a bachelor who was just about to break up with the chick he'd been living with.

``I believe you, Avi,'' Randy said. ``Is it a problem with you if I buy a business-class ticket?''

Avi didn't hear him, so Randy assumed that meant yes. ``As long as that's the case, there will be a big market for Pinoy-grams.''

``Pinoy-grams?''

``For god's sake, don't say it out loud! I'm filling out the trademark application as we speak,'' Avi said. Randy could hear a rattling sound in the background, computer keys impacting so rapidly it sounded like Avi was simply holding the keyboard between his pale, spindly hands and shaking it violently up and down. ``But if the Filipinos do get their shit together, then we see explosive growth in telecoms, as in any other Arday.''

``Arday?''

``R-D-A-E. Rapidly Developing Asian Economy. Either way, we win.''

``I gather you want to do something with telecoms?''

``Bingo.'' In the background, a baby began to cough and cry. ``Gotta go,'' Avi said, ``Shlomo's asthma is spiking again. Take down this fingerprint.''

``Fingerprint?''

``For my encryption key. For e-mail.''

``Ordo?''

``Yeah.''

Randy took out a ballpoint pen and, finding no paper in his pocket, poised it over the palm of his hand. ``Shoot.''

``67 81 A4 AE FF 40 25 9B 43 0E 29 8D 56 60 E3 2F.'' Then Avi hung up the phone.

Randy went back into the restaurant. On his way back, he asked the waiter to bring him a half-bottle of good red wine. Charlene heard him, and glowered. Randy was still thinking about innate ferocity, and did not see it in her face; only a schoolmarmishness common among all of her friends. My god! I have to get out of California, he realized.

SEAWEED

Woman holds baby

Eyes pale as a muzzle flash

Band chimes frozen tears

The fourth marines is marching downhill to the strains of John Philip Sousa, which ought to be second nature to a Marine. But the Fourth Marines have been in Shanghai (which ain't no halls of Montezuma nor shores of Tripoli) for too long, longer than Marines should ever stay in one place, and Bobby's already seen his sergeant, one Frick, throw up from opium withdrawal.

A Marine band is several Shanghai blocks ahead. Bobby's platoon can

hear the thumpity-thump of the big drums and the piercing noises from piccolos and glockenspiels but he can't follow the tune. Corporal Shaftoe is effectively their leader, because Sergeant Frick is useless.

Shaftoe marches alongside the formation, supposedly to keep an eye on his men, but mostly he's just staring at Shanghai.

Shanghai stares back, and mostly gives them a standing ovation. Of course there is a type of young street rowdy who makes it a point of honor to let the Marines know he isn't scared of them, and they are jeering the Marines from a safe distance, and setting off strings of firecrackers, which does nothing to steady anyone's nerves. The Europeans are applauding--a whole chorus line of Russian dancing girls from Delmonte's is showing thigh and blowing kisses. But most of the Chinese look pretty stonefaced, which--Bobby suspects--means they're scared shitless.

The worst thing is the women carrying half-white babies. A few of these women are rabid, hysterical, throwing themselves into formations of massed Marines, undeterred by rifle butts. But most of them are stoic: they stand with their light-eyed babies and glare, searching the ranks and files for the guilty party. They've all heard about what happened upriver in Nanjing when the Nips came there, and they know that when it's all over, the only trace that they and their babies ever existed may be a really bad memory in the mind of some American Marine.

It works for Shaftoe: he has hunted deer in Wisconsin and seen them limping across the snow, bleeding to death. He saw a man die in basic training at Parris Island. He has seen whole tangles of bodies in the Yangtze, downstream of where the Nipponese were prosecuting the China Incident, and he has seen refugees from places like Nanjing starve to death in the gutters of Shanghai. He has himself killed people who were trying to storm the riverboats it was his duty to protect. He thinks that he has never seen, and will never see, anything as terrible as those stone-faced Chinese women holding their white babies, not even blinking as the firecrackers explode all around them.

Until, that is, he looks into the faces of certain Marines who stare into that crowd and see their own faces looking back at them, pudgy with baby fat and streaked with tears. Some of them seem to think it's all a joke. But many of the Marines who march out of their empty barracks that morning sane and solid men, have, by the time they reach the gunboats waiting for them at the Bund, gone mad. They don't show it. But Shaftoe can see in their eyes that something has given way inside.

The very best men in the regiment are in a foul mood. The ones like Shaftoe, who didn't get involved with the Chinese women, are still leaving plenty behind: houses with maids and shoeshine boys and coolies, with women and opium for almost nothing. They don't know where they are being shipped off to, but it's safe to say that their twenty-one dollars a month won't go as far. They'll be in barracks and they'll have to learn to polish their own boots again. When the gangplanks are drawn in from the stone edge of the Bund, they are cut off from a whole world that they'll never see again, a world where they were kings. Now they are Marines again. It's okay with Shaftoe, who wants to be a Marine. But many of the men have become middle-aged here, and don't.

The guilty men duck belowdecks. Shaftoe remains on the deck of the

gunboat, which casts off from the Bund, headed for the cruiser Augusta, which awaits in mid-channel.

The Bund is jammed with onlookers in a riot of differently colored clothing, so one patch of uniform drab catches his eye: a group of Nip soldiers who've come down to bid their Yank counterparts a sarcastic farewell. Shaftoe scans the group looking for someone tall and bulky, and picks him out easily. Goto Dengo's waving to him.

Shaftoe takes his helmet off and waves back. Then, on impulse, just for the hell of it, he winds up and flings the helmet directly at Goto Dengo's head. The throw goes awry and Goto Dengo has to knock down about a dozen of his comrades in order to catch it. All of them seem to think that it is a high honor, as well as tremendously amusing, to be knocked down by Goto Dengo.

Twenty seconds later, a comet sails up out of the flesh cosmos of the Bund and bounces on the wooden deck of the gunboat--a hell of a throw. Goto Dengo is showing off his follow-through. The projectile is a rock with a white streamer wrapped around it. Shaftoe runs over and snatches it. The streamer is one of those thousand-stitch headbands (supposedly; he's taken a few off of unconscious Nips, but he's never bothered to count the stitches) that they tie around their heads as a good-luck charm; it has a meatball in the center and some Nip writing to either side. He unties it from around the rock. In so doing he realizes, suddenly, that it's not a rock after all; it is a hand grenade! But good old Goto Dengo was just joking--he didn't pull the pin. A nice souvenir for Bobby Shaftoe.

Shaftoe's first haiku (December 1940) was a quick and dirty adaptation of the Marine Creed:

This is my rifle

There are many like it but

This rifle is mine.

He wrote it under the following circumstances: Shaftoe and the rest of Fourth Marines were stationed in Shanghai so that they could guard the International Settlement and work as muscle on the gunboats of the Yangtze River Patrol. His platoon had just come back from the Last Patrol: a thousand-mile reconnaissance-in-force all the way up past what was left of Nanjing, to Hankow, and back. Marines had been doing this ever since the Boxer Rebellion, through civil wars and everything else. But towards the end of 1940, what with the Nips basically running all of northeast China now, the politicians back in D.C. had finally thrown in the towel and told the China Marines not to steam up the Yangtze any more.

Now, the Old Breed Marines like Frick claimed they could tell the difference between organized brigands; armed mobs of starving peasants; rogue Nationalists; Communist guerrillas; and the irregular forces in the pay of warlords. But to Bobby Shaftoe they were all just crazy, armed slopes who wanted a piece of the Yangtze River Patrol. The Last Patrol had been a wild trip. But it was over and they were back in Shanghai now, the safest place you could be in China, and about a hundred times more dangerous than the most dangerous place you

could be in America. They had climbed off the gunboat six hours ago, gone to a bar, and not come out until just now, when they had decided it was high time they went to a whorehouse. On their way, they happened to pass this Nip restaurant.

Bobby Shaftoe had looked in the windows of the place before, and watched the man with the knife, trying to figure out what the hell he was doing. It looked a hell of a lot like he was cutting up uncooked fish and putting the raw meat on bullets of rice and handing it over to the Nips on the other side of the counter, who were wolfing it down.

It had to be some kind of optical illusion. The fish must have been precooked in the back room.

This had been nagging at Shaftoe for about a year. As he and the other horny drunk Marines went by the place, he slowed down to peer through the window, trying to gather more evidence. He could swear that some of that fish looked ruby red, which it wouldn't have been if it were cooked.

One of his buddies, Rhodes from Shreveport, noticed him looking. He dared Shaftoe to go in there and sit down at that bar. Then another private, Gowicki from Pittsburgh, double-dared him!

Shaftoe sucked his teeth and considered the matter. He had already made up his mind that he was going to do it. He was a sniper scout, and it was in his nature to do crazy shit like this; but it was also part of his training to scan the terrain carefully before venturing in.

The restaurant was three-quarters full, and everyone in the place was a uniformed member of the Nipponese military. At the bar where the man was cutting up the apparently raw fish, there was a marked concentration of officers; if you only had one grenade, that's where you'd throw it. Most of the place was filled with long tables where enlisted men sat, drinking noodle soup from steaming urns. Shaftoe paid particular attention to these, because they were the ones who were going to be beating the shit out of him in about sixty seconds. Some were there alone, with reading material. A cluster of them, back in one corner, were paying attention to one fellow who was apparently telling a joke or story.

The longer Shaftoe spent reconnoitering the place, the more convinced Rhodes and Gowicki became that he was actually going to do it. They became excited and called for the other Marines, who had gone ahead of them down the block, headed for that whorehouse.

Shaftoe saw the others coming back--his tactical reserve. ``What the fuck,'' he said, and went into the restaurant. Behind him, he could hear the others shouting excitedly; they couldn't believe he was doing it. When Shaftoe stepped over the threshold of that Nip restaurant, he passed into the realm of legend.

All the Nips looked up at him when he came in the door. If they were surprised, they didn't show it. The chef behind the counter began to holler out some kind of ritual greeting, which faltered and trailed off as he got a look at what had just come in. The fellow in the back of the room--a husky, pink-cheeked Nip--continued telling his joke or story or whatever it was.

Shaftoe nodded to no one in particular, then stepped to the nearest empty chair at the bar and sat down.

Other Marines would have waited until the whole squad had assembled. Then they would have invaded the restaurant en masse, knocked over a few chairs, spilled some soup. But Shaftoe had seized the initiative before the others could do any such thing and gone in by himself, as a sniper scout was supposed to do. It was not just because he was a sniper scout, though. It was also because he was Bobby Shaftoe, and he was sincerely curious about this place, and if he could, he wanted to spend a few calm minutes in here and learn a few things about it before the fun started.

It helped, of course, that Shaftoe was a quiet and contemplative drunk, not a dangerous explosive drunk. He must have reeked of beer (those Krauts in Tsingtao cranked out a brew whose taste took him right back to Wisconsin, and he was homesick). But he wasn't hollering or knocking things over.

The chef was busy crafting one of his little morsels and pretended to ignore Shaftoe. The other men at the counter stared coldly at Shaftoe for a while, then turned their attentions back to their food. Shaftoe looked at the array of raw fish laid out on shaved ice behind the bar, then looked around the room. The guy back in the corner was talking in short bursts, reading from a notebook. He would speak maybe ten or twenty words, and then his little audience would turn to one another and grin, or grimace, or sometimes even make a patter of applause. He wasn't delivering his material like a dirty joke. He spoke precisely and expressively.

Fuck! He was reading poetry! Shaftoe had no idea what he was saying, but he could tell, by the sound of it, that it must be poetry. Didn't rhyme though. But the Nips did everything queerly.

He noticed that the chef was glaring at him. He cleared his throat, which was useless since he couldn't speak Nip. He looked at some of that ruby red fish behind the bar, pointed to it, held up two fingers.

Everyone was startled that the American had actually placed an order. The tension was broken, only a little. The chef went to work and produced two morsels, which he served up on a wooden pedestal.

Shaftoe had been trained to eat insects, and to bite the heads off chickens, so he figured he could handle this. He picked the morsels up in his fingers, just like the Nips were doing, and ate them. They were good. He ordered two more, of another variety. The guy in the corner kept reading poetry. Shaftoe ate his morsels and then ordered some more. For perhaps ten seconds, between the taste of the fish and the sound of the poetry, he actually felt comfortable here, and forgot that he was merely instigating a vicious racial brawl.

The third order looked different: laid over the top of the raw fish were thin translucent sheets of some kind of moist, glistening material. It looked sort of like butcher paper soaked in oil. Shaftoe gawked at it for a while, trying to identify it, but it looked like no foodstuff he knew of. He glanced left and right, hoping that one of the Nips had ordered the same stuff, so that he could watch and learn the right way to eat it. No

luck.

Hell, they were officers. Maybe one of them spoke a little English. `` 'Scuse me. What's this?'' Shaftoe said, peeling up one corner of the eerie membrane.

The chef looked up at him nervously, then scanned the bar, polling the customers. Discussion ensued. Finally, a Nip officer at the end of the bar, a naval lieutenant, stood up and spoke to Bobby Shaftoe.

``Seaweed.''

Shaftoe did not particularly like the lieutenant's tone of voice--hostile and sullen. This, combined with the look on his face, seemed to say, You'll never understand it, you farmer, so why don't you just think of it as seaweed.

Shaftoe folded his hands primly in his lap, regarded the seaweed for a few moments, and then looked up at the lieutenant, who was still gazing at him expressionlessly. ``What kind of seaweed, sir?'' he said.

Significant glances began flying around the restaurant, like semaphores before a naval engagement. The poetry reading seemed to have stopped, and a migration of enlisted men had begun from the back of the room. Meanwhile the lieutenant translated Shaftoe's inquiry to the others, who discussed it in some detail, as if it were a major policy initiative from Franklin Delano Roosevelt.

The lieutenant and the chef exchanged words. Then the lieutenant looked at Shaftoe again. ``He say, you pay now.'' The chef held up one hand and rubbed his fingers and thumb together.

A year of working the Yangtze River Patrol had given Bobby Shaftoe nerves of titanium, and unlimited faith in his comrades, and so he resisted the impulse to turn his head and look out the window. He already knew exactly what he would see: Marines, shoulder to shoulder, ready to die for him. He scratched the new tattoo on his forearm: a dragon. His dirty fingernails, passing over the fresh scabs, made a rasping sound in the utterly silent restaurant.

``You didn't answer my question,'' Shaftoe said, pronouncing the words with a drunk's precision.

The lieutenant translated this into Nipponese. More discussion. But this time it was curt and decisive. Shaftoe could tell that they were about to bounce him. He squared his shoulders.

The Nips were good; they mounted an organized charge out the door, onto the sidewalk, and engaged the Marines, before anyone actually laid a hand on Shaftoe. This spoiling attack prevented the Marines from invading the restaurant proper, which would have disturbed the officers' meal and, with any luck, led to untold property damage. Shaftoe then felt himself being grabbed from behind by at least three people and hoisted into the air. He made eye contact with the lieutenant while this was happening, and shouted: ``Are you bullshitting me about the seaweed?''

As brawls went, the only remarkable part of this one was the way he was carried out to the street before he could actually get started. Then it was like all the other street fights he'd been in with Nip soldiers in Shanghai. These all came down to American brawn (you didn't get picked for the Fourth Regiment unless you were an impressive-looking six-footer) versus that Nipponese chop-socky.

Shaftoe wasn't a boxer. He was a wrestler. This was to his advantage. The other Marines would put up their dukes and try to fight it out--Marquis of Queensberry style--no match for chop-socky. Shaftoe had no illusions about his boxing, so he would just put his head down and charge like a bull, take a few blows to the face on his way in, but usually get a solid hold on his opponent and slam him into the cobblestones. Usually that shook the Nip up enough that Shaftoe could get him in a full-nelson or a hammerlock and get him to cry uncle.

The guys who were carrying him out of the restaurant got jumped by Marines as soon as they were in the open. Shaftoe found himself going up against an opponent who was at least as tall as he was, which was unusual. This one had a solid build, too. Not like a sumo wrestler. More like a football player--a lineman, with a bit of a gut. He was a strong S.O.B. and Shaftoe knew right away that he was in for a real scrape. The guy had a different style of wrestling from the American, which (as Shaftoe learned the hard way) included some illegal maneuvers: partial strangulation and powerful, short punches to major nerve centers. The gulf between Shaftoe's mind and body, already wedged open by alcohol, was yanked open to a chasm by these techniques. He ended up lying on the sidewalk, helpless and paralyzed, staring up into the chubby face of his opponent. This was (he realized) the same guy who'd been sitting in the corner of the restaurant reading poetry. He was a good wrestler for a poet. Or maybe vice versa.

``It is not seaweed,'' said the big Nip. He had a look on his face like a naughty schoolkid getting away with something. ``The English word is maybe calabash?'' Then he turned and walked back into the restaurant.

So much for legend. What none of the other Marines knows is that this was not the last encounter between Bobby Shaftoe and Goto Dengo. The incident left Shaftoe with any number of nagging questions about subjects as diverse as seaweed, poetry, and chop-socky. He sought out Goto Dengo after that, which was not that hard--he just paid some Chinese boys to follow the conspicuous Nip around town and file daily reports. From this he learned that Goto Dengo and some of his comrades gathered every morning in a certain park to practice their chop-socky. After making sure that his will was in order and writing a last letter to his parents and siblings in Oconomowoc, Shaftoe went to that park one morning, reintroduced himself to the surprised Goto Dengo, and made arrangements to serve as human punching bag. They found his self-defense skills hilariously primitive but admired his resilience, and so, for the small cost of a few broken ribs and digits, Bobby Shaftoe got a preliminary course in the particular type of chop-socky favored by Goto Dengo, which is called judo. Over time, this even led to a few social engagements in bars, and restaurants, where Shaftoe learned to recognize four types of seaweed, three types of fish eggs, and several flavors of Nip poetry. Of course he had no idea what the fuck they were saying, but he could count syllables, which, as far as he could tell, is about all there is to Nip poetry appreciation.

Not that this--or any other knowledge of their culture--is going to do

him any good now that it will soon be his job to kill them.

In return, Shaftoe taught Goto Dengo how not to throw like a girl. A lot of the Nips are good at baseball and so it was hilarious, even to them, to see their burly friend pushing ineffectually at a baseball. But it was Shaftoe who taught Goto Dengo to stand sideways, to rotate his shoulders, and to follow through. He's paid a lot of attention to the big Nip's throwing form during the last year, and maybe that's why the image of Goto Dengo planting his feet on the ashlars of the Bund, winding up, throwing the streamer-wrapped grenade, and following through almost daintily on one combat-booted foot stays in Shaftoe's mind all the way to Manila and beyond.

A couple of days into the voyage it becomes apparent that Sergeant Frick has forgotten how to shine his boots. Every night he puts them on the deck beside his bunk, like he's expecting a coolie to come around and shine them up during the night. Every morning he wakes up and finds them in a sorrier state than before. After a few days he starts to draw reprimands from On High, starts to get a lot of potato-peeling duty.

Now in and of itself this is forgivable. Frick started out his career chasing bandolier-draped desperadoes away from mail trains on the High Chaparral, for God's sake. In '27 he got shipped off to Shanghai on very short notice, and no doubt had to display some adaptability. Fine. And now he's on this miserable pre-Great War cruiser and it's a little hard on him. Fine. But he does not take all of this with the dignity that is demanded of Marines by Marines. He whines about it. He lets himself get humiliated. He gets angry. A lot of the other old China Marines see things his way.

One day Bobby Shaftoe is up on the deck of the destroyer tossing the old horsehide around with a couple of the other young Marines when he sees a few of these older guys accumulating into a sort of human booger on the afterdeck. He can tell by the looks on their faces and by their gestures that they are bellyaching.

Shaftoe hears a couple of the ship's crew talking to each other nearby. ``What the hell is wrong with those Marines?'' one of them says. The other one shakes his head sadly, like a doctor who has just seen a patient's eyeballs roll up into their sockets. ``Those poor bastards have gone Asiatic,'' he says.

And then they turn and look at Shaftoe.

That evening, at mess, Bobby Shaftoe gulps his food down double-time, then stands up and approaches the table where those Old Breed Marines are sullenly gathered. ``Begging your pardon, Sergeant!'' he hollers. ``Request permission to shine your boots, Sarge!''

Frick's mouth drops open, revealing a half-chewed plug of boiled beef. ``Whud you say, Corporal?''

The mess has gone silent. ``Respectfully request permission to shine your boots, Sarge!''

Frick is not the quickest guy in the world even when he's sober, and it's pretty obvious, just from looking at his pupils, that he and his comrades have brought some opium aboard. ``Wull, uh, I guess so,'' he says. He looks around at his crew of gripers, who are a little confused and a little amused. He unlaces his boots. Bobby Shaftoe takes those disgraceful things away and returns a bit later with them resplendently shined. By this time, Frick has gotten high and mighty. ``Wull, those boots look real good, Corporal Shaftoe,'' he says in a brassy voice. ``Darned if you ain't as good a shoe-shiner as my coolie boy was.''

At lights out, Frick and crew are short-sheeted. Various other, ruder practical jokes ensue during the nighttime. One of them gets jumped in his bunk and beaten by unspecified attackers. The brass call a surprise inspection the next morning and cuss them out. The ``gone Asiatic'' crew spend most of the next day gathered in a cluster, watching each other's backs.

Around midday, Frick finally gets it through his head that all of this was triggered by Shaftoe's gesture, and that Shaftoe knew, all along, what was going to happen. So he rushes Bobby Shaftoe up on the deck and tries to throw him over the rail.

Shaftoe's warned at the last minute by one of his compadres, and spins around just enough to throw off Frick's attack. Frick caroms off the rail, turns around, and tries to grab Shaftoe's nuts. Shaftoe pokes him in the eye, which straightens him right up. They back away from each other. The opening formalities having been finished; they put up their dukes.

Frick and Shaftoe box for a couple of rounds. A large crowd of Marines gathers. On most of their cards, Frick is winning the fight. Frick was always dim-witted, and is now crazy to boot, but he knows his way around a boxing ring, and he has forty pounds on Shaftoe.

Shaftoe puts up with it until Frick socks him pretty hard in the mouth and gives him a bloody lip.

``How far are we from Manila?'' Shaftoe hollers. This question, as usual, leaves Sergeant Frick confused and bewildered, and straightens him up for a moment.

``Two days,'' answers one of the ship's officers.

``Well, goddamn,'' Bobby Shaftoe says. ``How'm I gonna kiss my girl with this fat lip?''

Frick answers, ``Just go out and find a cheaper one.''

That's all he needs. Shaftoe puts his head down and charges in on Frick, hollering like a Nip. Before Frick can get his brain in gear, Bobby Shaftoe has him wrapped up in one of those chop-socky holds that Goto Dengo taught him in Shanghai. He works his way up Frick's body to a choke-hold and then clamps down until Sergeant Frick's lips turn the color of the inside of an oyster shell. Then he hangs Frick over the rail, holding him upside-down by the ankles, until Frick recovers enough to shout, ``Uncle!''

A disciplinary proceeding is hastily called. Shaftoe is found guilty of being courteous (by shining Frick's boots) and defending the life of a

Marine (himself) from a crazed attacker. The crazed attacker goes straight to the brig. Within a few hours, the noises Frick makes lets all of the Marines know what opium withdrawal feels like.

So Sergeant Frick does not get to see their entrance into Manila Bay. Shaftoe almost feels sorry for the poor bastard.

The island of Luzon lies to port all day long, a black hulk barely visible through the haze, with glimpses of palm trees and beaches down below. All of the Marines have been this way before and so they can pick out the Cordillera Central up north, and later the Zambales Mountains, which eventually plunge down to meet the sea near Subic Bay. Subic triggers a barrage of salty anecdotes. The ship does not put in there, but continues to swing southward around Bata'an, turning inland toward the entrance of Manila Bay. The ship reeks of shoe polish, talcum powder, and after-shave lotion; the Fourth Marines may have specialized in whoring and opium abuse, but they've always been known as the best-looking Marines in the Corps.

They pass by Corregidor. An island shaped like a bead of water on a waxed boot, it is gently rounded in the middle but steeply sloping into the water. It has a long, bony, dry tail that trails off at one end. The Marines know that the island is riddled with tunnels and bristling with terrible guns, but the only sign of these fortifications is the clusters of concrete barracks up in the hills, housing the men who serve the weapons. A tangle of antennas rises up above Topside. Their shapes are familiar to Shaftoe, because many of the same antennas rose above Station Alpha in Shanghai, and he had to take them apart and load them into the truck.

There is a giant limestone cliff descending nearly into the sea, and at the base of it is the entrance to the tunnel where all the spooks and radio men have their hideaway. Nearby is a dock, quite busy at the moment, with supplies being offloaded from civilian transports and stacked right there on the beach. This detail is noticed by all of the Marines as a positive sign of approaching war. Augusta drops anchor in the cove, and all of that tarp-wrapped radio stuff is unloaded into launches and taken to that dock, along with all of the odd pencil-necked Navy men who tended that gear in Shanghai.

The swell dies as they pass Corregidor and enter the bay. Greenish-brown algae floats in swirls and curlicues near the surface. Navy ships lay brown ropes of smoke across the still sea. Undisturbed by wind, these unfold into rugged shapes like translucent mountain ranges. They pass the big military base at Cavite--a sheet of land so low and flat that its boundary with the water would be invisible except for the picket line of palm trees. A few hangars and water towers rise from it, and low dark clusters of barracks farther inland. Manila is dead ahead of them, still veiled in haze. It is getting on toward evening.

Then the haze dissolves, the atmosphere suddenly becomes as limpid as a child's eyes, and for about an hour they can see to infinity. They are steaming into an arena of immense thunderheads with lightning corkscrewing down through them all around. Flat grey clouds like shards of broken slate peek out between anvils. Behind them are higher clouds vaulting halfway to the moon, glowing pink and salmon in the light of the setting sun. Behind that, more clouds nestled within banks of humidity like Christmas ornaments wrapped in tissue paper, expanses of blue sky, more thunderheads exchanging bolts of lightning twenty miles

long. Skies nested within skies nested within skies.

It was cold up there in Shanghai, and it's gotten warmer every day since. Some days it's even been hot and muggy. But around the time Manila heaves into view, a warm breeze springs up over the deck and all of the Marines sigh, as if they have all ejaculated in unison.

Manila's perfume

Fanned by the coconut palms

The thighs of Glory

Manila's spreading tile roofs have a mestizo shape about them, half-Spanish and half-Chinese. The city has a concave seawall with a flat promenade on the top. Strollers turn and wave to the Marines; some of them blow kisses. A wedding party is gushing down the steps of a church and across the boulevard to the seawall, where they are getting their pictures taken in the flattering peach-colored light of the sunset. The men are in their fancy, gauzy Filipino shirts, or in U.S. military uniforms. The women are in spectacular gowns and dresses. The Marines holler and whistle at them and the women turn towards them, hitching up their skirts slightly so that they won't trip, and wave enthusiastically. The Marines get woozy and practically fall overboard.

As their ship is easing into its dock, a crescent-shaped formation of flying fish erupts from the water. It moves away like a dune being blown across the desert. The fish are silver and leaf-shaped. Each one strikes the water with a metallic click, and the clicks merge into a crisp ripping noise. The crescent glides beneath a pier, flowing around its pilings, and disappears in the shadows underneath.

Manila, the Pearl of the Orient, early on a Sunday evening, the 7th of December, 1941. In Hawaii, on the other side of the Date Line, it is only just past midnight. Bobby Shaftoe and his comrades have a few hours of freedom. The city is modern, prosperous, English-speaking, and Christian, by far the wealthiest and most advanced city in Asia, practically like being back home in the States. For all its Catholicity, it has areas that seem to have been designed, from the foundation-stones upwards, to the specifications of horny sailors. You get to those parts of town by turning right once your feet are on dry land.

Bobby Shaftoe turns left, politely excuses himself past a legion of excited prostitutes, and sets his course on the looming walls of Intramuros. He stops only to buy a sheaf of roses from a vendor in the park, who is doing land-office business. The park and the walls above it are crowded with strolling lovers, the men mostly in uniforms and the women in demure but stunning dresses, twirling parasols on their shoulders.

A couple of fellows driving horse-drawn taxis want to do business with Bobby Shaftoe but he turns them down. A taxi will only get him there faster, and he is too nervous to get there fast. He walks through a gate in the wall and into the old Spanish city.

Intramuros is a maze of buff-colored stone walls rising abruptly from narrow streets. The first-floor windows along the sidewalks are guarded by black ironwork cages. The bars swell, swirl, and sprout finedly

hammered leaves. The second stories hang out overhead, sporting gas lights that are just now being lit by servants with long, smoking poles. The sound of laughter and music drifts out of the windows above, and when he passes by the archways that open into the inner courtyards, he can smell flowers back in the gardens.

Damned if he can tell these places apart. He remembers the street name of Magallanes, because Glory told him once it was the same thing as ``Magellan.'' And he remembers the view of the cathedral from the Pascuals' window. He wanders around a block a couple of times, certain that he is close. Then he hears an exaltation of girlish laughter coming from a second-story window, and moves toward it like a jellyfish sucked into an intake pipe. It all comes together. This is the place. The girls are all gossiping, in English, about one of their instructors. He does not hear Glory's voice but he thinks he hears her laughter.

``Glory!'' he says. Then he says it louder. If they hear him, they pay him no mind. Finally he winds up and flings the bouquet of roses like a potato-masher grenade over the wooden railing, through a narrow gap between the mother-of-pearl shutters, and into the room.

Miraculous silence from within the room, and then gales of laughter. The nacre shutters part with slow, agonizing coyness. A girl of nineteen steps out onto the balcony. She is dressed in the uniform of a nursing student. It is as white as starlight shining on the North Pole. She has let her long black hair down to brush it, and it stirs languidly in the evening breeze. The last ruddy light of the sunset makes her face glow like a coal. She hides behind the bouquet for a moment, buries her nose in it, inhales deeply, peeking out at him over the blossoms with her black eyes. Then she lowers the bouquet gradually to reveal her high cheeks, her perfect little nose, the fantastic sculpture of her lips, and teeth, white but fetchingly crooked, barely visible. She is smiling.

``Jesus H. Christ,'' Bobby Shaftoe says, ``your cheekbones are like a fucking snowplow.''

She puts her finger to her lips. The gesture of anything touching Glory's lips puts an invisible spear through Shaftoe's chest. She eyes him for a while, establishing, in her own mind, that she has the boy's attention and that he is not going anywhere. Then she turns her back on him. The light grazes her buttocks, showing nothing but suggesting cleavage. She goes back inside and the shutter glides shut behind her.

Suddenly the room full of girls becomes quiet, except for occasional ripples of suppressed laughter. Shaftoe bites his tongue. They are screwing it all up. Mr. or Mrs. Pascual will notice their silence and become suspicious.

Ironwork clangs and a big gate swings open. The porter beckons him inside. Shaftoe follows the old fellow down the black, arched tunnel of the porte-cochere. The hard soles of his shiny black shoes skid on the cobblestones. A horse back in the stable whinnies at the smell of his aftershave. Sleepy American music, slow-dance stuff from the Armed Forces station, spills tinnily from a radio in the porter's nook.

Flowering vines grow up the stone walls of the courtyard. It is a tidy, quiet, enclosed world, almost like being indoors. The porter waves him in the direction of one of the stairways that lead up to the second floor.

Glory calls it the entresuelo and says that it's really a floor between the floors, but it looks like a full-fledged, regular floor to Bobby Shaftoe. He mounts the steps and looks up to see Mr. Pascual standing there, a tiny bald man with glasses and a trim little mustache. He is wearing a short-sleeved shirt, American style, and khaki trousers, and slippers, and is holding a glass of San Miguel in one hand and a cigarette in the other. ``Private Shaftoe! Welcome back,'' he says.

So. Glory has decided to play this one by the book. The Pascuals have been alerted. A few hours of socializing now stand between Bobby Shaftoe and his girl. But a Marine is never fazed by such setbacks.

``Begging your pardon, Mr. Pascual, but I am a corporal now.''

Mr. Pascual puts his cigarette in his mouth and shakes Corporal Shaftoe's hand. ``Well, congratulations! I just saw your uncle Jack last week. I don't think he had any idea you were on your way back.''

``It was a surprise to everyone, sir,'' Bobby Shaftoe says.

Now they are on a raised walkway that runs around the courtyard. Only livestock and servants live at ground level. Mr. Pascual leads them around to a door that takes them into the entresuelo. The walls here are rough stone, the ceilings are simple painted planks. They pass through a dark, somber office where Mr. Pascual's father and grandfather used to receive the managers of the family's haciendas and plantations. For a moment, Bobby Shaftoe gets his hopes up. This level has a few rooms that back in the old days were apartments for high-ranking servants, bachelor uncles, and spinster aunts. Now that the hacienda business ain't what it used to be, the Pascuals are renting them out to female students. Perhaps Mr. Pascual is leading him directly to Glory.

But this goes the way of all foolish, horny illusions as Shaftoe finds himself at the foot of a vast staircase of polished nara wood. He can see pressed-tin ceiling up there, chandeliers, and the imposing superstructure of Mrs. Pascual, contained within a mighty bodice that looks like something dreamed up by naval engineers. They ascend the stairs into the antesala, which according to Glory is strictly for casual, drop-in visitors but is fancier than any room Bobby Shaftoe has ever seen. There are big vases and pots all over the place, supposedly old, and supposedly from Japan and China. A fresh breeze runs through; he looks out a window and sees, neatly framed in it, the green dome of the cathedral with its Celtic cross on top, just as he remembered it. Mrs. Pascual holds out her hand and Shaftoe clasps it. ``Mrs. Pascual,'' he says, ``thank you for welcoming me into your home.''

``Please sit down,'' she says, ``we want to hear everything.''

Shaftoe sits in a fancy chair next to the piano, adjust his trousers a bit so that they will not cramp his erect penis, checks his shave. It probably has a few good hours left. A wing of airplanes drones overhead. Mrs. Pascual is giving instructions to the maid in Tagalog. Shaftoe examines the crusted lacerations on his knuckles and wonders whether Mrs. Pascual has the slightest idea of what she would be in for if he really told her everything. Perhaps a little anecdote about hand-to-hand combat with Chinese river pirates on the banks of the Yangtze would break the ice. Through a door and down the hall, he can see a corner of the family chapel, all Gothic arches, a gilded altar, and in front of it an

embroidered kneeler worn threadbare by the patellas of Mrs. Pascual.

Cigarettes are brought round, stacked in a large lacquer box like artillery shells in a crate. They drink tea and exchange small talk for what seems like about thirty-six hours. Mrs. Pascual wants to be reassured, over and over again, that everything is fine and that there will not be a war. Mr. Pascual obviously believes that war is just around the corner, and mostly broods. Business has been good lately. He and Jack Shaftoe, Bobby's uncle, have been shipping a lot of stuff between here and Singapore. But business will get a lot worse soon, he thinks.

Glory appears. She has changed out of her student's uniform and into a dress. Bobby Shaftoe nearly topples backward out of the window. Mrs. Pascual formally reintroduces them. Bobby Shaftoe kisses Glory's hand in what he thinks is more than likely a very gallant gesture. He's glad he did, because Glory is palming a tiny wadded-up note which ends up in his hand.

Glory takes a seat and is duly issued her own teacup. Another eternity of small talk. Mr. Pascual asks him for the eighty-seventh time whether he has touched base with Uncle Jack yet, and Shaftoe reiterates that he literally just stepped off the boat and will certainly see Uncle Jack tomorrow morning. He excuses himself to the bathroom, which is an old-fashioned two-holer mounted above deep shafts that must descend all the way to hell. He unwads and reads Glory's note, memorizes the instructions, tears it up and sprinkles it down the hole.

Mrs. Pascual allows the two young lovers a full half hour of ``private'' time together, meaning that the Pascuals leave the room and only come back every five minutes or so to check up on them. There is a painfully elaborate and lengthy good-bye ceremony which ends in Shaftoe returning to the street and Glory waving to him from her balcony.

Half an hour later, they are doing tongue judo in the back of a horse-drawn taxi galloping over the cobblestones toward the nightclubs of Malate. The extraction of Glory from the Pascual residence was a simple matter for a highly motivated China Marine and a squadron of saucy nursing students.

But Glory must be kissing him with her eyes open because all of a sudden she wriggles loose and says to the taxi driver, ``Stop! Please stop, sir!''

``What is it?'' Shaftoe says blurrily. He looks around and sees nothing but a great big old stone church looming up above them. This brings a preliminary stab of fear. But the church is dark, there's no Filipinas in long dresses, no Marines in dress uniforms, it can't be his wedding.

``I want to show you something,'' Glory says, and clambers down out of the taxi. Shaftoe has to pursue her into the place--the Church of San Augustin. He's gone by this pile many times but he never reckoned he would come inside--on a date.

She stands at the bottom of a huge staircase and says, ``See?''

Shaftoe looks up into darkness, thinks there might be a stained-glass window or two up there, maybe a Laceration of Christ or an Impalement of the Blessed Thorax, but--

``Look down,'' Glory says, and taps one miniature foot against the first tread of the staircase. It is a single great big huge slab of granite.

``Looks like ten or twenty tons of rock there I'd estimate,'' he says authoritatively.

``It came from Mexico.''

``Ah, go on!''

Glory smiles at him. ``Carry me up the stairs.'' And in case Shaftoe's thinking of refusing, she sort of falls into him, and he has no choice but to catch her up in his arms. She traps his nape in the crook of her arm, the better to pull her face close to his, but what he remembers is how the silk of her sleeve feels against the freshly shaved skin of his neck. He begins the ascent. Glory doesn't weigh much, but after four steps he has broken a fine sweat. She is watching him, from four inches away, for signs of fatigue, and he feels himself blushing. Good thing that the whole staircase is lit up by about two candles. There's a lovely bust of a thorn-crowned Jesus with long parallel blood-drops running down his face, and on the right--

``These giant stones you are walking on were quarried in Mexico, centuries and centuries ago, before America was even a country. They were brought over in the bottoms of the Manila Galleons, as ballast.'' She pronounces it bayast.

``I'll be damned.''

``When those galleons arrived, the stones were brought out of their bellies, one by one, and taken here to the Church of San Agustin, and piled up. Each stone on top of the last year's stone. Until finally after many, many years this staircase was finished.''

After a while it seems to Shaftoe as though it's going to take at least that many years to reach the top of the damn thing. The summit is adorned with a life-sized Jesus carrying a cross that appears to be at least as heavy as one of those stair-treads. So who's he to complain? Then Glory says, ``Now carry me down, so you will remember the story.''

``You think I'm some horny jarhead who won't remember a story unless it's got a pretty girl in it?''

``Yes,'' Glory says, and laughs in his face. He carries her down to the bottom again. Then, before she goes off on some other tangent, he carries her straight out the door and into the taxi.

Bobby Shaftoe is not one to lose his cool in the heat of action, but the rest of the evening is a blurry fever dream to him. Only a few impressions penetrate the haze: alighting from the taxi in front of a waterfront hotel; all of the other boys gaping at Glory; Bobby Shaftoe glaring at them, threatening to teach them some manners. Slow dancing with Glory in the ballroom, Glory's silk-clad thigh gradually slipping between his legs, her firm body pressing harder and harder against his. Strolling along the seawall, hand in hand beneath the

starlight. Noticing that the tide is out. Exchanging a look. Carrying her down from the seawall to the thin strip of rocky beach beneath it.

By the time he is actually fucking her, he has more or less lost consciousness, he is off in some fantastic, libidinal dream. He and Glory fuck without the slightest hesitation, without any doubts, without any troublesome thinking whatsoever. Their bodies have spontaneously merged, like a pair of drops running together on a windowpane. If he is thinking anything at all, it is that his entire life has culminated in this moment. His upbringing in Oconomowoc, high school prom night, deer hunting in the Upper Peninsula, Parris Island boot camp, all of the brawls and struggles in China, his duel with Sergeant Frick, they are wood behind the point of a spear.

Sirens are blowing somewhere. He startles back to awareness. Has he been here all night long, holding Glory up against the seawall, her thighs wrapped around his waist? That would not be possible. The tide hasn't come in at all.

``What is it?'' she says. Her hands are clasped around the back of his neck. She lets go and runs them down his chest.

Still holding her up, his hands making a sling under her warm and flawless ass, Shaftoe backs away from the seawall and turns around on the beach, looking at the sky. He sees searchlights beginning to come on. And it ain't no Hollywood premiere.

``It's war, baby,'' he says.

FORAYS

The lobby of the manila hotel is about the size of a football field. It smells like last year's perfume, rare tropical orchids, and bug spray. There is a metal detector set up at the front door, because the Prime Minister of Zimbabwe happens to be staying here for a couple of days. Big Africans in good suits stand around the place in clusters of two and three. Mini-throngs of Nipponese tourists, in their Bermuda shorts, sandals and white socks, have lodged themselves in the deep, thick, wide sofas and sit quietly, waiting for a prearranged signal. Upper-class Filipino children brandish cylindrical potato chip canisters like tribal chieftains carrying ceremonial maces. A dignified old bellman carrying a hand-pumped tank circulates around the defensive perimeter and silently sprays insecticide against the baseboard. Enter Randall Lawrence Waterhouse, in a turquoise polo shirt embroidered with the logo of one of the bankrupt high-tech companies that he and Avi have founded, and relaxed-fit blue jeans held up with suspenders, and bulky athletic shoes that once were white.

As soon as he got through the formalities at the airport, he perceived that the Philippines are, like Mexico, one of those countries where Shoes Matter. He approaches the registration counter quickly so that the ravishing young woman in the navy-blue uniform will not see his feet. A couple of bellhops are engaged in a pathetic, Sisyphean contest with his bag, which has roughly the dimensions and mass of a two-drawer filing cabinet. ``You will not be able to find technical books there,'' Avi told him, ``bring anything you might conceivably need.''

Randy's suite is a bedroom and living room, both with fourteen-foot ceilings, and a corridor along one side containing several closets and various plumbing-related technologies. The entire thing is lined in some kind of tropical hardwood stained to a lovely glowing auburn, which would be dismal in the northern latitudes but, here, gives it a cozy and cool feeling. The two main rooms each have huge windows with tiny signs by the latch handles warning of tropical insects. Each room is defended from its windows by a multilayered system of interlocking barriers: incredibly massive wooden shutters that rumble back and forth on tracks, like freight trains maneuvering in a switching yard; a second layer of shutters consisting of two-inch squares of nacre held in a polished wooden grid, sliding on its own set of tracks; window sheers, and finally, heavy-gauge blackout curtains, each suspended from its own set of clanging industrial rails.

He orders up a large pot of coffee, which barely keeps him awake long enough to unpack. It is late afternoon. Purple clouds tumble out of the surrounding mountains with the palpable momentum of volcanic mudflows and turn half of the sky into a blank wall striped with vertical bolts of lightning; the walls of the hotel room flash with it as though paparazzi are working outside the window. Below, food vendors in Rizal Park run up and down the sidewalks to get out of the rain, which falls, as it has been doing for about half a millennium, on the sloping black walls of Intramuros. If those walls did not run in straight lines they could be mistaken for a natural freak of geology: ridges of bare, dark volcanic rock erupting from the grass like teeth from gums. The walls have dovetail-shaped notches that converge to old gun emplacements, providing interlocking fields of fire across a dry moat.

Living in the States, you never see anything older than about two and a half centuries, and you have to visit the eastern fringe of the country to see that. The business traveler's world of airports and taxicabs looks the same everywhere. Randy never really believes he's in a different country until he sees something like Intramuros, and then he has to stand there like an idiot for a long time, ruminating.

Right now, across the Pacific Ocean, in a small, tasteful Victorian town located a third of the way from San Francisco to Los Angeles, computers are seizing up, crucial files are disappearing, and e-mail is careening into intergalactic space, because Randy Waterhouse is not there to keep an eye on things. The town in question sports three small colleges: one founded by the State of California and two founded by Protestant denominations that are now actively reviled by the majority of their faculty. Taken together these colleges--the Three Siblings--comprise an academic center of middling importance. Their computer systems are linked into one. They exchange teachers and students. From time to time they host academic conferences. This part of California has beaches, mountains, redwood forests, vineyards, golf courses, and sprawling penal facilities all over the place. There are plenty of three- and four-star hotel rooms, and the Three Siblings, taken together, have enough auditoria and meeting rooms to host a conference of several thousand.

Avi's telephone call, some eighty hours ago, arrived in the middle of a major interdisciplinary conference called ``The Intermediate Phase (1939›45) of the Global Hegemony Struggle of the Twentieth Century (Common Era).'' This is a bit of a mouthful and so it has been given a pithy nickname: ``War as Text.''

People are coming from places like Amsterdam and Milan. The conference's organizing committee--which includes Randy's girlfriend, Charlene, who actually gives every indication of being his ex-girlfriend now--hired an artist in San Francisco to come up with a poster. He started with a black-and-white halftone photo of a haggard World War Two infantryman with a cigarette dangling from his lower lip. He worked this image over using a photocopier, blowing the halftone dots up into rough lumps, like rubber balls chewed by a dog, and wreaking any number of other distortions on it until it had an amazingly stark, striking, jagged appearance; the soldier's pale eyes turned an eerie white. Then he added a few elements in color: red lipstick, blue eyeshadow, and a trace of a red brassiere strap peeking out from the soldier's unbuttoned uniform shirt.

The poster won some kind of an award almost the moment it came out. This led to a press release, which in turn led to the poster's being enshrined by the news media as an Official Object of Controversy. An enterprising journalist managed to track down the soldier depicted in the original photograph--a decorated combat veteran and retired tool-and-die maker who, as it happened, was not merely alive but in excellent health, and, since the death of his wife from breast cancer, had spent his retirement roaming around the Deep South in his pickup truck, helping to rebuild black churches that had been torched by drunken yahoos.

The artist who had designed the poster then confessed that he had simply copied it from a book and had made no effort whatsoever to obtain permission--the entire concept of getting permission to use other people's work was faulty, since all art was derivative of other art. High-powered trial lawyers converged, like dive bombers, on the small town in Kentucky where the aggrieved veteran was up on the roof of a black church with a mouthful of nails, hammering down slabs of A/D exterior plywood and mumbling ``no comment'' to a horde of reporters down on the lawn. After a series of conferences in a room at the town's Holiday Inn, the veteran emerged, accompanied by one of the five most famous lawyers on the face of the planet, and announced that he was filing a civil suit against the Three Siblings that would, if it succeeded, turn them and their entire community into a flat, smoking abrasion in the earth's crust. He promised to split the proceeds between the black churches and various disabled veterans' and breast cancer research groups.

The organizing committee pulled the poster from circulation, which caused thousands of bootleg copies to go up on the World Wide Web and, in general, brought it to the attention of millions who never would have seen it otherwise. They also filed suit against the artist, whose net worth could be tallied up on the back of a ticket stub: he had assets of about a thousand dollars and debts (mostly student loans) amounting to sixty-five thousand.

All of this happened before the conference even began. Randy was aware of it only because Charlene had roped him into providing computer support for the conference, which meant setting up a Web site and e-mail access for the attendees. When all of this hit the news, e-mail began to flood in, and quickly jammed up all of the lines and filled up all of the disk capacity that Randy had spent the last month setting up.

Conferees began to arrive. A lot of them seemed to be sleeping in the house where Randy and Charlene had been living together for seven years. It was a big old Victorian house and there was plenty of room. They stumbled in from Heidelberg and Paris and Berkeley and Boston, then sat around Randy and Charlene's kitchen table drinking coffee and talking at great length about the Spectacle. Randy inferred that the Spectacle meant the poster furor, but as they went on and on about it, he sensed that they were using the word not in a conventional sense but as part of some academic jargon; that it carried a heavy load of shadings and connotations to them, none of which Randy would ever understand unless he became one of them.

To Charlene, and to all of the people attending War as Text, it was self-evident that the veteran who filed the lawsuit was the very worst kind of human being--just the sort they had gathered together to debunk, burn in effigy, and sweep into the ash-bin of posthistorical discourse. Randy had spent a lot of time around these people, and thought he'd gotten used to them, but during those days he had a headache all the time, from clenching his teeth, and he kept jumping to his feet in the middle of meals or conversations and going out for solitary walks. This was partly to keep himself from saying something undiplomatic, and partly as a childish but fruitless tactic to get the attention he craved from Charlene.

He knew the whole poster saga was going to be a disaster from early on. He kept warning Charlene and the others. They listened coolly, clinically, as if Randy were a test subject on the wrong side of a one-way mirror.

Randy forces himself to stay awake long enough for it to get dark. Then he lies in bed for a few hours trying to sleep. The container port is just north of the hotel, and all night long, Rizal Boulevard, along the base of the old Spanish wall, is jammed from one end to the other with container-carrying semis. The whole city is a cauldron of internal combustion. Manila seems to have more pistons and exhaust pipes than the rest of the world combined. Even at two in the morning the hotel's seemingly unshakable mass hums and rattles from the seismic energy pouring from all of those motors. The noise detonates car alarms down in the hotel's lot. The noise of one alarm triggers others, and so on. It is not the noise that keeps Randy awake so much as the insane stupidity of this chain reaction. It is an object lesson: the kind of nightmarish, snowballing technological fuck-up that keeps hackers awake at night even when they can't hear the results.

He paws open a Heineken from his minibar and stands in front of the window, looking. Many of the trucks are adorned with brilliant displays of multicolored lights--not quite as flashy as those of the few jeepneys that scurry and jostle among them. Seeing so many people awake and working puts sleep out of the question.

He is too jet-lagged to accomplish anything that requires actual thought--but there is one important job he can do, which requires no thinking whatsoever. He starts up his laptop again. Seeming to levitate in the center of his dark room, the screen is a perfect rectangle of light the color of diluted milk, of a Nordic dawn. This light originates in small fluorescent tubes imprisoned in the polycarbonate coffin of his computer's display. It can only escape through a pane of glass, facing Randy, which is entirely covered by small transistors arranged in a grid,

which let photons through, or don't, or let through only those of a particular wavelength, cracking the pale light into colors. By turning those transistors on and off according to some systematic plan, meaning is conveyed to Randy Waterhouse. A good filmmaker could convey a whole story to Randy by seizing control of those transistors for a couple of hours.

Unfortunately, there are a lot more laptop computers floating around than there are filmmakers worth paying attention to. The transistors are almost never put into the hands of human beings. They are controlled, instead, by software. Randy used to be fascinated by software, but now he isn't. It's hard enough to find human beings who are interesting.

The pyramid and the eyeball appear. Randy spends so much time using Ordo now that he has his machine boot it up automatically.

Nowadays the laptop has only one function for Randy: he uses it to communicate with other people, through e-mail. When he communicates with Avi, he has to use Ordo, which is a tool for taking his ideas and converting them into streams of bits that are almost indistinguishable from white noise, so that they can be sent to Avi in privacy. In exchange, it receives noise from Avi and converts it into Avi's thoughts. At the moment, Epiphyte has no assets other than information--it is an idea, with some facts and data to back it up. This makes it eminently stealable. So encryption is definitely a good idea. The question is: how much paranoia is really appropriate?

Avi sent him encrypted e-mail:

When you get to Manila I would like you to generate a 4096-bit key pair and keep it on a floppy disk that you carry on your person at all times. Do not keep it on your hard disk. Anyone could break into your hotel room while you're out and steal that key.

Now, Randy pulls down a menu and picks an item labeled: ``New key. . . .''

A box pops up giving him several KEY LENGTH options: 768 bits, 1024, 1536, 2048, 3072, or Custom. Randy picks the latter option and then, wearily, types in 4096.

Even a 768-bit key requires vast resources to break. Add one bit, to make it 769 bits long, and it becomes twice as difficult. A 770-bit key is twice as difficult yet, and so on. By using 768-bit keys, Randy and Avi could keep their communications secret from nearly every entity in the world for at least the next several years. A 1024-bit key would be vastly, astronomically more difficult to break.

Some people go so far as to use keys 2048 or even 3072 bits in length. These will stop the very best codebreakers on the face of the earth for astronomical periods of time, barring the invention of otherworldly technologies such as quantum computers. Most encryption software--even stuff written by extremely security-conscious cryptography experts--can't even handle keys larger than that. But Avi insists on using Ordo, generally considered the best encryption software in the world, because it can handle keys of unlimited length--as long as you don't mind waiting for it to crunch all the numbers.

Randy begins typing. He is not bothering to look at the screen; he is staring out the window at the lights on the trucks and the jeepneys. He is only using one hand, just flailing away loosely at the keyboard.

Inside Randy's computer is a precise clock. Whenever he strikes a key, Ordo uses that clock to record the current time, down to microseconds. He hits a key at 03:05:56.935788 and he hits another one at 03:05:57.290664, or about .354876 seconds later. Another .372307 seconds later, he hits another one. Ordo keeps track of all of these intervals and discards the more significant digits (in this example the .35 and the .37) because these parts will tend to be similar from one event to the next.

Ordo wants randomness. It only wants the least significant digits--say, the 76 and the 07 at the very ends of these numbers. It wants a whole lot of random numbers, and it wants them to be very, very random. It is taking somewhat random numbers and feeding them through hash functions that make them even more random. It is running statistical routines on the results to make sure that they contain no hidden patterns. It has breathtakingly high standards for randomness, and it will not stop asking Randy to whack on the keyboard until those standards are met.

The longer the key you are trying to generate, the longer this takes. Randy is trying to generate one that is ridiculously long. He has pointed out to Avi, in an encrypted e-mail message, that if every particle of matter in the universe could be used to construct one single cosmic supercomputer, and this computer was put to work trying to break a 4096-bit encryption key, it would take longer than the lifespan of the universe.

``Using today's technology,'' Avi shot back, ``that is true. But what about quantum computers? And what if new mathematical techniques are developed that can simplify the factoring of large prime numbers?''

``How long do you want these messages to remain secret?'' Randy asked, in his last message before leaving San Francisco. ``Five years? Ten years? Twenty-five years?''

After he got to the hotel this afternoon, Randy decrypted and read Avi's answer. It is still hanging in front of his eyes, like the afterimage of a strobe:

I want them to remain secret for as long as men are capable of evil.

The computer finally beeps. Randy rests his tired hand. Ordo politely warns him that it may be busy for a while, and then goes to work. It is searching the cosmos of pure numbers, looking for two big primes that can be multiplied by each other to produce a number 4096 bits long.

If you want your secrets to remain secret past the end of your life expectancy, then, in order to choose a key length, you have to be a futurist. You have to anticipate how much faster computers will get during this time. You must also be a student of politics. Because if the entire world were to become a police state obsessed with recovering old secrets, then vast resources might be thrown at the problem of factoring large prime numbers.

So the length of the key that you use is, in and of itself, a code of sorts. A knowledgeable government eavesdropper, noting Randy's and Avi's use of a 4096-bit key, will conclude one of the following:

--Avi doesn't know what he's talking about. This can be ruled out with a bit of research into his past accomplishments. Or,

--Avi is clinically paranoid. This can also be ruled out with some research. Or,

--Avi is extremely optimistic about the future development of computer technology, or pessimistic about the political climate, or both. Or,

--Avi has a planning horizon that extends over a period of at least a century.

Randy paces around his room while his computer soars through number space. The shipping containers on the backs of those trucks bear exactly the same logos as the ones that used to fill the streets of South Seattle when a ship was unloading. To Randy this is oddly satisfying, as if, by making this crazy lunge across the Pacific, he has brought some kind of antipodal symmetry to his life. He has gone from the place where things are consumed to where they are produced, from a land where onanism has been enshrined at the highest levels of the society to one where cars have ``NO to contraception!'' stickers in their windows. It feels bizarrely right. He has not felt this way since Avi and he founded their first doomed business venture twelve years ago.

Randy grew up in a college town in eastern Washington State, graduated from the University of Washington in Seattle, and landed a Clerk Typist II job at the library there--specifically the Interlibrary Loan Department--where his job was to process incoming loan requests mailed in from smaller libraries all over the region and, conversely, to mail out requests to other libraries. If nine-year-old Randy Waterhouse had been able to look into the future and see himself in this career, he would have been delighted beyond measure: the primary tool of the Interlibrary Loan Department was the Staple Remover. Young Randy had seen one of these devices in the hands of his fourth-grade teacher and been enthralled by its cunning and deadly appearance, so like the jaws of some futuristic robot dragon. He had, in fact, gone out of his way to staple things incorrectly just so he could prevail on his teacher to unstaple them, giving him another glimpse of the blood-chilling mandibles in action. He had gone so far as to steal a staple remover from an untended desk at church and then incorporate it into an Erector-set robot hunter-killer device with which he terrorized much of the neighborhood; its pit-viper yawn separated many a cheap plastic toy from its parts and accessories before the theft was discovered and Randy made an example of before God and man. Now, in the Interlibrary Loan office, Randy had not just one but several staple removers in his desk drawer and was actually obligated to use them for an hour or two a day.

Since the UW library was well-endowed, its patrons didn't request books from other libraries unless they had been stolen from their own or were, in some way, peculiar. The ILL office (as Randy and his coworkers affectionately called it) had its regulars--people who had a whole lot of

peculiar books on their wish lists. These people tended to be either tedious or scary or both. Randy always ended up dealing with the ``both'' subgroup, because Randy was the only Clerk Typist in the office who was not a lifer. It seemed clear that Randy, with his astronomy degree and his extensive knowledge of computers, would one day move on, whereas his coworkers did not harbor further ambitions. His larger sphere of interests, his somewhat broader concept of normalcy, was useful when certain patrons came into the office.

By the standards of many, Randy was himself a tedious, scary, obsessed character. He was not merely obsessed with science but also with fantasy role-playing games. The only way he could tolerate working at such a stupid job for a couple of years was that his off time was completely occupied with enacting fantasy scenarios of a depth and complexity that exercised all of the cranial circuitry that was so conspicuously going to waste in the ILL office. He was part of a group that would meet every Friday night and play until sometime on Sunday. The other stalwarts in the group were a computer science/music double major named Chester, and a history grad student named Avi.

When a new master's degree candidate named Andrew Loeb walked into the ILL office one day, with a certain glint in his eye, and produced a three-inch-thick stack of precisely typed request forms from his shitty old knapsack, he was recognized immediately as being of a particular type, and shunted in the direction of Randy Waterhouse. It was an instant meeting of minds, though Randy did not fully realize this until the books that Loeb had requested began to arrive on the trolley from the mail room.

Andy Loeb's project was to figure out the energy budgets of the local Indian tribes. A human body has to expend a certain amount of energy just to keep breathing and to maintain its body temperature. This figure goes up when it gets cold or when the body in question is doing work. The only way to obtain that energy is by eating food. Some foods have a higher energy content than others. For example, trout is highly nutritious but so low in fat and carbohydrates that you can starve to death eating it three times a day. Other foods might have lots of energy, but might require so much work to obtain and prepare that eating them would be a losing proposition, BTU-wise. Andy Loeb was trying to figure out what foods had historically been eaten by certain Northwest Indian tribes, how much energy they expended to get these foods and how much they obtained by eating them. He wanted to do this calculation for coastal Indians like the Salish (who had easy access to seafood) and for inland ones like the Cayuse (who didn't) as part of an extremely convoluted plan to prove some sort of point about the relative standards of living of these tribes and how this affected their cultural development (coastal tribes made lots of fantastically detailed art and inland ones occasionally scratched stick figures on rocks).

To Andrew Loeb it was an exercise in meta-historical scholarship. To Randy Waterhouse, it sounded like the beginnings of a pretty cool game. Strangle a muskrat and you get 136 Energy Points. Lose the muskrat and your core temp drops another degree.

Andy was nothing if not methodical and so he had simply looked up every book that had ever been written on such topics, and every book mentioned in those books' bibliographies, yea, even unto four or five generations; checked out all of them that were available locally; and ordered the rest from ILL. All of the latter passed across Randy's desk.

Randy read some and skimmed all. He got to learn about how much blubber the Arctic explorers had to eat in order to keep from starving to death. He perused detailed specifications for Army C-rations. After a while, he actually began sneaking into the photocopy room and making copies of key data.

In order to run a realistic fantasy role-playing game, you had to keep track of how much food the imaginary characters were getting and how much trouble was involved in getting it. Characters passing across the Gobi desert in November of the year 5000 B.C. would have to spend more time worrying about food than, say, ones who were traveling across central Illinois in 1950.

Randy was hardly the first game designer to notice this. There were a few incredibly stupid games in which you didn't have to think about food, but Randy and his friends disdained them. In all of the games that he participated in, or that he himself designed, you had to devote a realistic amount of effort to getting food for your character. But it was not easy to determine what was realistic. Like most designers, Randy got over the problem by slapping together a few rudimentary equations that he basically just pulled out of thin air. But in the books, articles, and dissertations that Andrew Loeb was borrowing through ILL, he found exactly the raw data that a mathematically inclined person would need to come up with a sophisticated rules system based on scientific fact.

Stimulating all of the physical processes going on in each character's body was out of the question, especially in a game where you might be dealing with armies of a hundred thousand men. Even a crude simulation, tracking only a few variables and using simple equations, would involve a nightmarish amount of paperwork if you did it all by hand. But all of this was happening in the mid-1980s, when personal computers had become cheap and ubiquitous. A computer could automatically track a large database and tell you whether each character was well-fed or starving. There was no reason not to do it on a computer.

Unless, like Randy Waterhouse, you had such a shitty job that you couldn't afford a computer.

Of course, there's a way to dodge any problem. The university had lots of computers. If Randy could get an account on one of them, he could write his program there and run it for free.

Unfortunately, accounts were only available to students or faculty members, and Randy was neither.

Fortunately, he started dating a grad student named Charlene at just about this time.

How the hell did a generally keg-shaped guy, a hard scientist, working a dead-end Clerk Typist job, and spending all his spare time in the consummately nerdy pastime of fantasy role-playing games, end up in a relationship with a slender and not unattractive young liberal arts student who spent her spare time sea kayaking and going to foreign films? It must have been one of those opposites-attract kind of deals, a complementary relationship. They met, naturally, in the ILL office, where the highly intelligent but steady and soothing Randy helped the highly intelligent but scattered and flighty Charlene organize a messy

heap of loan requests. He should have asked her out then and there, but he was shy. Second and third opportunities came along when the books she'd requested began to filter up from the mailroom, and finally he asked her out and they went to see a film together. Both of them turned out to be not just willing but eager, and possibly even desperate. Before they knew it, Randy had given Charlene a key to his apartment, and Charlene had given Randy the password to her free university computer account, and everything was just delightful.

The university computer system was better than no computer at all. But Randy was humiliated. Like every other high-powered academic computing network, this one was based on an industrial-strength operating system called UNIX, which had a learning curve like the Matterhorn, and lacked the cuddly and stylish features of the personal computers then coming into vogue. Randy had used it quite a bit as an undergraduate and knew his way around. Even so, learning how to write good code on the thing required a lot of time. His life had changed when Charlene had come along, and now it changed more: he dropped out of the fantasy role-playing game circuit altogether, stopped going to meetings of the Society for Creative Anachronism, and began to spend all of his free time either with Charlene or in front of a computer terminal. All in all, this was probably a change for the better. With Charlene, he did things he wouldn't have done otherwise, like getting exercise, or going to see live music. And at the computer, he was learning new skills, and he was creating something. It might be something completely useless, but at least he was creating.

He spent a lot of time talking to Andrew Loeb, who actually went out and did the stuff he was writing programs for; he'd disappear for a few days and come back all wobbly and haggard, with fish scales caught in his whiskers or dried animal blood under his fingernails. He'd ram down a couple of Big Macs, sleep for twenty-four hours, then meet Randy in a bar (Charlene wasn't comfortable with having him in the house) and talk learnedly of the difficulties of day-to-day life, aboriginal style. They argued about whether aborigines would eat the more disgusting parts of certain animals or throw them away. Andrew voted for yes. Randy disagreed--just because they were primitive didn't mean they couldn't have taste. Andrew accused him of being a romantic. Finally, to settle it, they went up into the mountains together, armed with nothing but knives and Andrew's collection of exquisitely crafted vermin snares. By the third night, Randy found himself seriously thinking about eating some insects. ``Q.E.D.,'' Andrew said.

Anyway, Randy finished his software after a year and a half. It was a success; Chester and Avi liked it. Randy was moderately pleased at having built something so complicated that actually worked, but he had no illusions about its being good for anything. He was sort of embarrassed at having wasted so much time and mental energy on the project. But he knew that if he hadn't been writing code, he'd have spent the same amount of time playing games or going to Society for Creative Anachronism meetings in medieval drag, so it all zeroed out in the end. Spending the time in front of the computer was arguably better, because it had honed his programming skills, which had been pretty sharp to begin with. On the other hand, he'd done it all on the UNIX system, which was for scientists and engineers--not a savvy move in an age when all the money was in personal computers.

Chester and Randy had nicknamed Avi ``Avid,'' because he really, really liked fantasy games. Avi had always claimed that he played them as a way of understanding what it was really like to live in ancient times, and

he was a maniac about historical authenticity. That was okay; they all had half-assed excuses, and Avi's historical acumen frequently came in handy.

Not long after this, Avi graduated and disappeared, and popped up a few months later in Minneapolis, where he had gotten a job with a major publisher of fantasy role-playing games. He offered to buy Randy's game software for the astonishingly large sum of $1000 plus a small cut of future profits. Randy accepted the offer in its general outlines, asked Avi to send him a contract, then went out and found Andrew boiling some fish guts in a birchbark kettle atop a Weber grill on the roof of the apartment building where he lived. He wanted to give Andrew the good news, and to cut him in on the proceeds. What ensued was a really unpleasant conversation, standing up there in a pelting, spitting, wind-blown rain.

To begin with, Andrew took this deal far more seriously than Randy did. Randy saw it as a windfall, a lark. Andrew, who was the son of a lawyer, treated it as if it were a major corporate merger, and asked many tedious and niggling questions about the contract, which did not exist yet and which would probably cover a single piece of paper when it did. Randy didn't realize it at the time, but by asking so many questions for which Randy had no answers, Andrew was, in effect, arrogating to himself the role of Business Manager. He was implicitly forming a business partnership with Randy that did not, in fact, exist.

Furthermore, Andrew didn't have the first notion of how much time and effort Randy had put into writing the code. Or (as Randy was to realize later) maybe he did. In any case, Andrew assumed from the get-go that he would share a fifty-fifty split with Randy, which was wildly out of proportion to the work he'd actually done on the project. Basically, Andrew acted as if all of the work he'd ever done on the subject of aboriginal dining habits was a part of this undertaking, and that it entitled him to an equal split.

By the time Randy extricated himself from this conversation, his mind was reeling. He had gone in with one view of reality and been radically challenged by another one that was clearly preposterous; but after an hour of Andrew's browbeating he was beginning to doubt himself. After two or three sleepless nights, he decided to call the whole thing off. A paltry few hundred dollars wasn't worth all of this agony.

But Andrew (who was, by now, represented by an associate of his father's Santa Barbara law firm) vehemently objected. He and Randy had, according to his lawyer, jointly created something that had economic value, and a failure on Randy's part to sell it at market value amounted to taking money out of Andrew's pocket. It had become an unbelievable Kafkaesque nightmare, and Randy could only withdraw to a corner table at his favorite pub, drink pints of stout (frequently in the company of Chester) and watch this fantastic psychodrama unfold. He had, he now realized, blundered into some serious domestic weirdness involving Andrew's family. It turned out that Andrew's parents were divorced and, long ago, had fought savagely over custody of him, their only child. Mom had turned into a hippie and joined a religious cult in Oregon and taken Andrew with her. It was rumored that this cult engaged in sexual abuse of children. Dad had hired private dicks to kidnap Andrew back and then showered him with material possessions to demonstrate his superior love. There had followed an interminable legal battle in which Dad had hired some rather fringey psychotherapists

to hypnotize Andrew and get him to dredge up repressed memories of unspeakable and improbable horrors.

This was just the executive summary of a weird life that Randy only learned about in bits and pieces as the years went on. Later, he was to decide that Andrew's life had been fractally weird. That is, you could take any small piece of it and examine it in detail and it, in and of itself, would turn out to be just as complicated and weird as the whole thing in its entirety.

Anyway Randy had blundered into this life and become enveloped in the weirdness. One of the young eager beavers in Andrew's dad's law firm decided, as a preemptive move, to obtain copies of all of Randy's computer files, which were still stored on the UW computer system. Needless to say, he went about it in a heavy-handed way, and when the university's legal department began to receive his sullen letters, it responded by informing both Andrew's lawyer, and Randy, that anyone who used the university's computer system to create a commercial product had to split the proceeds with the university. So now Randy was getting ominous letters from not one but two groups of deadly lawyers. Andrew then threatened to sue him for having made this blunder, which had halved the value of Andrew's share!

In the end, just to cut his losses and get out of it clean, Randy had to hire a lawyer of his own. The final cost to him was a hair more than five thousand dollars. The software was never sold to anyone, and indeed could not have been; it was so legally encumbered by that point that it would have been like trying to sell someone a rusty Volkswagen that had been dismantled and its parts hidden in attack dog kennels all over the world.

It was the only time in his life when he had ever thought about suicide. He did not think about it very hard, or very seriously, but he did think about it.

When it was all over, Avi sent him a handwritten letter saying, ``I enjoyed doing business with you and look forward to continuing our relationship both as friends and, should opportunities arise, as creative partners.''

INDIGO

Lawrence Pritchard Waterhouse and the rest of the band are up on the deck of the Nevada one morning, playing the national anthem and watching the Stars and Stripes ratchet up the mast, when they are startled to find themselves in the midst of one hundred and ninety airplanes of unfamiliar design. Some of them are down low, traveling horizontally, and others are up high, plunging nearly straight down. The latter are going so fast that they appear to be falling apart; little bits are dropping off of them. It is terrible to see--some training exercise gone miserably awry. But they pull out of their suicidal trajectories in plenty of time. The bits that have fallen off of them plunge smoothly and purposefully, not tumbling and fluttering as chunks of debris would. They are coming down all over the place. Perversely, they all seem to be headed for the berthed ships. It is incredibly dangerous--they might hit someone! Lawrence is outraged.

There is a short-lived phenomenon taking place in one of the ships down the line. Lawrence turns to look at it. This is the first real explosion he's ever seen and so it takes him a long time to recognize it as such. He can play the very hardest glockenspiel parts with his eyes closed, and The Star Spangled Banner is much easier to ding than to sing.

His scanning eyes fasten, not on the source of the explosion, but on a couple of airplanes that are headed right toward them, skimming just above the water. Each drops a long skinny egg and then their tailplanes visibly move and they angle upwards and pass overhead. The rising sun shines directly through the glass of their canopies. Lawrence is able to look into the eyes of the pilot of one of the planes. He notes that it appears to be some sort of Asian gentleman.

This is an incredibly realistic training exercise--even down to the point of using ethnically correct pilots, and detonating fake explosives on the ships. Lawrence heartily approves. Things have just been too lax around this place.

A tremendous shock comes up through the deck of the ship, making his feet and legs feel as if he had just jumped off a ten-foot precipice onto solid concrete. But he's just standing there flatfooted. It makes no sense at all.

The band have finished playing the national anthem and are looking about at the spectacle. Sirens and horns are speaking up all over the place, from the Nevada, from the Arizona in the next berth, from buildings onshore. Lawrence doesn't see any antiaircraft fire going up, doesn't see any familiar planes in the air. The explosions just keep coming. Lawrence wanders over to the rail and stares across a few yards of open water towards the Arizona.

Another one of those plunging airplanes drops a projectile that shoots straight down onto Arizona's deck but then, strangely, vanishes. Lawrence blinks and sees that it has left a neat bomb-shaped hole in the deck, just like a panicky Warner Brothers cartoon character passing at high speed through a planar structure such as a wall or ceiling. Fire jets from that hole for about a microsecond before the whole deck bulges up, disintegrating, and turns into a burgeoning globe of fire and blackness. Waterhouse is vaguely aware of a lot of stuff coming at him really fast. It is so big that he feels more like he is falling into it. He freezes up. It goes by him, over him, and through him. A terrible noise pierces his skull, a chord randomly struck, discordant but not without some kind of deranged harmony. Musical qualities aside, it is so goddamned loud that it almost kills him. He claps his hands over his ears.

Still the noise is there, like red-hot knitting needles through the eardrums. Hell's Bells. He spins away from it, but it follows him. He has this big thick strap around his neck, sewn together at groin level where it supports a cup. Thrust into the cup is the central support of his glockenspiel, which stands in front of him like a lyre-shaped breastplate, huge fluffy tassels dangling gaily from the upper corners. Oddly, one of the tassels is burning. That isn't the only thing now wrong with the glockenspiel, but he can't quite make it out because his vision keeps getting obscured by something that must be wiped away every few moments. All he knows is that the glockenspiel has eaten a huge quantum of pure energy and been kicked up to some incredibly high state never before achieved by such an instrument; it is a burning,

glowing, shrieking, ringing, radiating monster, a comet, an archangel, a tree of flaming magnesium, strapped to his body, standing on his groin. The energy is transmitted down its humming, buzzing central axis, through the cup, and into his genitals, which would be tumescing in other circumstances.

Lawrence spends some time wandering aimlessly around the deck. Eventually he has to help open a hatch for some men, and then he realizes that his hands are still clapped over his ears, and have been for a long time except for when he was wiping stuff out of his eyes. When he takes them off, the ringing has stopped, and he no longer hears airplanes. He was thinking that he wanted to go belowdecks, because the bad things are coming from the sky and he would like to get some big heavy permanent-seeming stuff between him and it, but a lot of sailors are taking the opposite view. He hears that they have been hit by one and maybe two of something that rhymes with ``torpedoes,'' and that they are trying to raise steam. Officers and noncoms, black and red with smoke and blood, keep deputizing him for different, extremely urgent tasks that he doesn't quite understand, not least because he keeps putting his hands over his ears.

Probably half an hour goes by before he hits upon the idea of discarding his glockenspiel, which is, after all, just getting in the way. It was issued to him by the Navy with any number of stern warnings about the consequences of misusing it. Lawrence is conscientious about this kind of thing, dating back to when he was first given organ-playing privileges in West Point, Virginia. But at this point, for the first time in his life, as he stands there watching the Arizona burn and sink, he just says to himself: Well, to heck with it! He takes that glockenspiel out of its socket and has one last look at it, it is the last time in his life he will ever touch a glockenspiel. There is no point in saving it now anyway, he realizes; several of the bars have been bent. He flips it around and discovers that chunks of blackened, distorted metal have been impact-welded onto several of the bars. Really throwing caution to the winds now, he flings it overboard in the general direction of the Arizona, a military lyre of burnished steel that sings a thousand men to their resting places on the bottom of the harbor.

As it vanishes into a patch of burning oil, the second wave of attacking airplanes arrives. The Navy's antiaircraft guns finally open up and begin to rain shells down into the surrounding community and blow up occupied buildings. He can see human-shaped flames running around in the streets, pursued by people with blankets.

The rest of the day is spent, by Lawrence Pritchard Waterhouse and the rest of the Navy, grappling with the fact that many two-dimensional structures on this and other ships, which were put into place to prevent various fluids from commingling (e.g. fuel and air) have holes in them, and not only that but a lot of shit is on fire too and things are more than a little smoky. Certain objects that are supposed to (a) remain horizontal and (b) support heavy things have ceased to do either.

Nevada's engineering section manages to raise steam in a couple of boilers and the captain tries to get the ship out of the harbor. As soon as she gets underway, she comes under concerted attack, mostly by dive bombers who are eager to sink her in the channel and block the harbor altogether. Eventually, the captain runs her aground rather than see this happen. Unfortunately, what Nevada has in common with most other naval vessels is that she is not really engineered to work from a

stationary position, and consequently she is hit three more times by dive bombers. So it is a pretty exciting morning overall. As a member of the band who does not even have his instrument any more, Lawrence's duties are quite poorly defined, and he spends more time than he should watching the airplanes and the explosions. He has gone back to his earlier train of thought regarding societies and their efforts to outdo each other. It is very clear to him, as wave after wave of Nipponese dive bombers hurl themselves, with calligraphic precision, at the ship he is standing on, and as the cream of his society's navy burns and explodes and sinks, putting up virtually no resistance, that his society is going to have to rethink a thing or two.

At some point he burns his hand on something. It is his right hand, which is preferable--he is left-handed. Also, he becomes more clearly aware that a portion of Arizona has tried to take his scalp off. These are minor injuries by Pearl Harbor standards and he does not stay long in the hospital. The doctor warns him that the skin on his hand might contract and limit his fingers' range of motion. As soon as he can withstand the pain, Lawrence begins to play Bach's Art of Fugue in his lap whenever he is not otherwise occupied. Most of those tunes start out simple; you can easily picture old Johann Sebastian sitting there on the bench on a cold morning in Leipzig, one or two blockflote stops yanked out, left hand in his lap, a fat choirboy or two over in the corner heaving away on the bellows, faint gasping noises coming from all the leaks in the works, and Johann's right hand wandering aimlessly across the forbidding simplicity of the Great manual, stroking those cracked and yellowed elephant tusks, searching for some melody he hadn't already invented. That is good stuff for Lawrence right now, and so he makes his right hand go through the same motions as Johann's, even though it is a gauze-wrapped hand and he is using an upside-down dinner tray as a substitute for the keyboard, and he has to hum the music under his breath. When he really gets into it, his feet skid around and piston under the sheets, playing imaginary pedals, and his neighbors complain.

He is out of the hospital in a few days, just in time for him and the rest of Nevada's band to begin their new, wartime assignment. This was evidently something of a poser for the Navy's manpower experts. These musicians were (from a killing-Nips point of view) completely useless to begin with. As of 7 December, they no longer have even a functioning ship and most of them have lost their clarinets.

Still, it isn't all about loading shells and pulling triggers. No large organization can kill Nips in any kind of systematic way without doing a nearly unbelievable amount of typing and filing. It is logical to suppose that men who can play the clarinet will not botch that kind of work any worse than anyone else. And so Waterhouse and his bandmates receive orders assigning them to what would appear to be one of the typing-and-filing branches of the Navy.

This is located in a building, not a ship. There are quite a few Navy people who sneer at the whole idea of working in a building, and Lawrence and some of the other recent recruits, eager to fit in, have gotten into the habit of copping the same attitude. But now that they have seen what happens to a ship when you detonate hundreds of pounds of high explosive on, in, and around it, Waterhouse and many others are reassessing their feelings about working in buildings. They report to their new post with high morale.

Their new commanding officer is not so cheerful, and his feelings appear to be shared by everyone in the entire section. The musicians are greeted without being welcomed and saluted without being honored. The people who have been working in this building--far from being overawed by their status as guys who not only worked on an actual ship until recently but furthermore have been very close to things that were exploding, burning, etc., and not as the result of routine lapses in judgment but because bad men deliberately made it happen--do not seem to feel that Lawrence and his bandmates deserve to be entrusted with this new work, whatever the hell it is.

Glumly, almost despairingly, the commanding officer and his subordinates get the musicians squared away. Even if they don't have enough desks to go around, each man can at least have a chair at a table or counter. Some ingenuity is displayed in finding places for all the new arrivals. It is clear that these people are trying their best at what they considered to be a hopeless task.

Then there is some talk about secrecy. A great deal of talk about it. They run through drills intended to test their ability to throw things away properly. This goes on for a long time and the longer it continues, without an explanation as to why, the more mysterious it becomes. The musicians, who were at first a little put out by their chilly reception, start to speculate amongst themselves as to what kind of an operation they have gotten themselves into now.

Finally, one morning, the musicians are assembled in a classroom in front of the cleanest chalkboard Waterhouse has ever seen. The last few days have imbued him with just enough paranoia that he suspects it is that clean for a reason--erasing chalkboards is not to be taken lightly during wartime.

They are seated in little chairs with desks attached to them, desks designed for right-handers. Lawrence puts his notepad in his lap, then rests his bandaged right hand on the desk and begins to play a ditty from Art of Fugue, grimacing and even grunting with pain as his burned skin stretches and slides over his knuckles.

Someone chucks him on the shoulder. He opens his eyes to see that he is the only person in the room sitting down; an officer is on the deck. He stands up and his weak leg nearly buckles. When he finally gets himself fully to his feet, he sees that the officer (if he even is an officer) is out of uniform. Way out of uniform. He's wearing a bathrobe and smoking a pipe. The bathrobe is extraordinarily worn, and not in the sense of, say, a hospital or hotel bathrobe that gets laundered frequently. This thing hasn't been laundered in a long time, but boy has it seen some use. The elbows are worn out and the bottom of the right sleeve is ashy grey and slippery with graphite from being dragged back and forth, tens of thousands of times, across sheets of paper dense with number-two pencil work. The terrycloth has a dandruffy appearance, but it has nothing to do with exfoliation of the scalp; these flakes are way too big, and too geometric: rectangles and circular dots of oaktag, punched out of cards and tape respectively. The pipe went out a long time ago and the officer (or whatever he is) is not even pretending to worry about getting it relit. It is there just to give him something to bite down on, which he does as vigorously as a civil war infantryman having a leg sawed off.

Some other fellow--one who actually bothered to shave, shower, and put on a uniform--introduces bathrobe man as Commander Shane-spelled-s-c-h-o-e-n, but Schoen is having none of it; he turns his back on them, exposing the back side of his bathrobe, which around the buttocks is worn transparent as a negligee. Reading from a notebook, he writes out the following in block letters:

19 17 17 19 14 20 23 18 19 8 12 16 19 8 3

21 8 25 18 14 18 6 3 18 8 15 18 22 18 11

Around the time that the fourth or fifth number is going up on the chalkboard, Waterhouse feels the hairs standing up on the back of his neck. By the time the third group of five numbers is written out, he has not failed to notice that none of them is larger than 26--that being the number of letters in the alphabet. His heart is pounding more wildly than it did when Nipponese bombs were tracing parabolic trajectories toward the deck of the grounded Nevada. He pulls a pencil out of his pocket. Finding no paper handy, he writes down the numbers from 1 to 26 on the surface of his little writing desk.

By the time the man in the bathrobe is done writing out the last group of numbers, Waterhouse is already well into his frequency count. He wraps it up as Bathrobe Man is saying something along the lines of ``this might look like a meaningless sequence of numbers to you, but to a Nip naval officer it might look like something entirely different.'' Then the man laughs nervously, shakes his head sadly, squares his jaw resolutely, and runs through a litany of other emotion-laden expressions not a single one of which is appropriate here.

Waterhouse's frequency count is simply a tally of how frequently each number appears on the blackboard. It looks like this:

1	14 ||
2	15 |
3 ||	16 |
4	17 ||
5	18 ||||||
6 |	19 ||||
7	20 |
8 ||||	21 |
9	22 |
10	23 |
11 |	24
12 |	25 |
13	26

The most interesting thing about this is that ten of the possible symbols (viz. 1, 2, 4, 5, 7, 9, 10, 13, 24, and 26) are not even used. Only sixteen different numbers appear in the message. Assuming each of

those sixteen represents one and only one letter of the alphabet, this message has (Lawrence reckons in his head) 111136315345735680000 possible meanings. This is a funny number because it begins with four ones and ends with four zeroes; Lawrence snickers, wipes his nose, and gets on with it.

The most common number is 18. It probably represents the letter E. If he substitutes E into the message everywhere he sees an 18, then--

Well, to be honest, then he'll have to write out the whole message again, substituting Es for 18s, and it will take a long time, and it might be time wasted because he might have guessed wrong. On the other hand, if he just restrains his mind to construe 18s as Es--an operation that he thinks of as being loosely analogous to changing the presets on a pipe organ's console--then what he sees in his mind's eye when he looks at the blackboard is

19 17 17 19 14 20 23 E 19 8 12 16 19 8 3

21 8 25 E 14 E 6 3 E 8 15 E 22 E 11

which only has 10103301395066880000 possible meanings. This is a funny number too because of all those ones and zeroes--but it is an absolutely meaningless coincidence.

``The science of making secret codes is called cryptography,'' Commander Schoen says, ``and the science of breaking them is cryptanalysis.'' Then he sighs, grapples visibly with some more widely divergent emotional states, and resignedly plods into the mandatory exercise of breaking these words down into their roots, which are either Latin or Greek (Lawrence isn't paying attention, doesn't care, only glimpses the stark word CRYPTO written in handsized capitals).

The opening sequence ``19 17 17 19'' is peculiar. 19, along with 8, is the second most common number in the list. 17 is only half as common. You can't have four vowels or four consonants in a row (unless the words are German) so either 17 is a vowel and 19 a consonant or the other way round. Since 19 appears more frequently (four times) in the message, it is more likely to be the vowel than 17 (which only appears twice). A is the most common vowel after E, so if he assumes that 19 is A, he gets

A 17 17 A 14 20 23 E A 8 12 16 A 8 3

21 8 25 E 14 E 6 3 E 8 15 E 22 E 11

This narrows it down quite a bit, to a mere 841941782922240000 possible answers. He's already reduced the solution space by a couple of orders of magnitude!

Schoen has talked himself up into a disturbingly heavy sweat, now, and is almost bodily flinging himself into a historical overview of the science of CRYPTOLOGY, as the union of cryptography and cryptanalysis is called. There's some talk about an English fellow name of Wilkins, and book called Cryptonomicon that he wrote hundreds of years ago, but (perhaps because he doesn't rate the intelligence of his audience too highly) he goes very easy on the historical background, and jumps directly from Wilkins to Paul Revere's ``one if by land, two if by sea''

code. He even makes a mathematics in-joke about this being one of the earliest practical applications of binary notation. Lawrence dutifully brays and snorts, drawing an appalled look from the saxophonist seated in front of him.

Earlier in his talk, the Schoen mentioned that this message was (in what's obviously a fictional scenario ginned up to make this mathematical exercise more interesting to a bunch of musicians who are assumed not to give a shit about math) addressed to a Nip naval officer. Given that context, Lawrence cannot but guess that the first word of the message is ATTACK. This would mean that 17 represented T, 14 C, and 20 K. When he fills these in, he gets

A T T A C K 23 E A 8 12 16 A 8 3

21 T 25 E C E 6 3 E 8 15 E 22 E 11

and then the rest is so obvious he doesn't bother to write it out. He cannot restrain himself from jumping to his feet. He's so excited he forgets about the weak legs and topples over across a couple of his neighbors' desks, which makes a lot of noise.

``Do you have a problem, sailor?'' says one of the officers in the corner, one who actually bothered to wear a uniform.

``Sir! The message is, `Attack Pearl Harbor December Seven!' Sir!'' Lawrence shouts, and then sits down. His whole body is quivering with excitement. Adrenalin has taken over his body and mind. He could strangle twenty sumo wrestlers on the spot.

Commander Schoen is completely impassive except that he blinks once, very slowly. He turns to one of his subordinates, who is standing against the wall with his hands clasped behind his back, and says, ``Get this one a copy of the Cryptonomicon. And a desk--as close to the coffee machine as possible. And why don't you promote the son of a bitch as long as you're at it.''

The part about the promotion turns out to be either military humor or further evidence of Commander Schoen's mental instability. Other than that small bit of drollery, the story of Waterhouse past this point, for the next ten months, is not much more complicated than the story of a bomb that has just been released from the belly of a plunging airplane. The barriers placed in his path (working his way through the Cryptonomicon, breaking the Nipponese Air Force Meteorological Code, breaking the Coral naval attache machine cipher, breaking Unnamed Nipponese Army Water Transport Code 3A, breaking the Greater East Asia Ministry Code) present about as much resistance as successive decks of a worm-eaten wooden frigate. Within a couple of months he is actually writing new chapters of the Cryptonomicon. People speak of it as though it were a book, but it's not. It is basically a compilation of all of the papers and notes that have drifted up in a particular corner of Commander Schoen's office over the roughly two-year period that he's been situated at Station Hypo, as this place is called.* It is everything that Commander Schoen knows about breaking codes, which amounts to everything that the United States of America knows. At any moment it could have been annihilated if a janitor had stepped into the room for a few minutes and tidied the place up. Understanding this, Commander Schoen's colleagues in the officers' ranks of Station Hypo have devised

strenuous measures to prevent any type of tidying or hygienic operations, of any description, in the entire wing of the building that contains Commander Schoen's office. They know enough, in other words, to understand that the Cryptonomicon is terribly important, and they have the wit to take the measures necessary to keep it safe. Some of them actually consult it from time to time, and use its wisdom to break Nipponese messages, or even solve whole cryptosystems. But Waterhouse is the first guy to come along who is good enough to (at first) point out errors in what Schoen has written, and (soon) assemble the contents of the pile into something like an orderly work, and (eventually) add original material onto it.

*``Hypo'' is a military way of saying the letter H. Bright boy Waterhouse infers that there must be at least seven others: Alpha, Bravo, Charlie, etc.

At some point Schoen takes him downstairs and leads him to the end of a long windowless corridor to a slab of a door guarded by hulking Myrmidons and lets him see the second coolest thing they've got at Pearl Harbor, a roomful of machinery from the Electrical Till Corporation that they use mainly for doing frequency counts on Nip intercepts.

The most remarkable machine* at Station Hypo, however--and the first coolest thing in Pearl Harbor--is even deeper in the cloaca of the building. It is contained in something that might be likened to a bank vault if it weren't all wired up with explosives so that its contents can be vaporized in the event of a total Nip invasion.

*Assuming, provisionally, that Alan is wrong and that human brains are not machines.

This is the machine that Commander Schoen made, more than a year ago, for breaking the Nipponese cipher called Indigo. Apparently, as of the beginning of 1940, Schoen was a well-adjusted and mentally healthy young man into whose lap was dumped some great big long lists of numbers compiled from intercept stations around the Pacific (perhaps, Waterhouse thinks, Alpha, Bravo, etc.). These numbers were Nipponese messages that had been encrypted somehow--circumstantial evidence suggested that it had been done by some kind of machine. But absolutely nothing was known about the machine: whether it used gears or rotary switches or plugboards, or some combination thereof, or some other kind of mechanism that hadn't even been thought of by white people yet; how many such mechanisms it did or didn't use; specific details of how it used them. All that could be said was that these numbers, which seemed completely random, had been transmitted, perhaps even incorrectly. Other than that, Schoen had nothing--nothing--to work on.

As of the middle of 1941, then, this machine existed in this vault, here at Station Hypo. It existed because Schoen had built it. The machine perfectly decrypted every Indigo message that the intercept stations picked up, and was, therefore, necessarily an exact functional duplication of the Nipponese Indigo code machine, though neither Schoen nor any other American had ever laid eyes on one. Schoen had built the thing simply by looking at those great big long lists of essentially random numbers, and using some process of induction to figure it out. Somewhere along the line he had become totally debilitated psychologically, and begun to suffer nervous breakdowns at the rate of about one every week or two.

As of the actual outbreak of war with Nippon, Schoen is on disability, and taking lots of drugs. Waterhouse spends as much time with Schoen as he is allowed to, because he's pretty sure that whatever happened inside of Schoen's head, between when the lists of apparently random numbers were dumped into his lap and when he finished building his machine, is an example of a noncomputable process.

Waterhouse's security clearance is upgraded about once a month, until it reaches the highest conceivable level (or so he thinks) which is Ultra/Magic. Ultra is what the Brits call the intelligence they get from having broken the German Enigma machine. Magic is what the Yanks call the intelligence they get from Indigo. In any case, Lawrence now gets to see the Ultra/Magic summaries, which are bound documents with dramatic, alternating red and black paragraphs printed on the front cover. Paragraph number three states:

NO ACTION IS TO BE TAKEN ON INFORMATION HEREIN REPORTED, REGARDLESS OF TEMPORARY ADVANTAGE, IF SUCH ACTION MIGHT HAVE THE EFFECT OF REVEALING THE EXISTENCE OF THE SOURCE TO THE ENEMY.

Seems clear enough, right? But Lawrence Pritchard Waterhouse is not so damn sure.

. . . IF SUCH ACTION MIGHT HAVE THE EFFECT OF REVEALING . . .

At about the same time, Waterhouse has made a realization about himself. He has found that he works best when he is not horny, which is to say in the day or so following ejaculation. So as a part of his duty to the United States he has begun to spend a lot of time in whorehouses. But he can't have that much actual sex on what is still a glockenspiel player's pay and so he limits himself to what are euphemistically called massages.

. . . ACTION. . . EFFECT . . .REVEALING . . .

The words stay with him like the clap. He lies on his back during these massages, arms crossed over his eyes, mumbling the words to himself. Something bothers him. He has learned that when something bothers him in this particular way it usually leads to his writing a new paper. But first he has to do a lot of hard mental pick-and-shovel work.

It all comes to him, explosively, during the Battle of Midway, while he and his comrades are spending twenty-four hours a day down among those ETC machines, decrypting Yamamoto's messages, telling Nimitz exactly where to find the Nip fleet.

What are the chances of Nimitz finding that fleet by accident? That's what Yamamoto must be asking himself.

It is all a question (oddly enough!) of information theory.

. . .ACTION . . .

What is an action? It might be anything. It might be something obvious like bombing a Nipponese military installation. Everyone would agree

that this would constitute an action. But it might also be something like changing the course of an aircraft carrier by five degrees--or not doing so. Or having exactly the right package of forces off Midway to hammer the Nipponese invasion fleet. It could mean something much less dramatic, like canceling plans for an action. An action, in a certain sense, might even be the total absence of activity. Any of these might be rational responses, on the part of some commander, to INFORMATION HEREIN REPORTED. But any of them might be observable by the Nipponese--and hence any of them would impart information to the Nipponese. How good might those Nips be at abstracting information from a noisy channel? Do they have any Schoens?

. . . EFFECT . . .

So what if the Nips did observe it? What would the effect be exactly? And under what circumstances might the effect be REVEALING THE EXISTENCE OF THE SOURCE TO THE ENEMY?

If the action is one that could never have happened unless the Americans were breaking Indigo, then it will constitute proof, to the Nipponese, that the Americans have broken it. The existence of the source--the machine that Commander Schoen built--will be revealed.

Waterhouse trusts that no Americans will be that stupid. But what if it isn't that clear-cut? What if the action is one that would merely be really improbable unless the Americans were breaking the code? What if the Americans, in the long run, are just too damn lucky?

And how closely can you play that game? A pair of loaded dice that comes up sevens every time is detected in a few throws. A pair that comes up sevens only one percent more frequently than a straight pair is harder to detect--you have to throw the dice many more times in order for your opponent to prove anything.

If the Nips keep getting ambushed--if they keep finding their own ambushes spoiled--if their merchant ships happen to cross paths with American subs more often than pure probability would suggest--how long until they figure it out?

Waterhouse writes papers on the subject, keeps pestering people with them. Then, one day, Waterhouse receives a new set of orders.

The orders arrive encrypted into groups of five random-looking letters, printed out on the blue tissue paper that is used for top-secret cablegrams. The message has been encrypted in Washington using a one-time pad, which is a slow and awkward but, in theory, perfectly unbreakable cipher used for the most important messages. Waterhouse knows this because he is one of the only two persons in Pearl Harbor who has clearance to decrypt it. The other one is Commander Schoen, and he is under sedation today. The duty officer opens up the appropriate safe and gives him the one-time pad for the day, which is basically a piece of graph paper covered with numbers printed in groups of five. The numbers have been chosen by secretaries in a basement in Washington by shuffling cards or drawing chits out of a hat. They are pure noise. One copy of the pure noise is in Waterhouse's hands, and the other copy is used by the person who encrypted this message in Washington.

Waterhouse sits down and gets to work, subtracting noise from ciphertext to produce plaintext.

The first thing he sees is that this message's classification is not merely Top Secret, or even Ultra, but something entirely new: ULTRA MEGA.

The messages states that after thoroughly destroying this message, he--Lawrence Pritchard Waterhouse--is to proceed to London, England, by the fastest available means. All ships, trains, and airplanes, even submarines, will be made available to him. Though a member of the U.S. Navy, he is even to be provided with an extra uniform--an Army uniform--in case it simplifies matters for him.

The one thing he must never, ever do is place himself in a situation where he could be captured by the enemy. In this sense, the war is suddenly over for Lawrence Pritchard Waterhouse.