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A SWIFT ENTERPRISES INVENTION STORY

## Tom Swift and His Resonance Engine

By T. Edward Fox

A mighty task faces Tom Swift in his exciting new project—finding a solution to keeping cars on the road now that the world is faced with the realities of rapidly-depleting oil supplies. To accomplish this astounding feat, Tom must perfect his latest invention, a sound-powered engine.

In a combination of a lab accident and his previous sonic stairway project, Tom stumbles upon a new technique that opens the potential for a radical new approach to using sonic power. The young inventor plunges himself into the task of building his new engine. The invention works even better than he had hoped—but it has a horrifying side-effect.

Tom is about to abandon the plans, but before he can, they are stolen by a group of North Korean gangsters. He soon finds himself in a race against time—part of his invention might be used as a deadly weapon!

How the young scientist-inventor achieves his goals is told dramatically in this heart-pounding adventure.

This story is dedicated to Jonathan Cooper and his incredible random title generator and his even newer Tom Swift Summary Generator. I tackled a couple of his random titles last year; this year I am determined to write at least two stories that come—mostly—from his Summary Generator. Keep it up, Jon, and I'll never get back to my novels. Or, is that your plan.....?

## Tom Swift and His Resonance Engine

### FOREWORD

Where previous generation(s) of Tom Swifts—and, as we have found out, even future ones—have been more involved in the design and creation of inventions that advance their own scientific and inventive desires, our Tom seems to be more attuned to issues involving our ecology, environment, and natural resources.

*Along with* creating things that advance his personal scientific and inventive desires.

More than a year before this story, he developed his Y-4 and Y-8 internal combustion engines, power plants capable of providing great power and torque in an engine with very small displacement. But, those and their variations use fossil fuels. You know... the ones that we are burning through at a disastrous rate.

It might be easy to sit back and say to yourself, “Why was he so worried about those little issues?” that you will read about later. You also might say to yourself, “That’s exactly what I would do. Good job, Tom!” and that would put you on Tom’s ‘I like that person’ list.

I would hope that more and more people make that list. If not, we are going to continue running along in ignorance until it kills us.

*Victor Appleton II*

## CHAPTER 1 /

### ONCE IT’S GONE, IT’S GONE FOREVER!

TOM SWIFT sat in his father’s favorite easy chair in the living room at their home in Shopton, New York. With increasing dismay he had been reading several of the latest technical papers having to do with the increasing levels of CO<sub>2</sub> and other greenhouse gasses, and the environmental impact that was having on the entire planet.

Already, his own family had seen some of these bad effects. Several types of flower and vegetables his mother had been planting in the small patch at the rear of their three-quarter acre property could no longer grow properly. Even the slight increase in yearly heat had an effect, but it was more than that.

Everywhere around the globe areas that had once flourished, were drying up. And, that was just one of many issues.

He folded the final page back over and set the last of the reports on the side table. He was still sitting there, contemplating what he had read, fifteen minutes later when his mother, Anne, entered the room.

“I’d offer you a penny for those thoughts, Tom,” she said giving him a mischievous smile, “but I fear that inflation must surely have increased the cost to two or three cents by now.”

“Oh, hey, Momsie,” he said focussing on her. “Uh, I was just going over some of the latest figures from a few Governmental and private research organizations. Lots of dull stuff, but a lot of things to think about.”

Seeing the look of concern now on her son’s face, she crossed the room and sat on the arm of the chair—something she did frequently with her husband, Damon, occupying that place

over the twenty-one years of their marriage. It was a familiar and comfortable spot to perch while her “man” got things off his chest. She secretly grinned at how similar her husband and her son looked sitting in that seat.

“Tell me the things you think I can comprehend.”

Tom grinned at his mother. “You’re going to have to stop all this, ‘What? Little old simple housewife, me?’ stuff. Dad shared your Doctoral dissertation with me last year. I was curious about why you never continued on with the whole microbial biology thing, and he gave that to me when I asked if you just weren’t very good at it.” He looked into her eyes and said very seriously, “You were tops in your field, weren’t you?”

It was true. Anne Swift had been both an exceptional student as well as an extremely talented researcher in the few years between her graduate studies and the time she married Damon Swift. But, she gladly put that behind her to be wife, companion and mother. At least, that was the story she was sticking to!

“Well, whether I was any good at it is up for debate. Right now,” she tried changing the subject, “I want to hear what it is that has you sitting here with that ‘I wish I had the answers’ look you get. So, spill the beans, as they say.”

Tom smiled as she leaned over and kissed his forehead. “Okay. One of those reports talks about the environmental impact of all the burning of fossil fuels humans have done over the last century plus. It isn’t pretty. You’ve seen some of the results outside in your flower beds. There are a few types you used to grow when I was a kid, and yet they just don’t make it these days. But, there is some good news on the horizon. According to at least two published reports, at the rate we—and by that I mostly mean the USA, India and China—are consuming oil, we shouldn’t have to worry for more than another three decades. After that... poof! All but the hardest to

find and pump out crude and shale oil will be gone.”

“What about your carbon scrubbers in your OzoNuts?” She meant the air cleaning and ozone producing envirozone revivicators Tom had created two years earlier and that plied the skies over the South Pole cleaning the air and replenishing the ozone layer. Bud Barclay, Tom’s closest friend and her daughter Sandy’s steady guy, had nicknamed them ‘OzoNuts’ for their appearance like giant doughnuts drifting across the sky.

“What do you mean?” Tom asked.

“I mean that your father told me you had been working on a way to reclaim and refine all of the carbon they collect and then to turn that into burnable fuel again.”

He nodded. “Oh. That. Well, in the first year flying them over Antarctica, we managed to collect a little under five hundred tons of airborne particles. Once we got that back here my test refinery was able to extract about forty pounds of carbon from each sixty pound puck. From that I was able to extract a brand new hydrocarbon gas that burns pretty well, but it requires special engines to be used, and ends up costing the equivalent of about ten dollars per gallon of today’s regular grade gasoline.”

“That’s something, though. Isn’t it?” she asked.

“Well, it is and it isn’t. I figure if I could cover the globe with OzoNuts and build refineries in about twenty countries, we could eventually reclaim about fifty percent of what we have been pumping into the atmosphere. Lots of it falls back the ground stuck to rain and snow. The good news is that my new gas, even when liquified and burned, puts out only about seven percent of the carbon monoxide and twenty-three percent of the carbon dioxide as gasoline. It might extend the petroleum supply by a decade, but it will probably never happen.”

When his mother made no comment, Tom continued. “The really bad thing is that so much of what we do and have these days depends on petroleum. Not just transportation and generating electricity either. Medicines, clothing, food packaging. Science can replace a lot of that with corn-based plastics, but we need to do what we can to reduce how much we burn so that there will be some left for non-transportation and power generation purposes.”

His shoulders slumped. “There is something on the edge of my brain, but I can’t bring it around to the front where I can see it. It’s in there waiting to get out.” He looked up at her. “Give me a good thump on the back of the head. Maybe that’ll shake it loose!”

Instead, she kissed his forehead once more, stood up and looked down at him. “Mothers only thump to correct bad behavior. You have been nothing but a good boy since you were about six. Oh, sure, you’ve tortured your little sister over the years, but what older brother hasn’t. So, no thump. I will, however, make your favorite avocado and quinoa salad for dinner tonight.”

When she left the room, Tom pulled out his cell phone and dialed his father’s private number at Enterprises. Even though it was a Sunday, the older inventor had gone into work hours earlier to prepare for a visit by some of his old NASA associates who now worked with the Senate Committee for Space Exploration.

“Hello, Son,” his father answered, having checked the caller ID. “If your mother put you up to this call, let her know I’ll be home in less than a half hour.”

“No. It isn’t that,” Tom told him, and then proceeded to relate what he had been reading and how much he wanted to do something about it.

“That’s something *not* best brainstormed over the phone. Listen. Give me five minutes to grab a few things and I’ll come home. We can get in an hour or so before dinner and then maybe another hour after before I will need to concentrate on my final preparations. Will that work?”

“I hope so, Dad. I need a little guidance on where to expend my brain energies. Right now I can’t even see an approximate direction!”

Forty minutes later the two inventors were sitting in Mr. Swift’s den and office. Tom had left him alone for twenty minutes to look through the two most relevant reports, and he had now finished one them.

“I read the other a few days ago when it came out,” Damon Swift explained. “So, tell me about this vague idea of yours.”

Tom shook his head. “That’s just it. It’s so vague that I can’t even figure out where in my mind it is right now. All I know is that there are three main uses of petroleum that consume the most. Power generation, transportation and lubrication. We are already attacking the power generation thing. Between your three generations of nuclear reactor/generators, my power pods and advances in wind and solar power, the use of natural gas and coal in generators has dropped by seventy percent.”

But,” his father reminded him, “those generators don’t directly burn petroleum. Most of *those* power stations were replace a couple decades ago.”

Tom nodded. “Yes. But that’s just here in North America. A lot of the rest of the world uses everything from heavy bunker oils to diesel.”

“Ah! Right. I wasn’t thinking globally. Go on.”

“So, that accounts for about a quarter of all the petroleum used. The biggest chunk is in basic transportation. We’ve

begun making inroads in the airline industry with the Quieturbine engines and they should have replaced more than half the traditional jet turbine engines by this time five years from now. And, it is at this point I sort of bog down,” he admitted with a shrug.

“Well, if that consumption report is correct, and better than sixty-five percent of petro-use is transportation, what else can you attack, as it were?”

Tom’s face clouded in concentration. Finally he looked up. “Maybe I can find new ways to promote the Y-4 engines. I did have the propulsion engineering team build a Y-2 version. It still totals six cylinders, but it can be made in sized from about 100 cc total displacement up to two-thirds of a liter. The smallest one could be used in hybrid cars to run the generator and would get almost three hundred miles per gallon equivalent.” He chuckled and then added, “Dianne and her team even dropped the 180 cc test version into one of those Smart cars. It scoots that little two-seater around as fast as the original one liter engine. And, gets about one hundred fifteen miles per gallon to boot!”

Mr. Swift sat across from his son, looking at the younger inventor thoughtfully. He knew that Tom’s revolutionary Y-series engines incorporated not one but three cylinder sets arranged in an upside-down Y pattern. This meant that the Y-4 engine actually was a twelve cylinder engine with almost constant firing of at least one cylinder eliminating the need for a heavy flywheel and providing incredibly high levels of torque. An 800 cc Y-4 engine could power almost any car or small van on the road. A pair of 3 liter Y-8 engines provided the electrical power for Tom’s Transcontinental BulleTrain.

Finally, he said, “But, that still burns fuel.”

“Yeah, it does,” Tom admitted. “Less, but as grandpa George told me before he passed away, ‘even a little is still some.’ I

know he was talking about my allowance back then, but it holds true for this, doesn’t it?”

Damon Swift nodded at his son. He felt a lot of pride in his boy.

“I suppose that means you’ll need to come up with another solution,” he said.

“It does,” Tom admitted. “Let me run this by you. What if I can create an engine that uses no fuel other than electricity? No hydrogen fuel cell, no miracle ‘water motor...’ nothing.”

Mr. Swift leaned forward to ask, “You do realize there are all-electric cars out there today? What would you propose doing that is different, then?”

Tom grinned. The Quieturbine jet engines he had developed more than a year earlier used small repelatrions to push the blades around at incredibly high speed. “Why not incorporate even smaller ones in the cylinder heads to push the pistons down. We’d get even more power because it would operate like a two-stroke engine. Power stroke down, recovery stroke up, and repeat!”

Now it was Damon Swift’s turn to grin. “If you are asking permission, I say try it!”

The following morning, while Mr. Swift was meeting with the NASA contingent, Tom headed to the Propulsion Engineering building to meet with Dianne Duquesne and her team. Over the previous two years they had come up with a number of devices based on Tom’s designs, including the Quieturbines.

“So, skipper,” Dianne said as Tom entered her office. “What might we mere PEs do for you today?”

Sitting down, Tom took out his tablet computer and called up a simple wire design of his proposed engine. “This,” he said turning it around for her to see and pointing at it.

“Been done,” she told him. “I hate to break it to you, my dear young Mr. Swift, but the internal combustion engine has been around more than a century!” She was about to look triumphant when something in the gleam of her young boss’ eyes caught her attention. “Oh. I see. This *isn’t* your run-of-the-mill engine, is it?”

Tom smiled innocently at her and shook his head. “Nope! It is a V-8 engine with a real difference. If you look closely you won’t see something. Eight somethings plus another sixteen other things and a big thing inside aren’t there!”

“You’re going to make me really study this, aren’t you?” Dianne asked looking at Tom through slitted eyes. “Okay. Let me enlarge some of that drawing.” She took the computer from the desk and, touching the screen with two fingers, opened them and enlarged the area around the fingertips by more than double. A moment later, she gasped. “There’s no combustion stuff. No spark plugs, no valves and no camshaft. What in the world...?”

“That,” Tom told her proudly, “is a repelatron-powered reciprocating engine. Special-purpose mini repelatrons shove down on the piston head in a power stroke and again each time the piston returns to the top. I fiddled with trying a straight six, an opposing four and six, and even a variation on the Y series, but all the numbers say that the V arrangement for this type of engine works best.”

“I would have thought that the Y arrangement would work. Why not?”

Tom looked a little embarrassed. “The truth is that my Y arrangement only works at top efficiency when it is a four-stroke engine. It needs the resting period to reduce vibrations and let the other pistons have their turn at pushing things around. I’m afraid that if we tried this new idea in that engine block it would shake apart in a few minutes.”

Dianne looked as if she were contemplating something. “I have to ask. Why go to all this trouble for an electrically-powered engine? Why not just a battery pack and a traditional wire-and-magnet motor?”

“Power and longevity. Even with the newest generation of Swift Solar Batteries I can only see about a thousand miles of travel before they have to be swapped out. That, or a nickel metal hydride or lithium-cadmium or lithium-air rechargeable pack with about one hundred fifty mile range. Perhaps two hundred in a light car. That’s okay for a small in-town car but not for a larger, heavier car or an engine technology that needs to replace our dependence on petroleum. That’s also why this is not part of a hybrid system.”

“Okay,” was all she said as she tapped a few of the pop-up keys on the tablet and then again on her desktop computer. Seconds later the design appeared on her screen. “Do you want to do the honors of giving this a skin, or do you want me to hand this over to Artie?”

Artie Johnson—no relation as he was quick to point out to anyone who appeared ready to tell him that the name was “Verrrrrry interesting!”—had begun his time to Enterprises as an intern but had been hired as a full-time employee even before his internship was more than half over. He had proven himself to be an excellent draftsman and frequently was given the duty to produce the outer look of a propulsion device.

“Sure. Nothing too fancy at first. Once we prove the concept, *then* he can go hog wild and make it beautiful.”

Dianne told him that it all seemed so straight forward that she believed they could built the prototype by week’s end. “We have all the parts in stock,” she informed him.

True to her word, Tom received a phone call late on Friday morning. “Tom? Dianne. We’ve got your little engine finished.

Come on over when you're ready."

Jumping up from his chair Tom told her, "Be there in five minutes!" and he ran out the door of his large lab in the Administration building. Four minutes, forty-five seconds later he raced into her office, panting. "Ready!" he announced.

"What took you so long?" Dianne asked laughing. "Come on. Let's go to the lab. We've mounted it in the test chamber."

They walked down the hall and into the large lab room. One-third of the room was located behind a thick pane of clear tomasite. Sitting on a four-legged stand was a very small engine.

"That use to be a Fiat engine," she told him. "Just two liters and only weighing in at one hundred and ninety-eight pounds. But," she said in a mock warning tone, "it was no weakling. One hundred and five horse power in that package. Ferrari even used it for awhile. Other than pulling out all the unnecessary stuff inside and welding the valves shut, we coated the piston heads in chromium and set the repelatron for that. James over there figured it would be safer than having it repel iron. After all, the entire block is full of iron and we don't want the repelatron pushing it all out of shape."

"Any idea what kind of performance we might get from this repelatron version?" Tom asked.

"Theoretically, the same as the gasoline version. We're just replacing one fuel source with another. Ready to see what happens?"

"Haven't you already tried it?" Tom asked.

Dianne shook her head. "We all thought it would be anticlimactic if we turned it over. You do the honors."

Tom shrugged and moved over to the control board. It was a very simple layout with a power switch for the entire system, a

slider control to increase and decrease power to the repelatron, and a bright red kill switch.

Tom toggled the power switch and saw a green LED light up. After grinning at the assembled team of eight engineers he slowly moved the slider forward. Inside the chamber the engine started spinning and a readout board inside began counting up the RPMs.

500... 800... 1540... 2800... 3225—

At that point, the room rocked as the little engine exploded inside the chamber flinging metal shards and chunks into the walls and safety window!

**CHAPTER 2 /****THE FORTUNATE ACCIDENT**

TOM AND DIANNE were the first to pick themselves up off the floor and were helping Artie and two others to get to their feet when the fire alarm went off.

Tom quickly got on the phone and cancelled the fire response. “Just an old engine going boom. A little smoke from the overheated oil but nothing combusting,” he assured the fire safety chief. He turned to look at the completely destroyed engine with dismay.

“Any ideas what might have happened?” he asked nobody in particular.

When no one had an answer, Dianne suggested that Tom head back to his office. “Not much for you to do right now. We’ll do a postmortem and try to have some answers by Monday. Sorry for the disappointment.”

He barely had returned and made a few notes when his phone rang. It was Dianne.

“Well, we have an answer, Tom. Total metal fatigue. The drive shaft was snapped in two places and the piston rods were all bent and most of them slammed through the cylinder sides. Now, normally in an engine built way back in the mid 1950s I’d say that was to be expected. The only issue is that this engine had just a couple hundred miles on it, and we did a complete x-ray inspection of all the parts as we stripped it down. No indication of any stress or fatigue or micro-fractures.”

“Do you have a guess what it might have been, then?”

“We do, and you’re probably going to tell me to try again. It’s the repelatrons. They just pushed too darned hard. To get the

revs up, we have to turn up the power on the repelatrons. Eventually—and in this case at around thirty-three hundred revs—it just became too much and everything shattered. So, before you tell me to do something about it, I have to tell you that you and my team need to work on this one together. I can get a replacement engine—as I mentioned, Fiat and Ferrari both made this engine and a small company called Siata made parts, whole cars and even some engines through the mid-seventies. When they disbanded, Fiat took control of all parts and they have over three hundred complete engines we can buy.”

“Okay, but where do I come in,” Tom asked her cautiously.

“You come in to figure a way to send out more repelatron pulses to speed things up without increasing the strength of the output. That is, after all, one of the features of the repelatrons. Right?”

Tom had to agree. It *was* a feature of repelatrons. When he had modified them for his Quieturbine jet engines, among other uses, that required pulses and not continuous force, it had been acceptable that the increased power needed for faster pulses all worked together. It was fine because the blades they pushed against were constantly moving away so no dangerous pressure built up before the next blade swung into position.

*This was going to take a little work*, he thought to himself before replying, “Sure. I’ve got a few weeks of not much to do. Let me get back to you after the weekend. I’ll see what I can come up with.”

It only required five hours of his Saturday—a good thing as he and Bud had promised Sandy and Bashalli, Tom’s girlfriend, a dinner and dance at the Yacht Club.

His solution was to add a small computer circuit to monitor the revolutions, compute the appropriate pulse rate and to



either maintain, decrease or increase the pulses per second without changing the actual level of force emitting from the repelatrns. The circuit was easy; he knew that the programming was going to require a couple of days, but that could come after the weekend.

Bashalli sensed that her man was a little distracted as they danced to a slow tune after a wonderful wild salmon dinner. “Thomas. If you do not come back to Earth and smile at me, I might have to run off with the milk man,” she teased.

It took a few seconds to penetrate his mind but he finally snapped his head back and exclaimed, “What? Who is this guy Millman?”

Bashalli laughed, her bright white teeth made even more radiant by her dark complexion and red lipstick. “Not Millman, silly. I said the milk man. As in you are not paying attention to the woman you are supposed to be totally and unceasingly in love with, and, as they say, the milk man delivers every day.”

“But,” he began to protest, “Shopton doesn’t have any milk men any— Ohhh. I see.” He grinned sheepishly at her. “Sorry, Bash. I promise that I’m back now.”

The Pakistani girl stopped dancing and pulled slightly back from his embrace. Leaning forward with her lips next to his right ear she told him, “I believe that it is time for us to have a seat so that you might tell me what is so obviously weighing heavily on your mind. Come on.” And, she took him by the hand and led him back to their table.

Bud and Sandy were still dancing, and from the looks on their faces probably weren’t even hearing the music anymore. They would be on the floor for quite some time.

“So,” Bashalli told Tom as she looked into his eyes, “what is this important project or thing or whatever that has your attention rather than me?”

He told her about the new engine, and about the failure of the engine on its first test. As he spoke, she listened carefully. Over their almost two-year courtship she had become very adept at hearing ‘between the lines’ of what he might be describing.

“I gather then that you have come up with a solution from the way you are telling me about the explosion. What is it?”

“Boy, you sure know me, Bash,” he told her. “And, you’re right. You see, I figure that if I modulate the power going to the repelatrns, and add a feedback detection circuit to make certain that each piston and each emitter are feeding out the same...” He stopped as she raised one hand up and put her index finger to his lips.

“Thomas. Do you know how Bud sometimes tells you to describe things so that, as Sandy tells me, his ‘little athlete’s brain’ can comprehend?”

Tom nodded. He playfully kissed her finger. She poked him on the nose and continued.

“I am not an athlete. But, I am an artist and I see things in terms of shapes, colors and patterns. I even see you in terms of colors. For instance, when you are deep into inventing some wonderful item or another, I see you in vivid purples and blues and even streaks of reds. I see power flowing around you.” She stopped, seeing a disbelieving look cross his face. “I do not mean that I see actual colors, but I do imagine those colors when you are energized. Tonight, I saw grays and browns at first. Now, as I ask you to explain things to me you are energized again.”

Tom nodded and took her hand, bringing it up to his face. He kissed her finger tips and then said, “You comprehend more than you give yourself credit. But, let me simplify my dissertation a little, anyway. What I am working on in my head

and on the computer is an electronic and automated sort of gas pedal. Except that it works sideways. By that I mean that it doesn't add fuel, or power in this case, to increase speed. It selectively reduces power while sending out the pulses more and more quickly. The more quickly, the lower the power."

He looked deeply into her eyes to see if he was going too far. Instead, she smiled brightly.

"I understand that!" she exclaimed happily. "Too much speed gave you too much force, and you are developing a way to make more speed with less force. Is that it?"

Now Tom smiled broadly. "It is, Bash."

Bright and early the following morning he went back to Enterprises and worked on his control software. Now that he had a solid idea what was needed, it was fairly easy to create the code. He had a working version running in simulation mode before he left to go home for dinner.

"I think I've found the solution, Dad," Tom said at the dinner table. He described the test engine breakdown to his mother and sister, then he told them all what he was doing to keep it from happening again.

"Have you computed the amount of power you will be draining from the batteries and how much mileage that will mean?" his father asked.

Tom shook his head. "Not yet. At least not with this new way of controlling the power into the cylinders. My preliminary numbers for the full-force repelatron looked like just a hundred or maybe one hundred twenty miles on a full charge of lithium-cadmium batteries or one-eighty on a small bank of nickel metal hydride or lithium-air cells. Not all that good, I admit."

"Isn't that about what the foreign all-electric cars get?"

Sandy asked.

"Yes, it is. But I want to triple or quadruple that. However, before I attack *that* issue I need to prove that the engine will work."

One week later Tom returned to the Propulsion lab for a demonstration of the second generation of his new engine.

"How is it looking?" he asked Dianne. "I assume that you did a practice run this time. At least, I hope you did."

She nodded. "We did. I wouldn't have wanted to have you come over just to witness explosion two-point-oh"

When she failed to look pleased, Tom asked, "Not good?"

She pointed at the test chamber. "We never ran it up over two thousand RPMs. I was a little gun shy after last week's fiasco, so we held it there for three minutes, shut things down and dismantled the engine to check it out. Everything looks okay, with the exception of the piston heads. They all were dented about three millimeters right at the center of the repelatron impact point." She took a deep breath before continuing. "We ran some numbers. It comes out that the engine probably will fail at the seven minute mark at two thousand revs and as quickly as two minutes at four thousand revs. I don't know what else to tell you."

"I do," he told her. "Let's run it until it fails, and then see if there is anything more to be done with this. Learn from failure, as dad says."

Tom kept the RPM under two thousand as he sped up and slowed down the engine. Dianne's team had set up a drive wheel and a dynamometer to check torque output. At the slower speeds the numbers looked promising. But, when he finally increased past the two thousand mark, the torque seemed to cease growing. It held steady all the way up to just

below four thousand RPM, which was where one side of the engine flew apart.

Looking into the chamber at the accumulation of parts and metal bits, Tom could see one of the pistons. The top was cracked half way across and one entire side was missing.

He sighed. “Well, it was a good idea on paper. Just not a practical one,” he told the assembled team.

“Tom?”

“Yes, Artie?”

“We could try it with a stronger material. Like durastress or even tomasite. That might hold.”

Tom shook his head. “No. At least not for now. While you were building this new model I was doing number crunching. A car would have to carry about one thousand pounds of batteries for each ton of car weight to get a little over two hundred miles. And, for each additional thousand pounds of car, you’d need an additional three hundred pounds of batteries, but to carry that extra weight you need an extra hundred pounds of batteries, and so on until the car becomes a van and you begin to lose mileage no matter how many batteries you carry.”

“Any idea what the answer is?” on of the engineers, Larry, asked.

“Something that doesn’t siphon off power like a fire hose,” Tom replied. “or beat up the inside of the engine like that.” He pointed over his shoulder at the test chamber. “The thing is, I’m not really certain what that is going to be.”

\* \* \* \*

Tom’s attention was taken away from his no-fuel engine a few days later when he received a call from an old friend in

Maryland. Dr. Anthony Merriweather was the curator and manager of the National Aquarium in Baltimore. Months earlier Tom had helped save both a new attraction at the aquarium as well as Dr. Merriweather’s job.

“Doctor. How nice to hear your voice again. How is the deep sea exhibit?”

“Hello, Tom. The exhibit is going along nicely, but I think I need to have your assistance. We have had a small accident.”

Given that the tank was pressurized to simulate conditions ten thousand feet below sea level, Tom wasn’t certain whether he might be actually able to help, so he inquired, “What sort of accident. I hope nobody was injured.”

“What? Oh, no. No real injuries, but we did have one patron take a small tumble on the ultrasonic stairway you installed. By the way, it has been working wonderfully and the fish are now thriving. We had our third hatching a week ago and now have almost tripled the number of fish in the tank. No, the reason for this call is because we need to see if something can be developed for customers who have balance issues. The ones too darned stubborn to read the signs and take the elevator down and back up or to hold onto the hand rail!”

“What in the world happened?” Tom asked.

“Well, we have a number of patrons at the aquarium. That’s someone who not only purchases year-long access passes, but also gives at least one thousand dollars to the aquarium foundation. Mrs. Helena Fitzgerald hyphen Venables, and that’s as in—as she is always prattling on about—the *New Hampshire Venables*. I don’t know what that means. I don’t really care what that means. What I do care about is the possibility of losing her annual fifty thousand dollar endowment, and all because the silly woman got a little tipsy before visiting us yesterday and she fell on the way down the

stairway.”

Tom was immediately worried. His ultrasonic stairway had been a breakthrough for the aquarium that was in danger of losing their newest, and most expensive, exhibit. One that featured the large highly-pressurized giant tank filled with fish that survive only below ten thousand feet in the ocean. Traditional moving stairs—escalators—made too much noise in certain low frequencies that scared the fish causing them to bash into rocks and the Plexiglass tank, killing themselves in the process.

“How did it happen. I mean, what exactly happened to this Mrs. Hyphen Venables?” Tom inquired.

“We had a brief power outage yesterday. And, while the back-up power generator handled keeping things running as we began the slowdown and shutdown procedures, power came back on before we could complete things. The continuous belt surged and she fell. Luckily it was just a slip down the final five or so feet. Everyone above and below her were quick enough, and sober enough, to grab the railing. Anyway, Tom, what I would like is for you to come up with some sort of new rail or whatever that might swing out in cases like this and keep people from falling over. Can you come over today or tomorrow?” He ended almost pleading.

Tom knew this was a serious thing so he agreed to come visit the following morning.

“In the meantime, it might be wise to post someone at the top of the downward run and at the bottom of the upward run to remind people to hold onto that moving handrail.”

When he arrived mid morning the next day, Tom saw that his suggestion had been put into place. Not only were the two guides posted as he had suggested, the aquarium had posters printed that previous afternoon advising visitors to, “Hang on

to the hand rail. We want you back in one piece and that means having you leave in one piece. Hold on at all times!”

He and the doctor took two trips on the continuous loop of walkway/stairway so that Tom would re-familiarize himself with the existing safety railing. By the time they arrived back at Doctor Merriweather’s office he had already formulated a plan.

“What I can do is to add a series of automatic arms that would pop out in front of descending and behind ascending people in case of any emergency. Power fluctuations, outages, and even seismic events. They would come out like those blow tickler noise makers you get at kid’s parties. I have a wonderful metal that is normally all coiled up, but extends once a small amount of electricity is applied and become very stiff once they are fully extended. They would slide out quickly enough to protect but not too quickly to hurt anyone they might bump into.”

“What about for people who are just to full of sherry?” the doctor asked.

After a moment, Tom replied, “I’ll come up with a sensor array that can be mounted above the belt. It should be able to determine if someone is starting to fall and then just activate their safety bars.”

They talked about the project and how long it might take. By the time Tom left an hour later he had assured the doctor that a team of Enterprises technicians would be there the following morning to take measurements and that such a system could be put together in about two weeks. When the subject of cost came up Tom offered to do things at basic cost along with free labor. Doctor Merriweather was so pleased that he offered to provide the Swifts with twenty lifetime passes good for any of their employees and their families.

“With what you are saving us, and also by saving us once

again, it is the very least I can offer.”

He assumed that the inventor’s big smile was in response to his offer of free passes.

But, as Tom left, he had more on his mind. It had come to him in a flash and he instinctively felt it must be the solution to his fuel-less engine.

Sonics. Possibly the same ultrasonic vibrations that operated the aquarium’s endless stairway.

By the time he reached Enterprises late in the afternoon, Tom had three potential designs sketched on his tablet computer. Instead of going home for dinner, he called the Swift’s personal chef and asked that a dinner be provided so that he could work into the night.

“Wahl, shore, Tom. Happy ta do it,” the pleasant and gravelly voice of Chow Winkler responded. “Jest tell me when an’ where. I kin whip up a really nice steak and taters fer ya. That sound okey-dokey? Mebbe some chocolate tapioca puddin’ fer dessert?”

“Sound great, Chow. Thanks. How about in my big lab just before you head home?”

“I ain’t headin’ home tonight, son. Tonights my night ta fill in fer that ornery Russian hash-slinger in the main kitchen. I’ll be here til midnight. You say the time. It’ll be thar.”

They agreed on seven o’clock.

Tom transferred his preliminary designs over to his main computer and then made another phone call.

“Sorry to get you right at quitting time, Dianne, but—” and he told her about his thoughts for using sonic pressure to move the pistons up and down in the cylinders.

He concluded with, “What do you think?”

He heard his department head chuckle. “I think that I’m going to tell my husband that I’ll be staying late, and then I’ll come over and we can hash out a design. Tonight!”

**CHAPTER 3 /****MORE PLAUSIBLE THAN IT SHOULD BE**

IN THE next five hours three things happened. Dianne arrived in her street clothes—she always changed into one of Enterprises’ blue overalls when she arrived at work to keep clean—she and Tom had a nice steak dinner after Tom called Chow to double the order, and they finished a preliminary design for her and her team to get started on the next morning.

“It’s beautiful, Tom,” she praised him. “And, because we can control the sonic pressure, we can keep it to the same level as it would be if the engine is burning fossil fuel. I am really going to enjoy building this one.”

Are you going to try another of those Fiat V-8 engine blocks?” Tom inquired.

“Just as a proof of concept and for running an hour or two. Then I’ll beg and plead for six weeks to create an all-new engine from scratch out of composite materials, and then you will ask if I can do it in four, and we’ll probably get it finished in three. Everyone will be happy!”

Tom smiled. He knew his people and they knew him. Nobody promised more than they believed they could deliver and he only asked for the impossible about half the time—and got it ninety percent of the time.

As a design, it wasn’t radically different than what they had attempted with the repelatron reciprocating engine. There was still no need for valves or a camshaft to rotate so they could lift and fall appropriately. New cylinder heads would need to be machined from solid aluminum and then tempered for strength. There would be no way to rework the existing heads to fit the necessary sonic emitters and circuitry.

While Dianne and her team were working on the concept model, Tom spent hours and hours working on computer models of different crank shafts to see if there was some way to get more power—torque—by changing the piston placements. As they had discovered with the repelatron version, changing the normally four-stroke engine to a two-stroke one had not made best use of where each piston was when it was pushed down in its power stroke.

Two days later he had the answer and he phoned Dianne to tell her the new shaft design had been posted to the company’s secure server. She promised to download it and have her metals man do his magic.

“If you need outside help, I’ve already cleared it with the folks over at the Construction Company,” he told her, referring to the original Swift plant that was still in existence and built many of the products developed at Enterprises.

The Electronic Department was also hard at work developing the sonic emitters to power the engine. It wasn’t just a matter of making noise; it was a matter of making noise at the right frequency to push on the pistons with the proper amount of force and at the proper time.

It wasn’t an easy task.

Seven days of experiments with low, mid-range and high frequencies produced only so-so results. Obviously, the low frequencies with their widely-spaced and fluctuating waveforms—at frequencies lower than most home stereo subwoofers could produce—had the most potential power. They also required the most electrical power to produce.

Tom felt that there must be a happy medium. *At least*, he pondered as he drove home one evening, *it looks like the emitters will only need a bank of batteries the size as before yet they should give at least three times the mileage.* That was

something to be happy about.

Taking the lessons learned from the repelatron version of the engine, Tom applied his power-controlling circuitry to what he was now thinking of as his Applied Sonic Reciprocating Engine. Bud, in his usual showing of nicknaming, had walked into Tom's lab one morning and, after listening to the combination of low and ultra-high frequencies Tom was experimenting with, has christened it The Little Grumbler.

"With all those low sounds you've got going up and down, it sounds like my grandfather whenever he was complaining about something. No words, just a low, rumbling grumble," he told Tom.

"Well, let's all hope that this does more than make grumbling noises," Tom replied. "As in, let's hope that once Dianne and Artie and the gang get this built, the little pistons go up and down and up and down."

"And nothing goes *boom*?"

"And noting goes boom," Tom agreed.

Bud's other choice had been an anagram of Tom's naming idea, but he wanted to rearrange it to Applied Reciprocating Sonic Engine. It took Tom a few seconds, but he reddened and shook his head at the suggestion.

Once the engine had been outfitted with Tom's latest sonic emitters and the necessary control equipment, another test was scheduled.

To everyone's disappointment, the results were dismal at best. It was obvious that sound alone wasn't going to be the solution.

"Okay," Tom said looking at the team. "Another step forward and three-quarters of a step back. I have another idea. Set things up so that we can use the valves again. At least, the

exhaust valve. We're going back to four-stroke mode but with a difference. I want you to add injectors to each cylinder to spray in a micro-fine mist of water."

Artie's eye brightened. "Are you saying that we could use the water vapor and the sonic emitters to create flash steam and use that to move everything?"

Tom smiled at the man but turned to Dianne before commenting, "Do we pay this guy enough?" Turning back to the now blushing man, Tom told him, "That is exactly what I am suggesting. It may be old-fashioned and a little funky, but I think we might just be on the verge of creating a steam engine for the twenty-first century!"

Dianne looked at Tom with curiosity. "How is it going to work?"

"My plan is to inject the water mist into the cylinder just as if it were a gasoline and air mixture. Then, rather than a spark plug causing it to explode, we use the sonic emitter in each cylinder to flash agitate the water causing it to expand and we use the increase in pressure to drive the piston down. As with any four-stroke engine as it comes back up we open the exhaust valve and let the steam out, it coasts back down and gets more water vapor injected and then pressurizes it on the upstroke, and the we start all over with the flash steam."

Dianne shook her head. "Sorry. I figured that out, what I should have asked is why are we kicking out the water vapor? Why not reuse it?"

"May I take this one, Tom?" Artie asked. "I think I understand your reasoning."

"Be my guest."

"I think Tom believes, and I do as well, that the water vapor will condense inside the cylinder, At least, some of it will.

Unless it is replaced with fresh vapor the second power stroke will be less than the first, and so on. Uh, the problem I see is that if the water isn't still in vapor form, some of it is going to remain inside the cylinder. How do you propose to get rid of that?" he asked Tom.

The inventor smiled. "Yeah. That one hit me as well. I would like to have you try adding a second valve. Probably activated using a solenoid. It should be at the bottom of a new vertical groove cut into the side of each cylinder. As the cylinder coasts back up to push out the leftover vapor, the bottom valve opens as well and the slight pressure remaining will push out any water that is accumulating."

He could tell from Artie's expression and exceptionally wide smile that the young engineer understood the entire concept.

"You can explain it to your boss and coworkers after I leave."

Artie's smile drooped a little—he still wasn't entirely confident that he might have answers his superiors didn't or how to tell them without appearing to be a smarty-pants—but he nodded.

"Good! I'll leave you folks to it. You may find that the water and the leftover vapor will pick up a little of the lubrication oil. Check that and be prepared to route everything through a centrifugal separator. I've got that designed already and you can find it under the designation TS-2015OS11. Thanks, everyone!"

Moments later, Tom had left the building and headed to meet up with Bud for a quick workout in the Enterprises gym. For the past year or so they had spent one hour almost every Tuesday and Thursday trying to burn off a few calories that were tending to stick around their middles as they reached their early twenties.

Jogging side-by-side on matching treadmills, Bud asked,

"How's the Grumbler going?"

"Not so good, at least not as you saw it." He explained about the low power output.

"Yeah. Grandma always said that once grandpa got to grumbling, he wasn't good for much else the rest of the day!" He laughed but then turned serious as he asked, "Have you got a new design figured out?"

Tom grabbed his water bottle and took a swig before saying, "Well, sort of. I've got Dianne and her team trying to turn the sonic engine into a steam engine."

Bud stopped jogging, forgetting momentarily that the treadmill was continuing to move. A second later he stumbled off the back of the belt and sat down heavily on the padded floor behind the machines. Looking up at Tom, who was reaching over to hit the STOP button on Bud's machine, he let out a sigh.

"Another of your futuristic inventions knocks me off my feet!" he declared. "Are you serious about that?"

Tom stopped his own machine and sat down next to his friend, wiping his face with the bottom of his t-shirt. "Yes, Bud. It may sound a little eighteen hundreds and hokey, but I may be onto something."

He explained the basic working concept of the engine.

"Who'd have thought that?" Bud stated, incredulously. "I thought steam engines had to be big things with folks shoveling coal under a boiler and lots of smoke and steam and a huge flywheel. Yours doesn't sound anything like that." He shook his head in wonder.

Tom smiled. "It's a simple concept now that we have the technology to do things using electronics and electricity. One of my favorite authors wrote a whole series of books about a



planet that never got past the steam age. They eventually had complex robots and high-speed transportation equipment, but it was all still powered by steam. Even steam powered horses!”

“Sounds like my kind of place,” Bud said, only half-jokingly.

“Not really,” Tom said with a frown. “The robots and other equipment were always blowing up for no good reason. Generally to hilarious results. My hope is that we can keep precise control of the steam and the pressure. We should be able to since no individual puff of steam will last more than a few thousandths of a second.”

The two finished their workout and took a quick shower before parting ways. Bud headed back to the small office he kept in one of the hangars at the northwest corner of Enterprises, while Tom returned to his large lab.

He answered a message from Dianne and found out that her team had decided to definitely put the water-release channel and valve into the cylinders.

“Our single cylinder test model flooded out after about one minute of running. Once Larry routed the channel and Artie fitted the valve and solenoid to it, everything kept nice and dry inside. Good call, skipper!”

Tom hung up, happy that a spur of the moment idea was going to prove to be a success.

After the weekend he was even more happy once he received the call to come witness the running of the improved sonic engine.

“Meet TESS, skipper,” Dianne told him when he came into the lab. “That’s as in Tom’s Engine, Sonic Steam. We banded around several other ideas but none could be turned into names.”

Grinning, Tom asked, “What was the runner up?”

“ReSSE.”

“Reece?”

“No. Reciprocating Sonic Steam Engine. We left the ‘e’ after the initial ‘R’ in there to help a bit, but I got outvoted by the guys. They wanted to make sure to get your name in there.”

“I’d have been happy even if you called it the PEST... Propulsion Engineering Steam Thingie!”

Dianne groaned. “Oh, Tom, You have to stay away from that Barclay guy. He’s a bad influence on you!”

Sobering a minute later, Tom suggested that a demonstration was in order. “Have you already run it?” he asked.

“Just enough to test the moisture exit valves,” she told him. “As per usual, we thought it best to let you take command of pushing the start button.” She motioned him to come forward to the control station.

He flipped the POWER switch and watched the LED above it turn orange. Raising one eyebrow, he looked at Dianne.

“We added a pre-purge cycle to ensure that all the cylinders get cycled a few times and any residual moisture expelled,” she explained as the LED turned green. “It’s ready, now.”

Tom nodded and reached out for the slider control. He started the engine, running it slowly at about 300 RPM, and left it there for a few seconds. After that he spent almost a half hour running it up and down between a low of just 150 RPM all the way up to 6,000 RPM.

It was a success. There were no indications of any overheating and a series of laser measurement devices detected zero warping or changes in any dimension of the engine block.

Shutting the unit off, Tom turned and smiled at everyone in the room. The team gave him an ovation that he acknowledged by telling them, “It isn’t me, guys. This is your work. I was just the idea man. So, let’s take a look at what the computer says.”

Everything looked pretty good until Dianne called up the figures for power drain.

“That’s going to be an issue,” Tom said as he saw that the engine had drawn as much power in thirty minutes as the power pack he envisioned could provide.

The team sat down for the next hour discussing ways that power use might be lowered, or at least partially replaced by running a generator powered by the drive shaft. Tom suggested a change in the frequencies used to try to get a little more power out of the engine. In all, they came up with fifteen different things to check and experiment with.

Tom gave them a final smile. “Chins up, guys. The engine is running better than it should and battery technology is improving every time you turn around. We’ll beat this!”

He arranged for them to try a twelve-hour run to see how the engine would hold up. Dianne agreed to start it by eight that evening.

He left the lab and headed back toward the Administration building. On the way he checked his watch. Six o’clock. As he thought about it he decided that what he needed about now was time by himself to think.

He walked past the building and realized that he was really elated at the success of the new engine, even if it had drawn more power than he hoped. That was a refinement he could tackle in the coming days. It was a beautiful late summer day and he felt like taking a good walk, so he opted to leave his convertible at Enterprises and take one of the three routes to his home. After leaving the main gate he crossed the county

highway that ran along the entire western side of Enterprises and headed down one of the brand new roads a developer had recently paved in hopes of attracting people to their proposed housing development.

Walking along the pristine asphalt, Tom wondered why anyone would want to build houses, much less move into them, right next to what amounted to a gigantic airport and industrial complex. He and his father had tried to purchase the land on several occasions simply to keep a complete buffer zone of unimproved land around Enterprises, but the owner had refused.

*What changed?* Tom wondered. He was lost in thought as he exited the four block deep area and crossed a foot bridge over the small Carlopa Creek that continued to the northeast, finally emptying into the lake. The forest around him offered cool shade and a calm beauty he greatly enjoyed. He was still wondering about the sudden sale and almost immediate bulldozing of the old scrub grass, dogwood trees and the occasional horse chestnut, when it hit him.

Literally.

Tom toppled to the ground, *unconscious*.

**CHAPTER 4 /****DAMN! DAMN! DAMN!**

IT WAS dark when his eyes flickered open and his head snapped up from his chest. Dizziness raced through his head and he had to take a few deep breaths to keep from being sick. In seconds, Tom's mind raced through the last things he remembered.

The heat coming off the asphalt—and the smell of the warm tar in it. He had crossed that little bridge. *The bridge? Was that it? No, wait*, he told himself. *I walked another hundred feet or so and was looking up at a sound in a tree...*

He wondered if it actually had been a sound from a tree. And, given the painful lump he could tell was on the back of his head, it had most probably *not* been a sound in a tree, but it had been someone sneaking up to clobber him.

Tom tried to move his body. With a sense of relief he discovered that his arms were free to move. He used them to pat himself over and found that one leg was handcuffed to a heavy metal ring bolted to the floor.

*No wonder they left my hands free. I can't move more than a foot or so in any direction!*

His eyes had become accustomed to the darkness by now and he could actually see that a fair amount of light was coming into the room from the single window set in the middle of the far wall. He listened carefully. There was a muttering sound from somewhere outside the room—he could not tell if it was inside whatever building he was prisoner in or outside—that he quickly realized came from at least three voices. Two deep, male voices arguing with a high-pitched and possibly female voice.

He failed to make out any details, but at least he now knew that he wasn't alone.

His wristwatch vibrated. Once... twice... up to a total of nine times. It was an alarm feature he had incorporated into the device months earlier. He generally got so tied up with one experiment or invention after another that he frequently lost track of time. This way, he was reminded each hour what time it had become.

*So*, he thought. *Nine o'clock and I'll bet it's the same day as when I got knocked out. That's good to know, but I wish I knew where I was.*

He found out a few seconds later when he heard a very familiar sound. It was the roar of a Swift cargo jet flying low and close by. It would be the return flight from The Citadel, he knew. Due at nine, and just a few seconds late.

That told Tom that he was very near to Enterprises. Whoever had knocked him out hadn't taken him very far. He took a deep, cleansing breath in through his nose, and a big smile played across his face.

He knew exactly where he was.

The smell of cooling asphalt and the proximity to Enterprises said that he was almost certainly in the construction manager's trailer to the back of the new housing construction area. And, that meant he was practically home free.

He moved his right hand up to his short collar. Yes! It was still there. He tapped the TeleVoc pin to activate it. As long as he was within a quarter mile of Enterprises, it would connect. He mentally thought and silently mouthed, "Security." Seconds later he heard another voice, this one inside his head.

"Tom? It's Gary. Where the heck are you?"

Tom relaxed. It was Gary Bradley, one of Harlan's elite

security men and the number three person in the hierarchy at Enterprises' Security.

Quickly he told the man about his situation and location.

"I'm not sure if you can get this place surrounded, Gary, but there are at least three people outside this trailer you will want to get your hands on."

"I've already got men in the woods near the back of that property searching for you, and others to the immediate north and south. If they try to escape to the east they'll just run into Enterprises' wall, so we've got 'em!"

Tom sat quietly for almost five minutes. The argument outside had ceased, but he could still hear at least one male and the female voice discussing something. He strained to make out any of the words with no positive results. However, the conversation was soon drowned out by the roar of what Tom believed would be his *Sky Queen* super jet. The noise got considerably louder until it seemed to be overhead. Intensely bright light suddenly lit the room from outside and Tom could feel the trailer rock from the downward thrust of the aircraft.

The *Sky Queen* was outfitted with the most recent version of his father's giant searchlight and it was obviously being trained right down onto the trailer and anyone outside.

Blaring from a loudspeaker came, "Get on the ground! You are surrounded and can not escape! Do not attempt to move into the trailer!"

Several gunshots rang out over the sounds of the *Sky Queen*. Tom smiled as he knew it would be the kidnappers—Enterprises people only carried e-guns and not ones using bullets—trying to fire at the giant jet. Made from tomasite plates, such small arms fire would harmlessly ricochet off. It was a futile gesture on the part of the criminals.

A minute later the *Queen* moved off, probably to land back within the complex walls, and sounds of a scuffle could be heard. The tell-tale ZEEERACKKK! sounds of discharging e-guns ended it all.

The door tore open and Gary Bradley and Chow Winkler came rushing in.

"Am I ever glad to see you two," Tom told them as they looked over the situation with Tom's makeshift leg iron.

"Me too, boss!" Chow declared. He reached down and grabbed the end of the handcuff attached to the metal ring and gave it a mighty yank. The ring and its mounting plate pulled right up off the floor.

Gary was left standing there holding his handcuff key and shaking his head. "We could have done it the easy way, Chow."

"Naw! More fun this way," the westerner told them as Gary leaned down to remove the cuff from his boss' ankle. "Didn't think this old rickety trailer could hang on much to that ring thing," Chow declared.

As they exited the trailer Tom could see the three people Enterprises' Security were just pulling up onto their feet. All three were Asian and were still looking woozy from the shocks they had received from the e-guns. The woman's head swung up and she tried to focus on Tom.

"Gae saeki!" she angrily said to him. "Miwohaeyo! Toejora!"

"And, that will be about enough of that," Gary told her grabbing her left shoulder and squeezing it hard enough to make her wince. "Take them to our holding cell and then call the FBI," he told one of his officers.

After they left, Tom asked, "Anyone know what she was saying?"

Chow rested on hand on his young boss' shoulder. "Yeah. I parlay some o' that lingo. Ya don't wanna know, son. Weren't nothin' *really* dirty, but it shore weren't nice. She's not a happy little lady right 'bout now."

Gary told them, "Unless I miss my guess, those three look to be Korean. My bet is we'll find out they are North Korean. There have been several bulletins this past month regarding spying and other activities coming from that country."

"Do you think they were after me on general principles, or for a specific reason?" Tom asked as the trio climbed into Gary's car and drove back across the highway.

"It's pretty well known that they are looking for anything that might be turned into a weapon. We know a group of them tried to hijack a shipment of Quieturbines last month in California. One of them cracked and admitted they wanted to see if the repelatrons could be used to launch cannon shells over great distances. It's possible that they read the press release about your forthcoming sonic engine and figured it might be something they could use." He shrugged.

The following day Tom received a call from Harlan Ames.

"Skipper? Two things. First, I'm just checking to see that you get your butt over to Doc Simpson to get checked up after that knock you took. Second, I have some news about your friends from last night."

Tom chuckled. "Doc gave me the once-over first thing this morning, Harlan. No concussion, for once, but it broke the skin so he gave me an antibiotic injection right in the scalp. I think that hurt more than the original thump!"

"At least that's good. The FBI figured out who those three are. The woman was Li Gwak, an industrial spy wanted here and in France. She's a real piece of work. Over the past five years she has... well let's say she has *ingratiated* herself into

the personal lives of at least four industrial leaders over there and one here in the U.S. Uses seduction the way some people use compliments to get what she wants."

"I wonder why the change in approach and technique," Tom muttered. "Not that it would have worked with me..."

"Must be for faster results, skipper. Although, now that I think about it, most of her conquests have been men in their fifties. Perhaps you are a little too young for her tastes," Ames teased. "Anyway, the other two are a pair of brothers by the name of Dongpang. Come from a family of thugs. About half of them are in prisons in South Korea and the other half seem to be actively supported by the government in the North. The FBI will be shipping them to Seoul where I hear they will face life plus life sentences. Those two will never see the light of freedom again."

Five minutes later, the conversation finished, Tom placed a call to Dianne Duquesne.

"Hey, Dianne. How did the overnight test go?"

"Ran like a little champ right up until the point where one of the pistons began to seize up around five this morning. Woke poor Artie up." She laughed. "The safety override shut it all off before there was major damage. We had added shear pins to the pistons just in case. It looks like we need to beef up the lubrication system. When we build these from scratch, we can incorporate more channels and spray nozzles, but this little old engine block was designed to use the injected gasoline to help keep the upper cylinder area lubed."

"Okay. What did the numbers look like?" He was asking about the torque and rotation speeds, but also about the power usage figures..

"The good number is the RPMs. No problems running at everything from full stop, which it would do in an automotive

installation whenever the car comes to a halt, up to about five thousand revs. This engine is rated at just under six, so we kept a fifteen percent safety margin. Torque is a little disappointing, even with your refined frequency settings. In an engine this size that would mean just enough to power a two-seater but nothing larger and probably noting running at over seventy miles per hour.”

“Oh,” was Tom’s only comment. “How about power drain?”

“Equally disappointing. The same size power packs that run current all-electric small sedans for around ninety miles on a charge would only get about eighty in this engine when mounted in a one-ton car. Sorry, Tom. But, this is just the start. We will keep working at it and get more out of it.”

Tom thought for a minute before asking, “Could you pop that engine into a small car so I can give it some real world driving?”

“Uh... sure. Does it need to be roadworthy and licensable?”

“I’d prefer it if that’s possible,” he replied.

“Hmmm. Give me a few days. I seem to recall that my cousin over at the Construction Company has an old Austin Healy Sprite, or at least the frame and body, but no engine. He ought to be able to loan it to me. I’ll call you once I know for sure.”

Ten minutes later she called back and assured Tom that the car would be picked up on a flatbed truck that afternoon and she would have it outfitted with the repaired engine two days later.

When it finally was finished, Tom gave an appreciative whistle upon seeing the little sports car sitting in The Barn. The paint looked practically brand new and the leather interior was immaculate.

“He got everything ready but never could complete the

engine,” Dianne told him. “She’s a beauty, though, isn’t she?”

Tom nodded. As he walked around the car and peered into the engine compartment—now filled with the sonic steam engine and about half of the batteries that would power the car—he asked her, “Do you think we should still call this an engine? I mean, traditionally engines have been combustion driven and motors have been those round things just using electricity.”

Dianne laughed a sparkling laugh. “Oh, Tom, you can’t imagine the discussions my team has been having about that these past weeks. In the end, we’ve come to the conclusion that it is an engine. Our marker for that is that it uses pistons and reciprocation, not magnetic forces and spinning.”

Tom agreed. If he could perfect it, being called an ‘engine’ would probably be an easier sell.

Five minutes later he was sitting behind the wheel and looking at the makeshift panel Dianne had temporarily mounted on the dash. He flipped the Power switch to the up, or On, position. There was a slight noise to tell him the purge cycle was being accomplished but nothing else to indicate anything was happening. The orange LED quickly turned to green.

Carefully, he released the brake and pressed down on the accelerator pedal. “Got to not think of it as a gas pedal,” Dianne had told him earlier.

The little car moved forward, almost silently. He listened and could hear the faint sound of the pistons moving inside the engine block and the gears of the transmission meshing and turning, but that was about it other than the road noise coming from the tires. The small bit of steam created by the superheated water trailed behind him like a continuous wispy cloud.

That steam would be gathered, separated from any lubricants, condensed and reused in production engines. Otherwise, his computations had indicated, the eleven gallon water tank—replacing the original gas tank—would only be good for about fifty miles.

The Sprite smoothly moved forward with unimpressive acceleration until he had it traveling at forty miles per hour down the nearby taxiway. At the far end he U-turned and came back. After giving Dianne a few verbal notes he waved at the assembled Propulsion Engineering team and headed toward the main gate.

As he sped up on the highway heading north, he looked at the readout for his power usage. Ten green LEDs and two red ones made up the 'battery charge remaining' readout. One of the green LEDs had extinguished just as he left Enterprises. A mile later he turned off the highway onto the country road that ran along the northern end of the complex. He tried getting the little car up to top speed, but soon decided against it when he watched, with some alarm, as two more of the green LEDs went out.

"Take it easy, Tom, or you won't get all the way around," he said.

By the time he pulled back into The Barn, only two of the green LEDs and the pair of red ones—the ones to tell him he was about to get into trouble if they started to go out—still indicated power, yet he had traveled just under eighteen miles.

That wasn't at all good.

He told Dianne and Artie, the two remaining engineers, about his experience and then headed to his underground office and small lab.

He was still there late in the day when his father called him.

"Son. Hate to bother you but I just got off the phone with the Sheriff's department. They had a complaint from one of the people living just east of Enterprises. It has to do with your little drive today, I believe."

Tom was curious about that. The car was all but silent, so what could anyone have to complain about. Especially as the only occupied house and property that sat along that stretch of road was a small goat farm. "What's the complaint?" he asked.

"The farmer was sitting on her porch when you drove past. Evidently she was surprised that the car you were in made no sounds. At least that she could hear. The thing is, she called the Sheriff telling him that when you drove past all her goats suddenly went crazy."

"Crazy?" Tom repeated.

"Yes. As in evidently running around, into one another and trying to even climb on top of each other to get away from something. She said they were panicking."

Tom couldn't think of anything to say for a minute. When he did, it was a question. "How did she know it was me. I wasn't the only car on the road."

"No, but she called the Sheriff and reported the only bright red completely quiet car that went by during that time trailing steam, and the Sheriff's office called here to see if we were doing something strange inside the walls. The call went to the main gate and the guard told them that you had recently left to test a new car. And, that it was red. And, a convertible. What could have happened, Son?"

Tom, stumped, told his father he had to go back to The Barn and talk with Dianne.

She was just getting into one of the small electric runabouts Enterprises kept for employees to use for getting around the

four-mile-square complex when he arrived.

Tom explained the recent complaint.

“But, it’s a quiet as a lamb,” Dianne replied.

“It may be quiet as a lamb, but it frightens goats, evidently,” he told her. “Can you please check it out?”

She agreed and made a TeleVoc call to several of her team to ask them to bring some equipment to her. “I’ll call you if and when I find out anything,” she assured Tom.

The following day, she did just that. “Tom. It’s Dianne. I think we found out what is happening. I did some measurements of all the sonics, both audible and inaudible. Then, I called an old college professor from a class I once took in animal physiology, and she put two and two together for me.”

When she paused, a little unsure how to break the news, Tom spoke up. “I have a nasty feeling you are going to tell me something along the lines of the ultrasonic noise we use is what drove the goats crazy. Is that it?”

“Sorry, skipper, but that’s it, only not exactly. Frances Denton is one of the top people in her field. I emailed her all my measurements and she got back to me. And, it isn’t what you might think.”

“What is it, if it isn’t the ultrasonic vibrations?” he asked, now very curious.

“It is the resonant frequencies that vibrate through the engine block. And, there’s no way to dampen it!”

## CHAPTER 5 /

### THEFT AND RECOVERY

TOM WAS dumbfounded. Resonance? That was, he knew, the tendency of an object to vibrate, or oscillate, at a greater amplitude at some frequencies than at others. At these frequencies, even small periodic driving forces could produce large amplitude oscillations, brought about through stored vibrational energy. In some applications, a resonance frequency could knock things over when it hit them.

But what sort of resonant vibrations would his emitters be producing?

“Does she have a theory on whether it is the emitters or the engine block?” Tom asked, “Or possibly both?”

“Sorry, skipper. Without having the entire setup in front of her, she wouldn’t even hazard a guess. I’m not sure what we do now,” she admitted, sadly.

“Can we get her up here?”

Dianne cleared her throat. “I should have said that I’m not sure what we do now, until she gets here tomorrow.” She went on to say how her professor had positively jumped at the chance to come to Enterprises, even though the following day was Saturday. “She and I will catch up tomorrow and then get to work on Sunday,” she promised.

Tom suggested that it could wait until the following Monday, but was reminded that the professor was a working teacher and had to be back in the classroom on Monday morning.

“I’ll meet you two here at nine on Sunday,” he told her.

When he breezed into the lab in the Propulsion lab two days



later, Tom stopped dead in his tracks. Dianne Duquesne was a moderately attractive woman in her mid-thirties and he had somehow expected her old professor to be a little old lady, gray hair pulled into a severe bun at the back of her head, wearing tweed. At least, an old cardigan with leather patches on the elbows.

To say that his original mental picture had been wrong was akin to saying that a Saturn V moon rocket “made just a little noise” when it took off.

Barely five or six years older than Dianne, Frances Denton was stunningly beautiful with a full head of flowing, red hair. Her features would possibly put a makeup model to shame and her figure was the sort of thing teenage boys dreamed about 24/7/365. In other words, she was gorgeous.

Dianne was smirking as she watched his reaction. It was the same one boys *and* girls alike had on walking into her classroom at the start of each semester.

He was still acting a little shocked during the introductions but managed to untie his tongue in time to discuss the little engine and his hopes for it.

“It is an absolutely intriguing idea, Tom, and I hope you manage to make something of it, but it can’t be what you have right now. It won’t just be goats that are affected by the noises. Just about any other animal, and most birds, will be panicked by it. That particular sound is primeval and terrifying to them.” Seeing his look, she tried to lighten the conversation. “On the positive side, it is a fairly narrow band of perhaps sixty Hertz. Can you broadcast, or whatever it is you do, around that if I give you the numbers?” She looked at them both, hopefully.

When their faces told her that things weren’t looking good, she sighed. “Ah. I see. If this were only to be used out in unpopulated areas I could suggest broadcasting a dampening

frequency like those noise canceling headphones do, but it would then be extremely annoying to humans. It would cause deep rumblings to be felt in people.”

Dianne asked, “Are you talking about the mythical brown noise?”

Frances smiled but shook her head. “Not exactly, but it might make some folks feel mighty uncomfortable in their gut.” She sighed again. “I’m sorry, Tom, to be the bearer of bad news. Dianne’s told me about the process and the weeks of work that went into this.”

Tom shrugged. There was really nothing he could say that hadn’t already been said. “I want to thank you for coming here, even if it was for a wild goose chase.” He reached out to shake her hand.

When their fingers touched, the young inventor felt a zap of electricity coursing up his arm. His mind raced. She was definitely beautiful, but he was definitely a one-woman man and Bashalli Prandit *was that woman*. A split second of panic threatened to envelope him, but by this time the feeling had passed.

“Oh, god. I’m so sorry,” Frances was saying to him. “I have this issue with storing up static electricity and zapping people. It’s always been a problem for me. I can’t even wear a battery-powered watch because I will drain a new battery in a month. I didn’t mean to shock you, Tom.”

Tom grinned as he heartily shook her hand. “You can’t imagine how glad I am to hear about that,” he told her.

With a few final words of goodbye, Dianne and Frances headed back to Dianne’s apartment to pick up her visitor’s luggage.

Tom went back to the Administration building and the large

office he shared with his father. Slumped down in one of the oversized leather chairs that surrounded a low table in one corner of the room, he tried to think of what to do next.

For the next hour his brain raced around covering dozens of possibilities. But, only one thing kept coming back to him.

*Resonance.*

Realizing that he was getting hungry, he started to push himself up from the chair. He froze half way up.

*Resonance!*

*That must be it, he thought. There are hundreds of resonant frequencies that have plenty of oomph. Perhaps even enough to push a piston down. Some of them have to be benign to animals.*

All thoughts of food disappeared as he ran down the corridor and into the large lab. For the next five hours he poured through the Internet looking for as much information as he could find. There had been studies at many universities and companies going all the way back to the 50s.

There was not, as far as he could find, any charts or definitive descriptions of the force that might be provided by the various oscillations.

And that, he knew, meant he would have to do a range of experiments himself.

It would need to wait until the following day as his father phoned to remind him that dinnertime was approaching and that he had promised his mother he would be there.

Bright and early the next morning Tom was back at Enterprises and his large lab. An hour later he put the finishing touches on a circuit board and emitter that could be used to run experiments on starting as low as 2 Hz and going

all the way up to 30K Hz.

He looked up when the knocking on the door finally got through to him. Turning, he grinned when he saw Dianne standing in the doorway.

“She makes quite an impression, doesn’t she?”

Tom felt himself redden. “Um... yes. She does.”

Dianne let out a delighted little laugh. “She has the same effect on everyone, Tom. She knows it, too, but she never plays on it. She’s had the same steady man since I first met her back at school. It was her first year teaching and he was one of the first men she had encountered since she was fifteen that didn’t fall all over himself trying to impress her. By the way... she thinks you’re pretty handsome!”

Tom’s face, that had just returned to its normal color, reddened even further than before. He took a deep breath and started to tell her about his new thoughts.

“So,” he concluded five minutes later, “if we can find at least one resonant frequency strong enough to give us some piston push, and all without making so much noise that it bothers man or animal, I’m hoping that we can rescue this sinking ship.”

“Bring your emitter over to our test chamber,” she offered, “and we can run through the entire range. I’m all set up for measuring every sort of noise that something can make. Frances left me her notes on the frequency range we need to keep clear of. We ought to know the results in an hour or two.”

He picked up the board, power supply, and the emitter and offered them to her.

“I’ve got to go have a talk with dad about this. I’m pretty close to hitting the wall on time and costs and need to beg for an extension.”

She smiled and took the devices. It was well known that Tom had an almost unlimited budget for his inventions, most of the time, but even Enterprises felt the recent economic downturn. Each department had been asked to carefully watch expenses, and Tom firmly believed that he should not be exempt from such a request.

By the time he got over to the Propulsion Engineering building one hour later, the equipment had been set up inside the soundproof test chamber. He had expected to see faces eager to begin. What he saw were eleven faces all looking nervous and miserable.

“What?” was all he could say.

Dianne stepped toward him. “Tom, we’ve had a robbery,” she told him. “It must have been last night after Frances and I left. I’m just sick about it. Oh, before you ask I already called Harlan Ames. He should be here any—”

The Security chief strode into the large lab room.

“Got here as quick as I could. Did anyone touch anything?”

“Uh, can someone tell me what was stolen,” Tom said in a fairly loud voice.

Everyone stopped and turned to look at him.

“Oh, sorry, Tom,” Dianne said. “It was the designs for the last version of the engine. At least, it was for the sonic emitter system. I goofed big time and left it sitting on my desk instead of locking it away. What with it being a no-go, I just put it out of my mind. I’m sorry. If you want me to resign, just—”

“Whoa!” Tom said raising one hand. “Nobody is going anywhere. Harlan? This is the first I’ve heard about it but we will all stand aside and let you get to work.” He looked at the assembled team and stated, “Be as thorough as you can be in answering this. If there is any chance that any of you touched

or moved or even bumped anything, be sure to tell Harlan.”

An hour later the Security man and the three members of his department who had arrived moments after him, all left. The only thing they had found was a palm print on the edge of Dianne’s desk. It did not match any member of the team. Whoever had taken the papers must have leaned on the desk. Unless, that is, the print belonged to the recent visitor, Frances Denton.

Dianne placed a call and left a message for her old professor to get to her local police station and to have them take and send a set of her finger and palm prints to Harlan.

“Okay,” Tom said a little more brightly than he felt. “Let’s get this experiment going.”

Final connections were made and all test programs started. As they watched, the emitter pulsed out frequency after frequency against both a measurement membrane as well as into a mockup of one of the cylinders. As expected, the results against the membrane were in line with the wavelength of each frequency. The lower ranges produced much more movement than mid range or high frequencies.

The telling thing was the reaction inside the cylinder. Five separate frequency ranges—each less than a few Hertz wide—produced noticeable driving reactions. And two of them were far stronger than the other three. It wasn’t the same level of force that an exploding mixture of gasoline and air might cause, but as Tom reminded them all, such an explosion only occurred for a fraction of a second and everything else was just the piston gliding down and up and down and up again.

In the case of the emitter, the full force could be programmed to continue to push all the way from the top of the stroke to the bottom. A quick calculation told them that this would theoretically produce almost as much driving force,

overall. That, he reminded them, should translate into torque.

Tom left just before lunch with Dianne promising to work on a totally new engine block and design. “We’ll need a couple weeks, skipper,” she told him, “because the resonance results will probably be different from engine block to block. I’ll keep you up to date.”

Tom took a couple days off, time during which he took Bashalli on a full-day sail up and down the length of Lake Carlopa. She had never traveled more than about the mile across the lake at the upper portion where Shopton was located and out to the small island where many young people liked to have picnics and parties.

More than once she turned to him with a bright and beautiful smile as she marveled at the scenery.

The dropped anchor at the shallow south end of the lake where the water was the warmest and had a good swim and early afternoon picnic lunch.

As they ate, Tom pointed to the southeast shore and remarked, “It was somewhere over there that my namesake had a little adventure with a group of thieves and diamond smugglers.” He told her about the first Tom Swift and his teenage exploits with a small motorboat he had rebuilt.

“In his younger years he fiddled with just about everything from motorcycles to cars to dirigibles to planes. About the only thing he never had the opportunity to see or experience was jet-powered flight and space travel.”

“You come from a long line of geniuses, Thomas. I am so proud of you,” she told him as she leaned in to kiss him.

They changed clothes into something more suitable when they arrived back at the Shopton Yacht Club and marina, and then had dinner on the terrace of the club.

Everything was going along nicely when Tom sat up straight with a start.

“What is it?” Bashalli asked in alarm.

“Don’t turn around, Bash, but I think I just spotted someone who might be part of an international gang, perhaps even the ones that kidnapped me and also stole my plans the other day!” he slid his chair slowly backwards.

She placed a firm hand on his forearm. “Call Mr. Ames,” she said in no uncertain tone of voice. “You will not abandon me here to go chasing after whoever it is out there. Call your Security people or the police and let them take care of it. Please!”

Tom could see the look in her eyes and realized that she was right, so he pulled out his cell phone and stepped away from the other diners.

Two minutes later he was back at the table. One glance had shown him the Asian man he had spotted was still standing about a hundred feet away, casually leaning against one of the fenceposts that held the security and safety fence between the water and the parking lot.

Tom tried to keep himself from looking more than a couple more times in order to not raise any alarm in the man. Five minutes went by and he was starting to worry that the man might take off. However, it was at that time he noticed at least two of Enterprises’ Security men casually walking in his general direction from the other side of the mystery man.

“Thomas,” Bashalli told him in a low voice, “I believe that I can see Mr. Ames and Mr. Bradley just over your shoulder. They appear to be coming this way... oh. They’ve split up and one is going around the front of the club building.”

“Where’s the other one?” Tom asked.

“He’s walking between us and the water. See?”

Tom glanced to the side in time to see Gary Bradley striding purposely past the raised dining terrace.

A moment later there was a slight sound of a scuffle. Tom turned and looked in time to see the Asian man being wrestled to the ground by Harlan and one of the other men. Less than a minute later, an Enterprises car pulled up, the man was bundled into it, and the team departed.

After taking Bashalli home, Tom phoned Harlan’s cell phone.

“Glad you called, skipper. We’re not certain who we’ve got, but we do know one thing about him. He is North Korean. Gary could tell by the very specific swear words he was using. He obviously speaks english since he reacted with a lot of alarm when we said we knew what he was up to, and that we already had arrested his accomplices. Other than that, though, nothing out of him.”

Before hanging up, Harlan told Tom that the man would be turned over to the local FBI agents first thing in the morning.

“They still have the two thugs from your kidnapping attempt in custody. Maybe putting the three of them together will get some results.”

Any positive results would only help Tom get out of a slight funk he had been feeling for a few days. Even with the evident success in the resonance experiments he couldn’t help but worry that this could be another dead end. And that, he knew, would put an end to the project. He was already getting some pressure from his father to assist in preparing a major bid for a proposed semi-permanent settlement and mining facility on the Moon.

It would be a matter of just a week or so before he would need to turn all his attention to that.

Unless he and Dianne and her people could tease success from the previous failures, he might be at a total dead end!

**CHAPTER 6 /****REINVENTION**

IN THE next thirty-six hours three extremely important things occurred.

First, the FBI's little trick worked. As soon as the newest prisoner had been reunited with the others, they all had begun jabbering and accusing each other for the failure of their plans. Five of the Bureau's top translators poured over every piece of their conversations and came up with identical results.

Twice the name of the female spy was mentioned by the newest man, and the others quickly cursed him into silence.

Even bits of conversation the criminals had believed could not be overheard had been recorded using microphones built into the ceiling tiles, the chairs and even into the table top itself.

The results were that Harlan could report that Tom's kidnapping had been part of an effort to steal designs for a weapon—or anything that could be used as a weapon—against both U.S. and South Korean ground forces. Evidently, the rulers in the north had instilled the belief that an invasion was imminent in these minor criminals.

The FBI also reported that the men had mentioned a fourth male member of the team and were smug about the fact he had not been captured.

The second thing that happened was that Dianne called Tom just five days after promising him results 'weeks later' to say that her team had successfully found a combination of a titanium-lined cast aluminum-alloy engine block—providing the best possible resonant frequency generation—shoving

down onto a lightweight carbon fiber piston head.

It had worked in the single cylinder test model they created, and she was calling to ask whether he wanted a demonstration before they began the V-8 version.

After thinking it over a moment, Tom decided that he had too many other things to attend to at that moment, and—rather than delay them even for an hour or a day—they should go ahead with the full-sized test engine.

“The good news is,” she told him, “that I'm pretty certain we can still deliver within that three week window I once promised you.”

“Good! Oh, before I let you get off the phone, Dianne, I realize that this is taking everything back to being a two-stroke engine, but have you any way to refit your single-cylinder to be a four-stroke to check if adding the water vapor helps?”

“Hmmm? Let me get back to you on that, Tom. In fact, if you can extend my window a few days I would actually like to do that before we commit to the V-8.”

He agreed.

“Oh, and I may have a little surprise for you,” she said as a tease, but would not elaborate on that.

The third thing that happened was on the afternoon of the following day when police pulled over an erratic driver on the highway out of Shopton heading south toward Albany. The man, an Asian, had no license or identifying papers. He was arrested and detained for the FBI.

A check of his palm print did not match the one in Dianne's lab, but he turned out to be another North Korean, in the country illegally, and probably the final member of the spy team.

Ames asked Tom to accompany him to the small FBI office just outside of downtown Shopton. They spent several hours watching agents grill the man, but he refused to speak.

When the name of the woman, Li Gwak, was mentioned, his eyes briefly widened.

“Well, that may not tell us who or how the plans were stolen, but it seems to round out the known members of that gang,” Harlan said as they were getting into the car.

Tom arrived back at Enterprises late in the day and just in time to watch Bud land the Swift cargo jet he had piloted back from Japan.

A small Japanese airline company had purchased fifteen of the Swift SE-11 “Toad” commuter jets, and Bud had been thrilled to volunteer to fly them, along with the final assembly team, over the week before.

He had been especially happy to volunteer once he found out that one of the other pilots was to be a vivacious blonde by the name of Sandy Swift! As she had told him the evening before departure from Shopton, “Daddy wants me to get my long-haul certification. I’ve got just about everything else, but not the paper to let me fly more than five thousand miles without setting down.”

Tom greeted them by shaking Bud’s hand and giving his sister a hug and a peck on the cheek. “Welcome back long distance travelers. How’d it go?”

“Great!” Sandy all but shrieked. “I loved it! Bud and Red and Hank all let me take as much time as possible at the controls. That thing flies a bit differently at forty-thousand over the ocean than it does at twenty-five over land. But, it was all great!”

Tom laughed. It was one of the things that surprised many

first-time pilots on such runs. Not only were you allowed to fly higher, in order to save fuel, but you flew in an entirely new part of the atmosphere, filled with jet stream winds, cross-currents and certain formations of clouds that could either make your trip a smooth and quick one, or shake you until your teeth almost came loose.

“Any issues with the Toads?” Tom asked.

“Not a one, skipper. Their pilots too to them like they’d been flying them for years. There’s a rumor they might want another dozen by year’s end.”

As they walked from the large hangar group at the northwest part of the complex, Tom told them about the Asian thug at the Yacht Club, the other one that had just been caught, and about all that had been happening with the new engine.

“Yeah. Dianne emailed me on Sunday evening about some of that,” Sandy told him, giving him an odd smile. The older woman had become somewhat of a mentor to Sandy and had been teaching her about management and team dynamics. Sandy next got a wicked grin on her face.

“Care to tell the viewing audience about a certain Miss Denton, Mr Swift?” she said holding out an invisible microphone.

Tom first turned beet red and then paled to almost ghostly white. Sandy watched this and dropped her hand. “Oh! I’m sorry, Tomonono. I shouldn’t tease you about things like that. I swear I won’t tell Bashi. Promise!”

They all stopped while Tom composed himself and Sandy gave the bewildered Bud a brief explanation.

As they resumed their walk, Tom told them, “It isn’t that Bash can’t hear about her. In fact, I’ve already mentioned that I was shocked to see how attractive an older college professor

could be and then said that I bet Bash will be even more so when she is that age. No, it's just that the memory of first seeing her..." he trailed off, lost in the memory.

"Earth to Swift," Bud said close to his ear. "Come in. Your time is up! But, tell me, skipper. Was she as drop-dead as Sandy says?"

Tom didn't get the chance to answer as Sandy stepped closer to Bud and elbowed him in the side. "Curiosity killed the possibility of a nice date with me, lunkhead. Care to go for the bonus round?" She held a fist in front of his nose.

"I give. Sorry, Sandy and sorry, Tom. I won't ask again. But, I will ask about that engine. Do you have any figures on how far and how fast she'll take a car?"

"Not yet. In fact, we're still not certain if it is going to be a dry two-stroke or a steam-filled four. Dianne should have her tests done in a couple days. Then we'll see."

When the test results came in, they pointed back to the two-stroke version. Adding the fine water vapor gave only nominal increases in power, but slowed the engine down based on a similar power drain on the batteries. Her computations showed that the more complex engine was simply that: more complex. More parts to move, more to have problems with, and more systems to control.

Tom gave the go-ahead for the V-8.

Nine days later, and just one day later than the original timetable, Dianne escorted Tom, Mr. Swift and Bud down to the parking lot next to the Administration building. Sitting next to the rear doors was the shiny red Sprite. To the eye, it appeared no different than before.

Tom and Bud leaned into the car and looked around. All of the instrumentation was the same as before. Tom popped the

hood and lifted it up. Underneath was an engine such that he had never seen before.

Bud was so stunned that all he got out was, "Oh, wow..."

Instead of gleaming chrome or even dull cast iron or aluminum, the engine appeared to be made from a pale blue plastic. There was no single cylinder head or even one over each bank of four cylinders. Instead, each cylinder extended about three inches away from the central crank case and featured a thick six-sided topping plate that began at the crank case and arched up over the top.

There were, as expected, no spark plugs or wires, just four raised bumps on each cylinder plate.

Tom arched an eyebrow and looked at Dianne.

Dianne turned and tapped Artie Johnson on the shoulder. "Tag. You're it."

Stepping forward, Artie said hello to Tom and Bud, and also to Mr. Swift who was now sitting in the car, and proceeded to tell them about the new engine.

"Probably the first thing you're noticing is the color. That is a new plasticized polymer coating—made from a soy oil derivative by the way—that we added to keep any of the resonant waves from being heard outside. It is an ultra-dense baked-on coating that absorbs and deadens sounds."

Dianne interrupted. "That's the surprise I mentioned, Tom. I'm thinking of presenting it at the next Department Head meeting, Mr. Swift. It seems to be a product we could sell into any number of industries."

"You have my support for that and the first spot on the agenda," he assured her.

Artie continued. "That arching plate that comes up and over



each cylinder is the channel through which the resonant waves pulse. Most of the waves come from deep inside the engine block; there is no way we can generate them individually at each cylinder, so we simply control them and their release into the cylinders at the appropriate times.”

“What happens to the ones that don’t get used?” Bud asked. “Do they just keep banging around inside?”

“No, Bud. That why the coating all over everything. They would normally vibrate the block and do a couple things. They would make noise outside that would bother people, and they might even cause sympathetic vibrations that could eventually damage the engine. We give them free rein to come out, but we just grab and silence them with the coating.”

“Okay.” Bud felt the top of his head. “My brain is still inside, so I guess I’ll ask another question. What’s with the little bumps on the top?”

Both Artie and Dianne smiled at this. He told the flier, “Those are the tops of the resonance enhancers. We found that the waves of pressure that come up and around the armature seemed to be missing a little something. Like if you have a cube, but the corners have been chipped off. It is still effectively a cube, but not a perfect one. Those enhancers are tiny resonance chambers that sort of put the corners back on.”

Damon got out of the car and came to peer at the engine. “It’s possibly the most beautiful engine I’ve seen. And, assuming that it performs, it will be about the most remarkable. But I have a question of my own. Isn’t everything you’re doing draining a lot of power?”

Dianne shook her head. “Not to any great extent, Mr. Swift,” she told him. “And, while we haven’t run any full-to-empty tests using the battery pack, our figures from the current drain on the power supply back at the lab indicates that this engine

should run at speed for up to five hours on a charge. That would be at an equivalent of around sixty miles per hour, so that is a range of three hundred miles on a charge.”

Artie added, “We built in a generator that only steals about one percent of the power output, but provides a nice power output back to the batteries. Oh, and the batteries should be able to be recharged from any 220-volt outlet in about three hours.”

Tom, Bud, and Mr Swift all let out low whistles. They exchanged looks and started to laugh.

“Well, I guess that just about says it,” Tom commented. “The whistles approve. Is she ready for a little run?”

Dianne motioned for him to stand back. She closed the hood and moved around to the driver’s door. Opening it, she said, “She’s ready for a test drive. Have fun!”

Tom began the test as he had with the previous steam engine with a run up and down the nearby taxiway. This time the acceleration was greatly improved. As he and Bud headed for the main gate, he looked at the battery charge LEDs and smiled. All of the green LEDs were still lit.

A thought hit him and he stopped the car at the gate. After TeleVoc-ing a message, he and Bud headed out and along the road, retracing his earlier route.

They were racing along the north road when Bud asked, “You gonna tell me what that message call was about?”

Tom shook his head. “It might not be in time. We’ll see. If it gets though then you’ll see. If not, I’ll tell you what I was hoping for.”

They turned the corner and headed south. A couple minutes later Tom slowed the car. Seeing what he had hope to see, he pulled the car over to the side of the road and stopped in front

of a woman standing next to the fence. With her were three goats.

“Hello, Mrs. Bailey. I’m Tom Swift, the one who scared your goats the other week. I want to apologize again for that. It was unintentional and unexpected, but it really helped me with a new invention.”

She smiled and replied, “They got used to the noise from the airport you have inside there, but whatever it was in that little car sure made them run scared. I couldn’t get milk from them for five days. But, I want to thank you and your father for paying for my losses. And, to your Mr. Winkler who came over and bought fifty pounds of my cheese with a promise of fifty pounds every month for at least two years.”

Tom smiled. He hadn’t been told about the payment or about the cheese, but he approved.

“They don’t seem to be too bothered now.” He gave her a layman’s overview of what had changed.

She nodded. “That’s nice. The goats would thank you but they’re not big on words. Thanks again!” With that, she turned and walked away.

Tom got the car back on the road and they were soon racing along at sixty MPH. “Take her up to top speed, skipper,” Bud urged.

Tom shook his head. “Sorry, flyboy, but I’ve just about got it floored right now. Looks like sixty is about it. It’s probably the single gear transmission. Maybe I can look into a multi-gear automatic one.”

A little disappointed himself, he was happy to see that all of the LEDs were still brightly lit. In fact it wasn’t until they had just passed the main gate for a second loop of Enterprises when the first LED dimmed and went out. Tom gave Bud a

chance to drive most of the second lap.

After letting Bud get out at the cafeteria, Tom drove around to the Propulsion Engineering building and parked in the ‘Special Projects’ spot. Upstairs, he found Dianne and her entire team waiting in anticipation.

They were happy to hear about the battery usage but disappointed at the speed.

“We were pretty certain that would happen,” she told Tom. “Even with the eight cylinders there isn’t a lot of extra torque at the upper speeds, and you need to have that to get the car moving faster and faster. We believe we have the solution, if you’ll green light it.”

She told him and he left after okaying the project, even if it came from his own funding.

Since she had promised to return the Sprite to her cousin by now, Dianne also asked permission to repurpose the small sports car that Tom had used for his original Y-4 engine demonstrations. Built around a frame from a Japanese car company, the body had been purpose-built. And, since it was made up of about sixteen different panels, it could be easily and inexpensively reconfigured for this new requirement.

Tom gave his approval.

He no sooner arrived at the office he shared with his father than Harlan Ames walked in.

“I’ve got some news on the break in front,” he told them as he took a seat across from Damon’s desk. “We okayed a new janitor to replace old Pete Dundy who retired last month. The new kid was right out of high school over in Thessaly and checked out. He’s been working in both the Admin building here and the Propulsion Building.”

Tom’s shoulders slumped. “He stoke the plans?”

Ames nodded. “And, he’s absolutely sick about it, as in he tried to overdose and kill himself. He’s in Shopton General right now with a really good chance at surviving. His mother told me she found the missing plans in his room along with a note to return them once he was gone. The poor kid met an exotic Asian lady who promised to love him forever if he could just bring her some of your latest plans.”

“Our North Korean spy, no doubt,” Damon said.

“That’s what I think. Anyway, the botched kidnapping put her away and once the kid finally got up the courage to steal the plans he had nobody to give them to.”

“So, he felt guilty and tried to kill himself?” Tom asked.

Ames nodded. “Case closed except for me firing the kid once he recovers.”

Tom shook his head. “No. Have him come talk to me. If he needs to be let go, I’ll do it. Otherwise, maybe he’s learned a life lesson.”

\* \* \*

Tom Swift sat in the driver’s seat of the low-slung sports car. The entire body was painted a light powder blue. The back of the car contained a brand new battery pack that took up half of the trunk space and extended into the cabin, ultimately bumping into the back of the two seats.

Under the hood—

To be honest. There really wasn’t much of a hood.

The front of the car tapered over and around a compartment that held the radically-redesigned resonance engine. Sticking out of both sides of the rounded cover were six cylinder heads with their resonance-enhancing and delivery covers.

When Tom had first seen it he had asked, “Is that a V-12?”

Dianne’s answer had been, “Yes. And, no. There are indeed twelve cylinders in there, but that is actually what I’m calling a Bi-planar V-6.”

He had stared at her until she gave in and explained.

“Right. What you have are two separate V-6 engines stacked one on top of the other, running separately and with different displacements, but all in the same engine block. The bottom one is almost three-point-two liters and the top one is just under two-point-four. Before you ask, we had to do that so they could stack without being too tall. Oh, and for power savings, but I’ll get into that in a second.”

“You have my undivided attention, Dianne,” he informed her.

“Good. So, what we wanted to do was to create a single engine block with the appropriate resonant characteristics and capabilities, but we knew we needed to increase the displacement and or the number of cylinders. This is what we came up with. The two V-6s can run independent of one another but are tied together inside with a special automatic clutch and a drive chain.”

Tom raised a hand. “Can I guess at some of this?” Receiving a nod, he continued. “I’ve seen this before, haven’t I? It’s based on one of my old reciprocating pump designs from back when I was fifteen or so.”

“You caught us, skipper,” she admitted. “I was looking through the archives for inspiration and came across your old double-V pump... It all just fell into place.”

“If I understand and interpret this right, for initial acceleration and for high torque needs both engines are running. When you are just gliding along on flat or coasting downhill, the larger engine shuts off—or stops drawing any power—and the smaller one keeps the speed up using the

inertia of the vehicle. How am I doing?”

“Just like you were looking over my shoulder, Tom. I suggest that you give it a try, but I also suggest you take advantage of my getting permission to close runway zero-one for the next several hours. It is long enough for you to get up to top speed and then safely decelerate. Take as many runs as you want. You may be surprised.”

Tom climbed into the car. It felt good. He looked at Dianne and gave her a thumbs-up before flicking the power switch and pressing down on the pedal.

The car raced up and down the runway for almost an hour before he brought it back. He had tried slow accelerations, fast ones, accelerations from fifty to eighty and many other tests. The car excelled at everything.

When he pulled back into the special parking space, the entire team was sitting on foldable chairs enjoying glasses of iced tea.

As he approached them, Dianne reached under her seat and handed Tom the glass she picked up.

“Time to celebrate?” she asked.

His ear-to-ear smile answered her question.