



Tom Swift's— Ah, Chute!

By T. Edward Fox

Three military pilots who recently were forced to bail out of their stricken fighter jets over hostile territory address Congress with their stories. And, while they were eventually rescued, all three have made strong suggestions indicating that any means of traversing to a landing area further away from the enemy, even by just a few miles, would have made a huge difference.

Tom Swift has been called to Washington D.C. and asked what Swift Enterprises might do to help. A new parachute? Perhaps.

Although he is well versed in many methods of propulsion, the restrictions of working with existing aircraft and ejection systems is almost too much of an obstacle.

Is there some way to outfit these brave aviators with a way to depart an area once they are falling free of their jets? Can Tom find that way?

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This story is dedicated to the (mostly) men who strap themselves into cramped cockpits, endure unhealthy G-forces, and sometimes are forced to bail out at speeds that might kill them. To make things worse, they sometimes must “hit the silk” over dangerous terrain or enemy territory. If I could make their jobs safer, I would. Is there anyone out there who can do what Tom does?

A SWIFT ENTERPRISES INVENTION STORY

Ah, Chute!

CONTENTS

FOREWORD

In my day, I piloted military and civilian aircraft during the dark the ages of both the propeller and the early jet. On only one occasion did I find it necessary to detach myself from several tons of twisted metal, explosively volatile fuel and flames, and plummet Earthward.

I don't recommend it.

Fortunately I did this over safe water and from a relatively slow flying P-82 Twin Mustang. I would hate to have been in one of the jets of the era or, more importantly, one of today's Mach-plus fighters. For my troubles I received a cracked elbow—I forgot the mantra of "Gulp, pull and tuck." I took that important gulp of air, I pulled the handle to blow away the canopy, but let my left arm flop out as I dove off the back of the left wing. We didn't have ejection seats.

It hit the side of the port fuselage with a resounding crack! I was fished out of the drink eighty-seven minutes later. As I lay flopped over my small inflatable raft, thoughts of "what would I have done if we—the P-82 was a two-pilot aircraft—had been five miles further inland. Would the North Koreans have just let us walk to the sea and paddle away? I doubt it.

Hopefully, Tom's new invention won't ever be needed. But...

PART		PAGE
1	They Barely Made It	3
2	Is It Possible or Even Practical?	8
3	Sailing The Sky	11

Victor Appleton II

PART 1**They Barely Made It**

TOM SWIFT, blond-haired young inventor, sat in the large and oddly noisy committee room in the U.S. Senate building. While the three men sitting at the table facing a group of scowling Senator's and Congressmen were telling their stories, dozens of people wandered in and out of the room, and those behind him were murmuring and commenting on what they thought of the testimony.

He craned his neck forward so that he might be able to hear what was being said. His turn at the table would come in a few minutes after the men—three military aviators from two different service branches—finished giving their testimony.

A U.S. Navy Commander in full dress uniform was speaking.

“Our objective was located inland by about one hundred ten miles, sirs and madam. Following the cat launch... by that I'm referring to a *catapult* launch, the six aircraft in my group assembled in the area you can see marked as Zone Alpha on the maps you each have.” He paused while the thirteen people looked at their maps. “You can also see our objective marked in red and indicated as ‘Hell Point.’ We made a direct route up the corridor shown by the green line to the objective, fulfilled the mission and—”

“What in the world does that mean, young man?” asked the only woman on the panel.

Looking directly at her and with several of her fellow senators watching to see her reaction, the pilot replied, “We dropped our high-explosive bombs on the target destroying everything at that particular compound and killing the enemy rebels.”

When she gulped but offered no follow-up question, he cleared his throat and continued. “As with my fellow aviators here at the table, my flight group turned to head back home. We took a different route to try to avoid any anti-aircraft fire that might be expected. That is the corridor designated by the blue line. Unfortunately, we ran into an incoming flight from NATO that nobody told us about. We had to scramble to get out of their way. It's a damn good thing we could see their electronic IDs or we might have engaged them.”

“Shot at them?”

“Yes, ma'am. As it was, the AA batteries their overflight had alerted as they came inbound were primed and ready to launch a couple surface-to-air missiles at us. Five of my aircraft made it. I wasn't so lucky. I took a hit to my starboard wing and barely was able to eject before the entire aircraft exploded.”

What was to come next was the reason Tom had been asked to attend early.

“I successfully ejected and separated from my seat, and my chute came out just fine. The problem was that I was still directly over hostile territory. It was a dead still day and I could do very little maneuvering. The rebels captured me as I hit the ground. I had no opportunity for escape or concealment.”

The committee chairman, a gruff, grey-haired senator from Minnesota, took advantage of a pause to ask, “What is it that you could have most used in that situation? Better armor in the jet? Something a bit more powerful than the service forty-five caliber pistol you carried?”

The commander shook his head. “Senator Tripp, sir. Uh, sirs and madam... more armor on the jets would only make for less capable and slower aircraft. More personal weapons would have meant that the rebels would have likely shot me dead. No. What I could have used most—what I know from speaking with my colleagues on either side of me today—was a method of transiting, uh, exiting the area once I exited my aircraft. A more steerable parachute comes to mind.”

“But,” another of the committee members asked, “you already have one of the best and most capable ejection and parachute systems available today, Son. Costs a million bucks per plane. What in the world could be any better?”

The Marine lieutenant to the commander’s left spoke up. “What I, what *we* could use is a redesign that allows two things. For starters, my bailout was at just five thousand feet over enemy terrain. I had only about two minutes to try to maneuver. But the current chutes only let you travel just three hundred feet on the horizontal for each thousand on the vertical. It meant that the best I could hope for was to get less than a quarter mile away from the emplacements right under me.”

He raised his left arm so that the committee could all see the prosthetic forearm and hand he wore in place of

his lost flesh and bone.

“I took small arms fire. Lost two-thirds of this arm and took five rounds to my legs and another two to my torso. If I could have, as the Commander says, exited the area to a greater extent, perhaps just one full mile, I might not have been shot and not held captive for six weeks without proper medical attention.” He again waived his false arm for emphasis. “I might still have my hand and be able to fly. Now, I face a desk job or retirement.”

The third aviator had a similar story. He had been shot down but not injured. However, he had been captured and held for a month until he escaped and was picked up by a Marine helicopter he had been able to signal.

When they had been thanked and dismissed, Tom’s name called. He rose and made his way out of the fifth row to the aisle and forward to the table.

A heavy-set man stopped him a few feet away and motioned for Tom to open his briefcase. “Security check,” he grunted. Tom obliged.

Once seated, the Chairman seemed to see him for the first time and reacted with mild surprise. “Uh, are you Damon Swift’s son?”

Tom nodded. “I am Tom Swift, sir.”

The Chairman looked over to the man seated to his left and asked him, “Didn’t we call his father? I don’t want to talk to some kid.”

“Excuse me, sir,” Tom said, raising his voice and adjusting the microphone in front of his face. “With

respect, this committee called for *my* attendance. And, I was called apparently because I have a higher level of experience with ejection systems, parachutes and other emergency egress devices than my father.”

After a little grumbling and a few other aside questions to an aide behind him, the Chairman turned back to face Tom. With a sly grin he said, “Good! Then let’s get started. I believe I saw you sitting there for the past two hours while we have had our military aviators providing testimony regarding ejection systems.” Tom nodded once. “Fine. So... what is your opinion?”

Tom pursed his lips before speaking. “Well, there are three things that I see need to be overcome before it might be practical to design and build a better parachute. Chief of them is materials. Current chutes are made from a nylon derivative. It is fairly strong, rip, rot and mildew resistant and lightweight.”

“What is the matter with it?” the Congressman from North Dakota asked.

“As light and as thin as it is, a fully-packed chute remains fairly bulky. A package about four inches thick, fourteen wide and eighteen tall. Given the amount of space available once a pilot is sitting in his ejection seat, you can’t have much more. The chutes in use today replaced those that once were round and barely steerable at all. Today, pilots have a modified sports-type chute. By modified I mean it is smaller so it fits and therefore it is less steerable. As the Marine officer said, he still had limited time and performance available even with that type of chute.”

“Can it be improved?”

“Oh, certainly. An oversized sports canopy could provide about a twenty percent increase in horizontal travel distance, but it is a larger chute. It comes down slightly slower due to its larger area. That might mean a pilot is a target for pot-shots for a longer period of time.”

The Chairman commented, “But my guess is that we have that space issue keeping us from that solution. Correct?”

Tom nodded.

“You mentioned three things I believe.”

“Right,” Tom said opening his briefcase. “The second thing is that today’s fastest fighter jets are almost too fast to let pilots eject. Full face masks and even helmets get ripped away causing severe injury, blindness and even two known deaths. Attempts have been made to provide a slide-over face shield built into the seat to protect the pilot from the skin-tearing forces of the supersonic wind. The results have not been encouraging. It could be mitigated, I believe, by building a new canopy with an inner and outer layer. The inner layer could be designed to snap down covering the pilot’s entire upper body as the outer layer is blasted away prior to ejection.”

He could see questions and objections coming from all over the Committee so he jumped ahead.

“As to the third issue, it is the overall bulk of the ejection seat. If that could be reduced by half, then any number of solutions might be possible. A larger and more

maneuverable chute, and possibly even one with variable characteristics might be developed.”

The Chairman raised a finger and an eyebrow.

“By that I mean a chute that could be configured by the pilot to be smaller and fast when desired and then extended out wider and slower when those flight characteristics might be advisable or desired.”

“If this committee asked you to return to us in six months with several solutions, could you do it?”

Tom gave the Chairman a smile. “Sir? With a couple things we are already working on at Swift Enterprises, I am certain I can be back in six weeks with at least three!”

Many of the committee members had questions for Tom which he answered as best he could.

Twenty minutes later he as was dismissed and the meeting broke for lunch, the Chairman made a motion for Tom to come up to the bench.

“Yes, sir?” he asked eyeing the large security man who had stepped forward to stand next to him. The Senator motioned the man to move away. With a small snort like an angry bull he complied.

“I want to tell you something, Mr. Swift.” he said in a very quiet voice. “I have a very deep vested interest in the success or failure of all this. My grandson is graduating from the Naval Aviation School in Florida in three months and will have just about another three or four months of stateside training before he will be sent overseas and into the heart of the action over there. I want my grandson to

have the very best. Aw, of course I mean I want all our men and women behind the joystick to have the best, but you know what I mean. Right?”

“Absolutely, sir.”

The Senator reached over the raised desk and offered Tom his hand. “I sincerely wish you the best of luck, Tom. Come back with a doozy of a solution!”

Late that afternoon Tom and his best friend—and top Enterprises flyer—Bud Barclay sat in the small office Tom kept to one side of the large underground hangar at Enterprises. He had just finished filling Bud in on both the official meeting as well as the Senator’s personal interest.

“Jetz! I can relate to that. I know that most of our smaller aircraft have full-fuselage recovery chutes, but we don’t fly in the war zone. What can we do?”

“For starters, I have been thinking about a new type of propulsion system for ejection seats, Bud. I envision a more stable explosive charge and solid rocket pairing that can launch the seat maybe ten percent higher yet take up twenty percent less space. It first came up five months ago when we received a request for proposal for some of the systems in the new Brazilian BX-3 fighter jet for their Air Force. We passed on most of it, but we did get the contract to provide the communications and GPS navigation systems. They were asking for an entirely new and smaller ejection seat. They want to put a pilot *and* a weapons and navigation copilot in a cockpit that is designed to be only slightly larger than one meant for a single occupant.”

“So, how big did they want it to be? I remember the ejection seat I sat in on those flight tests I took last month was a monster. Something like a back that is eleven inches thick, a lot of stuff crammed underneath and my pilot told me it weighs about seven hundred pounds.”

“Right. Looking at their specs was like looking at a kid’s letter to Santa. We want, we want, we want. The thing is, it made me think. There is a lot of structural stuff going on with current seats and a lot of stuff that goes into getting seat and pilot up and out. It’s all bulky and nothing can be considered as close to being light. Let me show you the start I got back then.”

He pulled up several design files and showed Bud his revised ejection seat drawings. Bud immediately spotted that it had about a third less overall bulk of seats used in all U.S. military fighters. It also appeared to be more encompassing for a pilot. *A lot more protection*, he thought.

“What’s that on the arms?” Bud asked pointing at something that looked like a half tube.

“Arm restraints for high-speed ejections. Along with facial and visual damage, the biggest issue is flailing arms. Pilots are taught to grip the handles between their legs but the force of the wind is often too much. Arms get broken, shoulders wrenched, and even collar bones cracked. These snap over the forearms of the pilot holding them down until the main chute deploys and the pilot is released from the seat.”

“Oh.”

“That’s all you have to say? Oh?”

“Well, ejection seats have almost no delay charge. Once you activate it and pull up on the handle you have about a half second before you blast off. The handle doubles as the spot you grip with both hands. That isn’t a lot of time to get your arms back up and settled down, is it?”

Tom’s face showed his disappointment. He hadn’t considered that. Then, he brightened. “Alright. We put the activate a button on the underside of one of the arms. No. Both arms will need to be pressed to avoid accidents.” He watched as Bud slowly shook his head. “What now?”

“Military specs call for the ejection to be completed even with one arm out of commission. And, lots of pilots grab their armrests really tight when performing high-G maneuvers. Especially if you’re the guy in the rear seat who isn’t touching the controls. Sorry to be a killjoy.”

“No, it’s good to know these things. Well, I guess I need to do a lot more research about current seats and those military specifications before I go any further down the path of redesigning the seat. Looks like I’ll have to stick with coming up with a better parachute.”

PART 2

Is It Possible or Even Practical?

IT WAS a week later that Tom hit on a revolutionary idea. As he organized his thoughts and prepared to discuss it with some of his engineering team members, he began thinking that it might be a bit too revolutionary.

His first stop was Propulsion Engineering on the opposite side of the cluster of buildings from the Administration building. It was a beautiful day and he enjoyed the walk, wondering if this was what it might be like on a college campus.

He was greeted by Artie Johnson—an intern with the group and a top-ranked student at MIT.

“Hello, Mr. Swift,” the young man, just a few years older than Tom but with a face more like that of a sixteen-year-old, said holding out a hand.

“Hello, old Mr. Johnson,” Tom said with a straight face, shaking the offered hand.

“It’s Artie, Mr.—oh. Right. Hello, Tom.” He gave the inventor a lopsided grin of embarrassment. “Dianne is expecting you.”

He led the way up one floor and into the conference room just down the hall from the heavily reinforced test chamber. Tom could hear the muffled sounds of a turbine whining even through several insulated walls. Standing in the middle of the room were a striking, dark-haired

woman in her late thirties and three men ranging from the mid-twenties to almost fifty. Tom greeted them each.

“So, Dianne,” he said turning to the woman. I have to ask you up front, am I crazy?”

“Well,” she replied, “I have heard tales but from what I’ve seen these past couple years I’ve been at Enterprises, I’d have to say that you might be frequently avant guard but never crazy. I suppose you want to talk about this odd turbine of yours.”

He smiled. Dianne Duquesne was an amazing woman with a talent for creating jet turbine engines and power plants that were smaller or lighter or more powerful than any competition to Swift Enterprises, and frequently they were all three.

“That’s right. I’m looking for something that is at least fifty percent more powerful than anything in the same size range. I’ve done a lot of number crunching and I think most of it says this is possible.” He looked at her as if to add, *With your expert help.*

“I have to admit that when I saw the drawings and read the description I told Artie and Bryan there I thought it was impossible. But the more I looked at it, the more intrigued I am. A supercharged turbine. Very interesting.” She looked at Artie as she said this.

He rolled his eyes.

“Can you give us the Tom Swift ten-cent tour?” she requested.

Tom picked up a remote control and turned on the big-

screen monitor built into a white board. Sliding out a small keyboard under the remote he keyed in the necessary sequence to call up the CAD files for the engine.

He stepped up to the screen and pointed at the casing. “As you can see, the turbine is going to be about twenty inches long and just under ten inches tall. There will be two actual turbines inside; the lower one faces backward and will scoop air flowing around and under the case, then compress it and drive hot airflow forward, up and around a specially-designed curve and into the lower front blades of the second turbine. That will accelerate the upper turbine allowing it to ram through even more outside air for propulsion. I’m calling the lower turbine the feeder and the upper one the power turbine.”

He paused looking at the assembled team. They were looking at his design with a new-found enthusiasm.

“The idea is to take an engine that might otherwise be able of moving our target payload at twenty MPH, and giving it a real kick by forcing the power turbine to ingest airflow already traveling at near supersonic speed and get our payload traveling at nearly one hundred MPH.”

“What sort of power increase do you expect, Tom?” Dianne asked.

“Oh, only about an eighty percent increase to be truthful. But, the idea behind this is to get something from one location to a point miles and miles away without having issues with wind resistance. And, size is an enemy. The entire turbine outer case can’t be any larger than this.” He tapped the screen.

“So,” Artie asked with a furrowed brow, “what *is* it you are trying to move? And, from where to where?”

Tom pressed a button on the remote and another picture, this one a fully-rendered color drawing, appeared. The team let out a group gasp.

“This,” he said pointing at the para-foil chute with a small capsule dangling underneath. The broad wing-like parachute was gracefully arched and in a beautiful pattern of blue tones. What made it absolutely gasp worthy were the two obvious additions; each end sported one of the turbines Tom had just shown them.

“Wow. And, how?” Dianne asked. “More to the point, why?”

Tom smiled at all of them. “Well, I started trying having a single turbine located under the seat. The biggest issue there was it meant the seat would be dragging the para-foil along and that made it very unstable.”

“How unstable?” Artie asked.

“The computer simulation said that as little as a ten knot side wind could flip the entire thing upside down.”

He gave them a minute to digest that image and its implications.

“As for the ‘why,’ we have a request from the Government and the military to try to come up with a new type of emergency chute system for pilots who bail out over hostile territory. That means both hostile people *and* hostile terrain. The average ejection takes place at under ten thousand feet which lets current equipment get them

only about a half mile away at best. A determined enemy can cover that distance in the same time it take the chute to get to the ground.”

They agreed that it wasn't very far from trouble.

“By making the casing for the turbine hollow, I believe we can pack about a gallon of some stabilized fuel inside giving them about three minutes of flight time. If we can get them up to about one hundred MPH, that means they can get them at least five miles away in that same time.”

“At that speed wouldn't they be able to climb and go even farther?” on of the other techs asked.

“Not quite enough lift, Bryan. We can't fit in a large enough chute for that.”

“What about adding tanks in the ends of the para-foil,” Bryan asked. “A couple extra gallons on each end and you have a fifteen mile travel radius.”

Tom nodded happily. “Just the sort of thing we need to look into but space is against us right now. The first step is going to be building a test turbine to prove that it works. We already have the small auxiliary power unit turbines we use in Swift cargo and commuter jets. I'm hoping that some of those components can be used here. The turbine blades are the right diameter for the power engine on top as long as we build a shorter drive shaft.”

Dianne stepped up and asked Tom to go back to the engine drawing. She squinted at it, then said, “I'm pretty sure that we would have to downsize the lower unit. That, or scale up the case size.”

Tom shook his head. He told them that the constraints of the case size were dictated by the total area they had to occupy behind the seat, and nothing greater.

“Which brings us to the other ‘why.’” Tom told them. “We are going to suggest a total replacement for the standard ejection seat in fighter jets. By using composites we can create a seat that is stronger, lighter, and with a lot of room in the back. But, when I say ‘a lot,’ I mean we have just enough room to fit the two cases as I've designed them. I'm going to have to reconsider a few things in order to accommodate two other fuel tanks.”

“Soft bladders,” Artie said as he chewed on his knuckle and looked at the drawing. When he realized he had spoken out loud he blushed and looked up at Tom. “Umm. I was just thinking that the extra fuel could be stored in self-contracting bladders inserted right into the chute.”

Tom walked over to the intern who was suddenly looking very self-conscious. He place a hand on the man's shoulder and gave it a small squeeze. “Brilliant!” he declared in a soft voice. “Absolutely brilliant, Artie.” He turned to Dianne Duquesne. “As soon as he graduates I'd like you to find a place for him.”

“Oh, I already did *that*, skipper,” she told him with a smile. “Extended the offer a couple of weeks ago.”

Dianne and her team cannibalized an older APU for it's turbine parts and rebuilt it to be the main thrust turbine during the ensuing week. She personally took on the task of finding suitable components from which she might build the feeder turbine. Although any final version of the

turbine would be made from parts built in-house, she located an off-the-shelf hobby jet turbine that would be sufficient for the proof on concept prototype.

Hank Sterling was called into Tom's office the same afternoon he met with the propulsion team. "Hey, Hank. Pull up a stool," Tom greeted him.

"By which you mean 'Hey, Hank, have I got a 'can you get it done tomorrow project for you?' Right?" the big man asked sitting down.

"Of course. Aren't they all?" Tom turned his monitor around so that the pattern maker and engineer could see the picture of the turbine.

"Is it really twice as tall as it is wide?" Hank asked.

"Yes it is." Tom hit a key and the case disappeared revealing the inner workings of the twin turbine design. He described and use a finger to indicate the air flow from the time it entered a wrap-around air scoop on the lower-back of the case, how it traveled forward and curled up and back into the power turbine at high speed and high temperature, and then was utilized by the power turbine for forward thrust.

"The lower turbine air scoops need to travel flush against the case and then flip out for use."

"I know that I say this quite a lot, skipper. In fact I probably say it at least once for each and every invention you come up with, but wow! How big is this thing?"

Tom held out his hands showing the approximate length. Hank slowly shook his head and chuckled softly.

"Wow! Okay, Give me the particulars about whatever I need to come up with." A thought struck him, so he asked, "Is this a one-off or will this be a production job?"

Tom looked at him for a few seconds before replying, "We'll be making three pairs of them for now. Maybe four. If this proves out and the military likes it, we could see a production run of anywhere from a few dozen pairs to a thousand pairs or more."

"Military?"

"Oh. Let me backtrack a little." Tom filled Hank in on the joint committee meeting and his promise of coming up with several solutions to the problems raised. He finished by saying, "If we can get everything down into a package that is usable with their existing ejection seats, then we might have a winner that delivers three solutions in one."

Hank pursed his lips while he thought about something. Finally he said, "If it were me, I'd just come up with an entirely new seat. Those big, clunky ones they use are over-engineered to the point of being ridiculous. Why, a good carbon fiber composite seat could be a third as bulky and a tenth as heavy! More protective to boot."

"I've been thinking along just those lines, Hank, but you've just given me a great idea," Tom exclaimed. "I got stuck the other day when Bud gave me the lowdown on all the mil specs for ejection seats. But, if we can come up with a lighter and stronger seat from things like tomasite, durastress and even carbon fiber, then all that space we save can be used for the turbines and the new para-foil. Up till now I was faced with devising a way to store half of

the system behind the seat and half or it under. That all left no room for a wrap-around head and upper body shield I would like to auto-deploy.”

“Was that the only problem then, not that it seems to be one now?”

“No. The big one was where to put the ejection charges. I was just going to make them smaller and only go for about twenty feet of separation.” He smiled. “Now I can go back to the full fifty feet.”

He showed the model maker the breakdown of the case parts. “To provide the best seal I’d like to do this in only two pieces. By the way, the reason we need a good seal is to hold about one gallon of a special stabilized aviation fuel around the turbine.”

Hank whistled. “Neat, compact and I suppose pretty powerful. For its size, I mean.” He promised to take Tom’s CAD images and create the necessary 3D rendered images so that the test case could be constructed. “The prototype one’ll be in your hands day after tomorrow.”

Tom spent the rest of the day and the entire following one coming up with several designs for the actual seat. He knew that it must be built so that it could use existing mounting points—that varied slightly from airframe to airframe—must be adjustable to suit the pilot’s height, leg length and weight, yet contain everything necessary to launch up and out of the cockpit in under a second.

His sister Sandy and girlfriend Bashalli dropped by the second afternoon but quickly saw how busy he was. Bashalli gave him a small kiss on the cheek and they both

tiptoed out.

Coming up with the seat was comparatively easy when measured against developing a very compact explosive charge and ram system to shove the seat up and out. It was stumping him until he glanced around the office and his eyes lit on the model of his *Star Spear* rocket ship.

Bells went off in his mind and he got to work calling up old experiment notes and running simulations in the computer. Bud found him deep in the latest test when he came by just before quitting time.

“I see you’ve got the old *Star Spear* model on your desk, skipper. Thinking of heading into space without me?”

“Huh?” Tom turned to look at his friend. “No. Actually, I think I’ve come up with the perfect system for ejecting the seat out, and it should take up less than twenty percent the space any of the most compact systems do today.”

Bud got a gleam in his eyes. He sat down and leaned forward. He loved it when Tom was hot on the trail of a solution. The energy that radiated from the inventor was palpable. “Okay?”

“Think back to the first experiments I did trying to find something to give us the extra oomph we needed to get into orbit. Remember? Before I came up with the Solarizer and the Fuel Kicker.”

Tom had run into a stumbling block in his attempts to be the first privately funded and manned rocket to orbit the Earth. Traditional fuel and oxidizer mixtures were just shy of letting him get to orbital velocity and altitude due

to the small size of his rocket. The Solarizer super energized the fuel/oxidizer mix by using solar radiation to make ozone out of oxygen giving the fuel a greater burning strength. The Fuel Kicker used a mass accelerator to fling the energized mixture back to the combustion chamber and rocket motor so fast that it helped accelerate the entire rocket.

“Uh,” Bud began. “Do you mean the high pressure test that almost exploded on you?”

“No. The one before. Where I took the old rocket backpack technology of hydrogen peroxide and exposing it to a mesh of pure silver.”

Bud sat upright. “That’s right! The peroxide expands hundreds of times its volume as steam. Right?”

“Actually, it is just around a five thousand time expansion coming out as pure oxygen as well as super-heated steam. So, taking that as the start point I now know that I can create a small version that will be a little more powerful than the explosive ram systems current seats have, and be tiny by comparison. And safer.”

He showed Bud the drawing he had begun making. It looked like a slightly squared letter ‘U’ with two small cylinders at the bottom connected to a small sphere. One, Tom explained, was highly compressed nitrogen. The other was almost pure hydrogen peroxide. When the system was armed, the safety on the nitrogen valve was disengaged. Once activated, the nitrogen shot into the cylinder of peroxide forcing it into the sphere filled with fine silver mesh.

The resulting gases shot out of the two tubes that contained the rams that would fling the seat upwards.

“Another amazing invention from the mind of...” Bud said, sweeping his arm toward Tom.

“I’m pretty happy about it myself,” Tom admitted.

Hank delivered the case components as promised and Tom took them over to Dianne Duquesne and her team.

“We should have the dual setup finished by this coming Tuesday, Tom,” she told him. “There is one thing we need to work on, though.”

When he merely raised an inquisitive eyebrow, she said, “How do we get at least the first turbine up to speed quickly? It will definitely have enough force to spin up the power turbine above it, but only once it gets itself to speed. The little build-in motor takes more than fifteen seconds to get it turning at about thirty-thousand revs , and it needs to be at that speed just to fire up. Then it takes another five seconds to get up to its power speed of a hundred thousand revs.”

Tom realized this was far too long of a delay before the powered para-foil could maneuver. In fact, a quick mental computation told him the chute could drop a full eighteen hundred feet in that time.

It was, as Dianne’s look told him, unacceptable.

To help raise the mood he told her about the new peroxide-based ejection system. “And, the best thing is that it now leaves us with ample room for your turbines, the chute and the extra fuel bladders. Even the emergency

life raft and supplies the Navy insists on.”

Dianne and Tom had been joined by Artie partway through this explanation.

“It’s too bad you don’t have some extra pressure from that peroxide charge,” he said almost offhandedly. “It might come in handy to... *What?*”

They were both staring at him as if he had just given them the winning lottery numbers.

PART 3

Sailing The Sky

TOM CHECKED all of the figures for the third time. It worked! Not only did the turbines come up to speed quickly enough to make a difference even if a pilot bailed out at just five hundred feet, but the entire package—seat, ejection charge, turbines, fuel and para-foil—all fit in exactly the same area as a standard ejection seat.

To sweeten matters, it all came in at half the weight of what he hoped it would replace.

After discussing it with his father, Tom made a call to Senator Tripp in his office in Washington D.C. He had expected to be asked to leave a message, but the Senator turned out to be in the office and was happy to receive his call.

“Well, well, well. Tom Swift. You told me you might have something for me in six weeks. It has only been five. I hope you are not calling to renege.”

“Quite the contrary, sir. I called to tell you that we have just finished building our prototype of a wholly new ejector seat and parachute system. It will fit right into existing jets, except for the A-6 with its strange side-by-side set-up. We’ll work on that later.”

“What makes this special?”

Tom told him about the turbines and the ability for the pilot to maneuver and leave an inhospitable area. “We believe they can travel at least ten miles. Even more if

they bail out about eight thousand feet, sir.”

“Son. If you’ve actually come up with something like that, something that might save even one of our brave men and women, you will have become my personal Santa Claus and I will never ask for another thing as long as I live!”

They talked about some of the other features for a few minutes before the politician had to excuse himself. “I’m needed on the floor to place a vote on whether to allow a variance in a federal law so that some fool in Montana can graze a herd of yaks on federal land.” He let out a sigh. “Yaks! Egads! Well, I hope to hear from you soon.”

Tom was floating on air as he relayed the conversation to his father. “He genuinely sounded pleased and grateful, Dad. It’s the first time a politician has been really glad to talk to me.”

Chuckling, Damon looked over at his son. “Those come every so often, Tom. I’ll wager that during your lifetime those sort of experiences will come more often than they did for me. Of course, you still need to prove that your ejection system works in a real application.”

Tom nodded. “Yes. And, I’ve been thinking about that. We really don’t have anything that is configured for an ejection seat. I may need to mount it on top of the *Sky Queen* and take a slow ride up to altitude.” He shrugged.

Mr. Swift rubbed his jaw in thought. “No. That doesn’t sound safe. But, I do have an idea for you.” He told Tom what he believed might be a good solution, and the young inventor broke out in another big smile.

“You’d let me do that... uh, modification?”

“Certainly. The one I’m thinking of was a trade-in and probably can’t be resold without a complete teardown and rebuild. You go ahead and take it.”

Tom did.

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The two friends stood side-by-side admiring the strange modifications that had been made to the old *Pigeon Special*. The cabin had been stripped of everything except the basic instruments. Squarely in the middle of the space was the new ejection seat while above that was... nothing!

“They really took a buzz-saw to the roof,” Bud remarked.

“They had to,” Tom said. “It’s the only way to have enough open space for the seat and the pilot to get out through. And, tomorrow morning at ten I’ll find out just how good all this really is.”

He felt a hand on his forearm and turned to look at Bud’s worried eyes. The flyer shook his head. “Not going to happen, skipper,” he said softly but in a matter-of-fact tone. “I’ll go test it.”

Now, Tom shook his head. “Bud. I made this, I did the static tests and I’ll take the risk.”

“Nope! Look it up. Your job description in the official company bio says you are a principle in the company, the chief technology officer and lead scientist. Mine just says test pilot.”

Tom looked slightly horrified. “Bud! If it’s a—”

The fliers laugh cut him short. “Tom. It’s not that. It’s that you are, in the real world of grown up things,

indispensable to Swift Enterprises. And, as much as I think of myself as being important, my job says that if push comes to shove, I'm the dispensable one. Your father agrees with me as does your mother and Bashalli. Sandy is torn between love for her brother and what I hope is love for the man she may someday call 'hubby'."

"Now you make me wish I'd left one seat in there. That way at least we could argue about this on the way up." He gave a rye grin.

"Didn't leave enough room for that," Bud stated. "Besides, with the flight controls now running through that R/C unit I get to toss aside just before hitting the button, you'd have nothing to use to fly with."

"I don't like it."

"Like it or not, Tom Swift, the man who will go down in history as proving the Swift Ejection Flying Wing Seat Thing worked will be listed as Budworth Barclay."

Tom had great difficulty sleeping that night and eventually rose just before four and headed to Enterprises. He checked in at the main gate—the private gate he and his father used was closed at night between eleven and six—and drove directly to The Barn, a large open-ended hangar closer to the main building complex than any other hangar. It was frequently used for final assembly of test devices.

Pulling around to the south end he climbed out of his car and walked inside. He came to a complete and sudden halt just a few feet later.

The *Pigeon Special* was gone!

Its place was an easel with a hand-lettered placard.

He recognized the writing as that of his girlfriend, Bashalli. It said:

Thomas. Your father wishes to remind you that Bud is correct. You will be welcomed to join him and others, including me, in the Sky Queen for a ten a.m. takeoff.

PS LLY!

Outsmarted! Rats. But, Tom had to admit that they knew him and realized he might try to sneak in and take the test plane up before anyone might stop him. He also knew it would be practically useless to go searching for the plane; it could be hidden anywhere. It might not even be at Enterprises!

He decided to go shower in the little apartment he kept for those times he found it necessary to remain at work overnight. When he toweled off and got dressed, he headed for the commissary where the night staff was preparing for the shift change and had just completed the food preparation for breakfast. A large urn of fresh coffee was nearing the end of its brew cycle.

He took a large mug and poured himself a full serving. Halfway through it he was joined by Dianne Duquesne and Artie Johnson.

"We couldn't sleep either," she admitted. "Good thing you didn't come in and do something sneaky like taking the thing up without us." She gave Tom a smile that spoke of innocence and almost total lack of innuendo.

He smiled back. "Yeah. Glad I didn't think to do that!"

As they sat sipping coffee, or in Artie's case a mocha, the three talked about the little turbine and the surprising results from the static tests.

"After running the prototype, we really tightened things up and worked a few miracles with the second and third engines," Dianne said "But we didn't have time to do a full range of static tests."

"If the real world results are similar or better than that first test unit," Artie commented, "then any pilot who needs to hit the silk as they say in old movies might even be able to make it twenty miles."

"The best thing is Artie's idea for the fast start. Using some of the extra force and vapors from the ejection charge to get the turbines spinning up to speed as the seat is leaving the cockpit was a stroke of genius."

"I didn't think of all that. Tom did. I mean sure, I kinda thought out loud a little, but he's the genius that made it work!"

Tom turned slightly red at this praise.

"Did someone just tell the professor an off-color joke?" Bud said as he plopped down next to his friend. "Something made him blush like a schoolgirl."

"Dianne was just praising Tom here for one of the design elements of the seat and the T-Chute," Artie told him giving Tom a look.

Bud had a small smile playing around his lips. "I thought people didn't like that name."

"No, flyboy. Actually it is just Sandy that doesn't like it. Everyone else thinks it is a great name. She thinks

something that can form an acronym would be better. Like Swift Turbine Evacuation Parachute. STEP."

As it neared eight o'clock, more and more employees came and went from the commissary. At eight-ten Tom excused himself and went to the office he and his father shared.

"Good morning, Son," his father greeted him. "I will assume that you have seen Bashall's little sign but I will choose to say nothing more. The plane is back in The Barn by now and the flight technicians are going over it. Everyone who's going up in the *Sky Queen* will be here by nine-thirty with takeoff at nine-fifty."

"I'm glad the forestry service gave us the okay to do the test over the north end of Lake Carlopa. In case I can't get control of the *Special* once Bud pops out and then get it heading back to Enterprises, at least we only have twenty feet or so of water to pull it out of."

"You're positive that the tomasite tank and your shut-off valve will keep any av-gas from getting into the water?"

"The valve will trip if I send the signal, and it will auto-trip if contact is lost. Ditto, if the plane goes into a dive. So, yes. I am sure. What I am not absolutely certain of is whether Bud can make it all the way back to Enterprises. Even with the test data, the nineteen miles is really pushing it. He may have to land short."

Damon Swift just smiled at his son. He knew it was Tom's way to underestimate just about everything.

Some time later they left the office and walked together to The Barn. The *Pigeon Special* had been rolled out and

Bud was standing next to it telling the small crowd what they would be seeing.

“My head is going to be just inside the upper part of the opening,” he was saying as they arrived. “Tom had to reinforce the wing and the floor to handle the stress of my launch and that means adding a couple inches under me. Oh, here’s the man now.”

Tom waved and walked over to Bud. He could see Sandy and Bashalli standing to one side, holding onto each other. Sandy had a look of deep concern on her face.

“Bud here will be safely encased in a clear tomasite shields that snap around him from behind the election seat and next to each leg. With those in place he can’t bang a knee into anything as he exits and nothing he might be flying through can hit him.”

He told them about the sequence of events right up until Bud’s touchdown almost where they currently stood. By the end Sandy looked a little more relaxed and Bashalli blew Tom a kiss and mouthed, “Thank you.”

Bud went into the small office inside The Barn to change into his flight gear while everyone who would be going in the *Sky Queen* walked over to the giant aircraft and climbed aboard. Only Tom remained behind to give Bud some last minute words of encouragement, and then he too climbed into what was to be the ‘chase’ craft for this test.

As Bud taxied out to one of the smaller south-to-north runways, the *Sky Queen* rose on her lifters and headed to the observation point. With Red Jones and Slim Davis at the controls, Tom walked back and through the lounge

where the eleven others were lining up looking out of the port side windows.

“It will all take place out there,” he said pointing. “I’ll see you again once Bud gets headed back to Enterprises.” He left them and went down and to the rear of the aircraft and into the hangar. He climbed into a harness and attached a safety cable to the central D-ring. Then, he opened the hangar door and stepped out onto the extended landing platform. While they waited for Bud he checked out his remote R/C control box. He had green lights with the exception of the signal acquisition light that would not come on until the *Pigeon Special* was within three miles.

Bud’s voice came through the radio that Tom had pumped throughout the plane. “I’m up and heading your way, folks. Just passing two thousand feet and climbing for ten thousand.”

Five minutes later Tom could see the small airplane heading their direction and a moment later he saw that the acquisition light had turned green. “I’ve got you visually, Bud, as well as showing control lock.”

“Great. Okay, I’m at about eight thousand and still climbing. I had to throttle back ‘cause it’s a bit windy in here with the top down. I’ll go a mile or so past you and then circle back for my pass along the *Queen’s* port side.”

Everyone watched as the plane climbed to their level and flew past. A minute later Bud said, “I’m initiating the turn and heading back. I’ll give a countdown to ejection. Skipper?”

“Yes, Bud.”

“Will you take her when I get to ten?”

“I’d planned on it. Happy flying!”

The countdown came:

“Ten... nine... eight... seven... six... five... four... three...”

Two more seconds went by and then everyone saw the amazing sight of the ejection seat, the front now encircled in gleaming, clear shields, shooting up and back from the little plane leaving a trail of water vapor. Two seconds later the drogue chute popped out and pulled the larger para-foil out behind it. With an almost casual flip, the



parachute opened into its full arch with the capsule dangling underneath.

Tom found that he was holding his breath and had almost forgotten to take control of the *Pigeon Special*. Trying to also keep an eye on Bud, he

maneuvered the plane back into level flight and put it on a heading toward Enterprises.

Bud’s para-foil had drifted a few hundred feet lower but it had also begun moving forward. “Hey!” Bud called over the radio. “I’m flying! Hot jetz! This thing really works. Hey, skipper?”

“Go ahead, flyboy. What can we do for you?”

“Nothing. I just wanted to give you some information about the handling. I’m only losing about a foot a second and it looks like I’m traveling ten feet forward in the same amount of time. Oh, and the shield? It’s working too.”

Tom asked Red and Slim to begin backing the *Sky Queen* up so they could keep pace with Bud and also so he could maintain control of the *Pigeon Special*. It needed to get two miles closer to Enterprises before their more powerful radio control equipment could take over.

As soon as he handed over control he closed the hangar, took off his harness and ran up to the lounge. Soon the *Queen* was back in forward flight and the group in the lounge had switched sides so they could continue to watch as Bud headed for home.

“She’s flying a little faster now, skipper,” Red said as Tom walked into the cockpit.

Tom looked at his watch. “My guess is that he’s run through about half of the fuel and that’s lightening the load on the ends of the chute a little making it a little more aerodynamic. How far are we from the field?”

“Nine miles now. Bud’s down to fifty-two hundred feet but going strong.”

Tom felt two arms encircle his waist and give him a hug. He eased around to look down into the radiant and smiling face of Bashalli. “I am so proud of you, Tom. And of course, Bud, but it will need to be Sandra to give him his hug of congratulations.”

Tom told his pilots to head to Enterprises and to land back next to The Barn. “We’ll get there ahead of him but I think he deserves an applauding crown when he lands,”

he told everyone.

Four minutes after they marched off the plane and stood watching, the para-foil with Bud underneath came into sight. It was still four or five hundred feet up so when it came even with them it passed overhead. Bud activated the shroud lines on one side and it turned back toward them swinging his capsule out during the turn.

Tom could hear the whine of the turbines cut out as either Bud shut them off or the fuel had finally run out. It overshot them by a hundred feet and came to rest with Bud facing away, but the auto-sever mechanism cut the lines and the capsule stopped within a few feet, rolling over so that Bud was face up.

By the time they got to him, Bud had opened the capsule and climbed out.

Tom thought he had never seen such a big smile on his face, until Sandy jumped into his arms wrapping her arms and legs around him, smothering him in kisses.

“That,” Tom said to Bashalli as they stood holding hands and watching Bud’s face, “is one big smile!”

“Well, what do you do now?” she asked him.

“Now, a certain senior Senator from the state of Minnesota is going to receive a copy of the video we shot of the test. And, I think both he and his grandson are about to receive an early Christmas present.”