



A SWIFT ENTERPRISES INVENTION STORY

## Tom Swift The Air That I Breathe

By T. Edward Fox

Tom Swift has developed atmosphere-creating devices for several of his own projects. There was his deep sea hydrodome requiring an atmosphere to be extracted from sea water, and the planetoid, Nestria, moved into Earth orbit by the Swift's space friends that required a solution that would not simply fly off in the microgravity of that small moon.

In each case, Tom found a way to provide a breathable atmosphere that had made it possible to live and breathe under those conditions.

Although they were passed over for the opportunity to help create a livable environment for a new colony on the Moon, he soon finds that Swift Enterprises must either come in to save the project or watch as fifty billion dollars is lost.

Tom digs back into his bag of tricks to come up with a machine that concentrates and cleans the available air and keeps it dispersed inside each of the 100,000 square foot buildings.

His largest obstacle? Keeping the carbon dioxide from forming a layer just at the height where most people breathe.

©Copyright 2012 by the author of this book (Thomas E. Hudson.) The book author retains sole copyright to his or her contributions to this book.

Although this manuscript has been self-published it is intended for public sale and is fully protected under all domestic and international copyrights. No publication or copying of this story, in whole or in part, may be made without the author's written consent.

This story is dedicated to geniuses who look at a problem caused by others, and can understand how to solve it, even if they never witness the area where it happens and will never have the chance to see the fruits of their labors.

## Tom Swift: The Air That I Breathe

### FOREWORD

Once Tom found a way for his Space Friends to come to Earth to visit the surface that once proved deadly to their ancestors, he began looking forward to a new era of technology sharing. Unfortunately, an old project that he and his father missed out on rears its ugly head and brings him back to the all-to-real world.

I don't know about all of you, but I've lived a lot of my life by the motto, "Once bitten, twice shy." Here, Tom is being asked to come back into an almost complete project and pick of some pieces that the very people who told Enterprises, "No thanks," a year earlier have allowed their chosen vendor to default on.

Worse, he finds himself heading into a probable unrealistic schedule, with very little solid information to go on and an individual who is more into a cover-his-own-ass mode than he is helpful.

He might not be blamed for telling them all where to stick it, but he *is* Tom Swift, after all.

*Victor Appleton II*

## CHAPTER 1 /

### UNDER DIFFERENT CIRCUMSTANCES...

IT HAD BEEN several weeks since Tom Swift—nineteen-year-old inventor and son of Damon Swift—had bothered his father for anything, and the older inventor was beginning to worry about his son. With Swift Enterprises now humming along and preparing to celebrate its fifth full year of business, there were few others of the 1,172 employees who were more often seen busy on some project than Tom.

And, when Tom was "on the hunt" with a new project, that generally meant practically daily conversations between the older and younger inventors, conversations that Damon looked forward to both at work and at home. But, recently there had been nothing. In fact, Tom—often sharing the large office space in the Administration building with his father—had been practically invisible.

On this day, the young inventor sat silently on a chair in his underground office, built into one of the walls of the hangar that housed his giant triple decked aircraft, the *Sky Queen*. He had been sitting for three hours with all the lights off, including those in the huge hangar, and was staring at nothing, allowing his eyes to focus out to infinity, a trick he had learned years earlier that involved purposely relaxing all the muscles in and around his eyes; it was very relaxing.

"Okay. I give up," came a voice from the doorway, startling the young inventor out of his reverie. It was Tom's best friend, and Swift Enterprises test pilot, Bud Barclay. "Your dad said you'd be down here. Why the stygian darkness? Who turned out all the lights?"

Reluctantly, Tom took a deep breath and answered, "I did. Come on in. Oh, and hit the switch on your way over here." As

the lights came on, both boys blinked and shielded their eyes.

"What gives, professor?" Bud asked, blinking. "You don't generally play mole man down here. Some sort of light deprivation experiment?"

Tom shook his head slowly and rather, to Bud's eye, sadly. "No. I just find that it is better to not be able to read this right now." He pushed a letter over to his friend.

Bud picked the three-page letter up and began reading. He nodded at various points but didn't look up until he finished and set the pages back on the desk.

"Ah. I see. This is the same lunar colony project they wouldn't let you and your dad bid on. Right?" Tom nodded.

Bud referred to a multinational effort to place a permanent colony of over one hundred people on the Moon, living inside of a series of prefabricated environment buildings. Eight, ten thousand square foot buildings had been specified: four for extensive hydroponic facilities to produce both food and oxygen, two for housing, one for recreation and additional plant life and one to operate as a processing plant for several minerals found to be in abundance just a few yards under the lunar surface. This final building also was designed to extract water from the permafrost layer under the Moon's surface.

"I don't want to scratch a scab, skipper, but remind me why they refused to consider your bid."

Tom tried to find the correct words. He was still stinging from the rebuke the selection committee had given Enterprises.

"They asked for solid structures, and we suggested inflatable pods, each one five times the size of the ones they wanted. Dad and I believe we could have made them out of a thin film of tomasite coating an ultra-fine mesh of durastress fibers. They would be as strong as anything the other bidders might come up with—probably stronger in fact—resilient to punctures,

weigh a fifth, and able to be transported to the lunar surface in just four trips in dad's *CosmoSoar*, at least once that we got it back in working condition."

"Why did they pass on that?"

"The word we got was that the committee had put the specification together in exactly one way to favor a single vendor and refused to consider anything else. Even though our solution would have saved everyone about twenty billion dollars!" Tom shook his head. "And, now this!" he exclaimed as he shoved the letter to one side.

"If I'm reading this right, this committee is all in a panic because nobody has been able to figure out how to generate the atmosphere they need. Why? Wasn't that part of the whole bid thing?"

Tom let out a rueful chuckle. "Sure it was, but nobody thought to keep their thumb down on the company supposedly building it. A Greek company that took the money, declared bankruptcy and then had all their owners disappear. Evidently, this committee never thought about contingencies. Oh, and it wasn't so much to generate the atmosphere as to keep it clean, safe and moving. They'll rely on hydroponics to produce their oxygen."

Bud thought a moment about what he could ask that wouldn't upset his friend. Finally, he ventured, "What's your dad think?"

"Dad dropped it all back in my lap. He told me that he will support anything I decide whether it is to try to fix things to tell them all to take a flying leap!" He smiled for the first time. "Care to wager what way I'm leaning?"

Bud grinned. "Not me. It would be a sucker's bet anyway. I don't believe I've ever seen you give up on something just because it was difficult or dangerous or because you hated

someone." He looked long and hard at Tom who just sat there nodding as if considering an invisible list of items.

"Do you have any idea how many companies they're asking to bid on this?"

Tom shook his head. "Nope. Not a clue, and nobody is going to talk to us. Say's right in the Request For Proposal that accompanied that letter that, and I quote, 'All specifications and considerations are to be found in the RFP. No special treatment will be provided to any company seeking such as it would give unfair advantages in the bidding process.' Period."

Bud scowled. "So, flying leap time?"

His friend sighed. "Probably not, Bud. Probably not. When dad dumped this on me he gave me one of his '*take a deep breath and seriously consider this one*' looks." Tom sighed again, this time more heavily. "Looks like I've got to give it real think time. That's what I've been doing. I got over the 'mad enough to spit' stage yesterday so now I've been going over everything I know about what they have up there already and all the *Tom makes a breathable atmosphere* stuff we've done already."

Bud brightened. "Like Nestria?"

Giving a small chuckle, "Yes, Bud. A bit like Nestria, only this time we have the actual buildings to keep the air from floating away. It makes it a lot more simple on one hand, and potentially much more difficult on the other."

"I don't get that last part. Small, interconnected buildings of known size. Known number of people. Plus, I guess somebody knows how much oxygen their plants and things generate. Plus, you already have the air-making machines. Right?"

"Well, almost. The problem with trying to use our Nestria solution is in the higher gravity of the Moon. The Inertite part of that atmosphere is made up from hundreds of billions of the

microscopic threads that form a sort of mesh to keep the air up there down close to the surface. On the Moon they would just drop to the ground. So, that part isn't needed and the rest of the atmosphere-making machine we use at the two poles won't do it for this project. Even one would overwhelm the capacity of the buildings. Besides, from what I understand, one of the problems is going to involve keeping the CO<sub>2</sub> from drifting down and hovering."

Bud scowled as he thought that over. "Hovering?" he finally asked.

"Sure. In the lower gravity the air will naturally tend to find levels. Lighter gasses like oxygen floating higher, and heavier gasses—"

"Like the carbon dioxide?"

"Like the CO<sub>2</sub> will collect from floor level up to about mouth level. Oh, sure, there will be a lot of mixing of the gases just by people walking around, but in places like sleeping quarters it might cause problems."

"So, what now?"

Tom motioned for his friend to take a seat and began explaining about all of the new problems that such an enclosed space presented. It all started, he told the flier, with needing to create the air from gases generated during the breakdown of Moon rocks and the aforementioned permafrost water. That would automatically be fun into the building.

"Then," he said, "we have to continue working at keeping it balanced, a lot more than on our little satellite planetoid."

Bud stared blankly. "Why?"

"Because the exhaled CO<sub>2</sub> has considerably less space to dissipate into. Even with the hydroponics, that means we need to scrub out a lot of it ourselves because, quite frankly and based on my first run through of the setup, the amount of space

they've devoted to their hydroponics and other plants is only sufficient for the exhaled CO<sub>2</sub> from about thirty people, not the ninety or one hundred they plan to have there."

"Well, that's really stupid of someone—" Bud stopped as Tom raised a warning finger.

"That's the attitude I had to get over before I could even consider this request. Stupid mistakes and bone-headed decisions have been made, but whoever gets this contract is going to need to get past all of them in order to succeed."

"What about that favored vendor?" Bud asked bitterly.

Tom actually grinned at his friend. "Seems, from what dad was able to get out of friends in D.C. that the *favored* company underbid, probably on purpose, and then started jacking up the costs. Final, the GAO stepped in and gave them, and the selection committee, an ultimatum. Get it done on the budget and on schedule or lose any further Government contracts."

"Did they do it?"

Tom shook his head. They finished a week late and tried to file a sixty-two million dollar add-on bill. They were refused and are under investigation, so they are not a bidder on this."

Bud nodded, feeling a little less angry but still unhappy for the sake of his friend. In the back of his mind he was sticking pins into Voodoo dolls of everyone responsible for the current crisis.

"When do they populate the colony?" Bud inquired.

"Hmmm? Certainly not until the atmosphere problems get ironed out. And, we all have until..." he picked up the RFP and leafed through it, trying to find something.

Bud leaned back in his chair knowing that Tom often took minutes or even hours to get back into an interrupted conversation. This time, he didn't have long to wait.

"Bud! These people haven't specified when the darned atmosphere machine needs to be up and running. I've got to make a call." So saying, Tom picked up his receiver and dialed a phone number from the cover letter.

"Hello. I need to speak with Quincy King, please. Tell him it's Tom Swift of Swift Enterprises and regards the Moon colony atmosphere project." He continued rifling through the RFP while waiting. "What? No, tell him that the RFP *doesn't* contain everything. There's no start or finish dates mentioned. Nobody is going to bid on what it says here... and that's 'all work to be complete to specifications and review committee satisfaction on or before defined timeline...' well, heck, ma'am. There's not even a timeline in the entire document. Tell him that!"

Two minutes later, Tom was speaking with the man who had signed the cover letter. After explaining what he believed to be missing, the man on the phone said, "Well, that must be somebody else's fault. Not mine, I can tell you. I just sign what they put in front of me. I can't be held responsible for missing information. Why are you pestering me!" He sounded almost desperate.

"Mr. King," Tom began, evenly, "whether it is yours or anyone's fault is immaterial right now. The fact is that you signed the cover letter and I find it hard to believe that the U.S. Government would just let someone off the street sign a letter for a project that could cost several billions of dollars. So, right now I see that you are the person in charge here. Says so, practically, on the cover letter. It says, 'Quincy King, Senior Project Procurement Officer' under your signature. So, unless there is some other Quincy King, that leaves you holding the bag, so to speak."

Even Bud could hear the sharp intake of breath over the phone. But, unlike what either of them expected to hear, the phone line clicked and went dead.

Tom pulled the receiver away from his ear, stared at it in disbelief and then carefully set it back in its cradle.

The two friends looked at one another for almost a minute before Bud began giggling. Tom quickly joined him and before long, the two were gasping and wheezing for breath.

“Can you... can you imagine the nerve of that— that— *bureaucrat!*” Bud managed to get out. That led to more laughter.

When it subsided a minute later, both Tom and Bud wiped tears from their eyes and took several deep breaths.

“We need to go speak with dad. I’d like you to be there to back me up on what just happened. Okay?”

Bud nodded, getting to his feet. “Lead on, professor.”

Damon Swift was just picking up the phone when the two boys walked into the large office. He set the receiver back down. “Tom. Bud. To what do I owe the pleasure?” he asked, then, on seeing the looks on their faces, he added, “Not pleasure? Let’s have a seat,” he told them, pointing at the arrangement of large, leather chairs and low conference/coffee table to occupied one quarter of the office.

As the boys sat down he opened the office door and said something to their secretary, Munford Trent.

Taking a seat, he prompted them. “What’s going on to deserve a posse of two?”

Tom told him about the missing information in the proposal request and how the phone call had gone. Bud sat silently, nodding in agreement with Tom’s version.

“Ah. I see,” Damon told them. “I would say that this sort of rudeness deserves a followup call. Want me to make it?”

Tom thought a moment. “Although it might be nice to unload this on you, Dad, I think it would be best for me to place the

call. But, I’d like you to be here.”

Trent opened the door and brought in a large tray holding three mugs, a small pot of coffee, one full of hot cocoa and a plate of assorted pastries. “Did I overhear that you need to place a call? Can I help with that?” he offered.

Tom handed him the signature page from the RFP. “That number and ask for Mr. King. Thanks, Trent.”

A minute later, the intercom buzzed. Damon reached out and pressed a button on the phone next to his seat. “Yes?”

“The secretary—functional, not political—informs me that Mr. King is in conference and cannot be disturbed. I informed her that both of the misters Swift had urgent business and she said that Mr. King would not be available for at least three days. I informed her that The Secretary of State, Secretary of Commerce and the Secretary of Transportation were all old college friends of the senior mister Swift and would probably just *love* to take time out of their busy, busy schedules to get Mr. King to the phone.” He paused before adding, “Mr. King is now available on line one.”

The three men in the office chuckled.

“Let’s see what Mr. King has to say,” Damon said, pointing at his son.

Tom pressed the button. “Mr. King. Evidently telephone gremlins cut our previous conversation off. And, just as you were about to help us by telling me the start, stop and activation dates. I’m assuming that you have that information?”

A rustling of papers at the other end told them that the man was looking for that data. King was nervously humming just loudly enough so that they could all hear the tune. “Trouble Right Here in River City.”

“Uh, umm, uh, yes. I mean, yes we did get mysteriously cut

off. I think my secretary must have pressed a wrong button out at her desk. That is, I seem to have had such troubles before. Ummm. Er... you wanted to know some dates. Happy to assist you. Really happy,” he added in a quiet tone of voice that said he was anything but.

He provided Tom with the appropriate dates and seemed about to end the conversation when Tom interrupted.

“You need to get that same information to all of the other companies who you sent the RFPs. My suggestion is that you do it today as any delay might be seen as providing ‘unfair advantages in the bidding process.’ That, by the way, is a quote from the document you signed but evidently have not yet read. Thank you and good day!”

He clicked the button on the phone base and cut off the call.

Damon leaned forward. “Well, boys, under different circumstances I’d say that was a very successful call. However,” he said, the smile he had been giving them now disappearing, “I have some very bad feelings about our Mr. Quincy King. Very bad indeed!”

## CHAPTER 2 /

### LIVING IS BREATHING (and vice versa)

TOM RETURNED to his underground lab, this time sitting down to his computer with all the lights on. He turned his scanner on and began feeding the RFP pages into it. Inside, they were scanned, turned into readable text and then saved as a fully searchable file, complete even to the eleven illustrations and diagrams that were part of the RFP.

He also called up his own proposal for the habitat dome he and his father had originally suggested. It had included a full atmosphere circulation and filtration system to be built right into the high domed ceiling of the structure. Both Tom and Damon believed that would allow the colonists to maximize all floor space and take advantage of thermodynamics to aid in circulation.

Given the moderately low roofs and rectangular nature of the buildings with all of the trusses and bracing that would be necessary for structural integrity, Tom believed he would need to design a floor-standing device.

And, now that he took a close look at the available space inside each of the buildings, it appeared that almost no floor space would be available in most of them.

Tom sat back and thought about possible solutions to the space issue. He knew it wouldn’t do to design a thirty by thirty foot box to house the equipment when there was probably less than a third that space to be had. He toyed with the idea of a separate ‘out building’ scenario that could be attached to each of the buildings, or even a large one that could be centrally located to serve them all. That left a lot of room for problems as one breakdown would cripple the entire base.

A light *ding* sounded across the giant hangar announcing the arrival of the elevator. Soon, a clatter and familiar sound of a rolling cart came through his opened office door. Soon, Chow Winkler, former ranch cook and now Swift Enterprises' head of food services and personal chef to all the senior employees, waddled in behind his cart.

"Little birdie tells me ya been see-questerin' yerself down here an' not comin' up fer air nor food. Wahl, I cain't do anythin' 'bout the air but I shore can do a lot about gettin' some good food inta ya!" he declared as his right hand swept the cover off a large dish.

Underneath was a steaming plate covered with noodles and a rich beef in sauce concoction. It smelled so good that Tom found his mouth salivating.

"Now, I don't want none o' this ta get back ta that mad Russian o'er in the big dinin' hall, but he makes a mean stroganoff. I smelt it a-cookin' in the big kitchen this mornin' so I decided ta make my own batch. Hope ya like it!"

"Gosh, Chow. If it tastes half as good as it smells, I'll declare that you've got a winner," Tom told him as he came over to the table where the roly-poly old Texan was setting up his late lunch.

Tom tucked in and gave Chow a big thumbs up after just the first bite. As the cook turned to leave, Tom said around a second mouthful, "Hey, Chow. I need your help." He managed to swallow the food and add, "Your unique approach to considering things would be greatly appreciated if you have a couple minutes."

A huge smile crossed the older man's face. "Why, shore, Tom. Love ta help whenever I can. Shoot!" He pulled out another chair and sat down opposite his young employer.

Tom explained about the basic project and the issue of

developing a machine to create and keep an atmosphere in balance.

"The big issue is space," he told Chow who was looking both concerned and contemplative. "Physical room is limited. The buildings are all about seventy feet wide and one hundred forty feet long. Maybe twenty-five feet tall—well, the roof is higher but that's about the maximum ceiling height. The thing is, I have absolutely no idea what our equipment is going to look like or how large it could be. Have you got *any* ideas where I should start looking?"

Chow had removed his ten-gallon cowboy hat and was fanning his slightly red face as he listened to Tom. Now, he set the hat on the table and leaned on his elbows, head nodding.

"Can ya hang the things from the rafters, so ta speak?"

"Probably not, Chow. We don't have any specs on what kinds of weight they might be capable of supporting. Besides, I have a feeling that any circulation fans we might put up there to keep the air moving would vibrate and might even turn into a buzzing noise that travels throughout the entire metal structure." He shrugged. "Oh, and the one thing I didn't tell you is that whatever we design will need to be opened probably once a day to have its filters and CO<sub>2</sub> scrubbers changed out."

Chow thought hard for a moment and then scratched at the back of his neck. Suddenly he brightened and looked at Tom.

"Well, then. Ya got ta make 'em so they can raise and lower themselves. Ya know, kinda like them ponies on merry-go-rounds." He nodded as if that were the final solution.

Tom smiled and thanked him. As he went back to eating, the cook waddled out the door and across the hangar floor to the elevator.

He sighed. It had been a long shot and he hadn't expected a



miracle answer. Five minutes later, food gone, he went back to his chair at his computer and leaned back to think.

He glanced through the specifications and rechecked the figures regarding oxygen use versus carbon dioxide exhalation. As he had discovered previously, the selection committee's figures didn't pan out. They just didn't account for enough generated CO<sub>2</sub> and he soon figured out why.

Whoever had come up with the figures had takes a singular approach. He or she had used an individual with an average body mass of one hundred fifty pounds, Earth weight, exhaling at an average rate of twelve breaths per minute.

What that did not account for was anyone doing more strenuous work than sitting, relaxing. Even in the reduced gravity field of the lunar surface—and Tom checked with Doc Simpson to be certain he had this right—anyone performing manual labor such as that entailed in the mining and refining processes that would make up the majority of the work, would breathe at an average rate of sixteen to eighteen breaths per minute. Even offsetting the slower breathing of anyone sleeping, Tom's figures showed that the atmosphere would be receiving almost twenty-three percent more CO<sub>2</sub> than the specs called for the new atmosphere machines to be capable of handling.

He called his father and discussed this issue.

"Should I risk another call to our good friend, Mr. King?" he asked a little sarcastically.

Damon could be heard humming tunelessly on the phone for a moment before answering. "It might be better to take a more diplomatic approach to this, and by that I mean an end-around run. Let me call an old friend down at NASA and ask her."

"Her? Why, Father, dear. What would my mother think about that?"

"Probably will ask me what Barbara is up to. The person I'm calling is Dr. Barbara Baxter, the woman who was your mother's maid of honor at our wedding. She was part of the steering committee for the project and was very upset when we weren't allowed to submit our proposal. Goodbye, my suspicious son!"

Half an hour later, Tom was outside, walking around the path that wove through the main buildings, when his TeleVoc pin signaled an incoming call. He tapped the collar-mounted pin to activate it.

"Tom here," he silently intoned, knowing that his message would be transmitted in his full voice to the caller.

"Tom? It dad. I had a most interesting conversation with Barbara. She tells me that our Mr. King is about an hour away from being dismissed. It appears that we are not the only ones registering complaints about his actions, or inactions, and his faulty specifications."

"That is interesting. Did she say who might be taking charge? And, when?"

He could hear the silent chuckle his father was making. "As a matter of fact, she did. Do you remember Perry Thomas by any chance?"

"Perry Thomas who used to work for the European Space Agency?" Tom well remembered the man who had once publicly declared that if built at a latitude of just 5 degrees north of the equator, the Swift's Loonauai rocket base would be so ill positioned that it would be useless, and then found himself building the ESA's Guyana Launch Facility at almost the same latitude.

He had called Damon Swift with a sincere apology shortly after announcing the ESA facility location and the two had become good friends.

“That’s the one, Son. He will be in the chair, so to speak, day after tomorrow, but Barbara has kindly given me his number. Come over to the office and we can call him.”

Tom signed off and strode quickly to the Administration building. On arriving at the outer office, Munford Trent, their secretary greeted him with, “Your father just had me place the call. Go on in.”

It was an eye-opening conversation, beginning with general niceties and quickly focusing on the issues surrounding the lunar colony project.

“I want you and Tom to understand that once that little twerp, Quincy King is gone—by the way, did you know that he changed his name to that? It used to be James King—anyway, once he is gone I’ll be open to any and all questions and suggestions from you two. In fact, from what I gather you are one of just two companies that haven’t tossed the RFP back into his face, and I wouldn’t trust the other one to save a cat up a tree. Please, Damon, tell me that you two will seriously consider keeping on this one.” He sounded almost pleading.

Tom spoke up. “Mr. Thomas, I have a few things that will need settling, but just as long as you can okay a little visit up there so I can get the lay of the land, I can assure you that we’ll seriously bid on this.”

“Don’t repeat this, but your main competition has already submitted their bid and it’s a whopper! I can’t say anything else except that they want the sun and Moon and the stars as payment in advance for something I fear isn’t at all viable. Call me day after tomorrow at King’s old number. Bye!”

Damon looked over at his son. “Interesting. Think we can do it now that someone who has half a brain is going to be in command?”

Tom smiled broadly. “You bet!”

Two days later, Tom was sitting at the workbench in his large lab in the Administration building. When Bud walked in, the young inventor was deep in concentration on a small model of one of his ideas for an atmosphere machine. It was built around a ‘muffin’ fan—about three inches across—normally found in computers. It was busy whirring away drawing in some smoke Tom fed it from a pressurized canister and appeared to be outputting clean air.

“Once *you* get this atmosphere thing of yours designed and built, how will *we* get it up there?” Bud asked with a waggle of his eyebrows.

“I know that look, Bud,” Tom replied, glancing up and favoring his friend with a grin. He set the canister down and turned to face his friend. “What if I tell you this will be an all-robot delivery? You know, Save space and weight by not worrying about air for a crew.”

Bud looked momentarily disappointed, then brightened. “But, you told me that no matter how fast you make a robot compute that it will never think. Right?” Tom nodded, suppressing a grin. “Okay then, that means that even if you devise some sort of Einstein ATOR or SERMAC clone, that you wouldn’t trust them on a mission where communication lags of a couple seconds might spell disaster. Ergo, you plan on taking your thing-air-majig up yourself and that, professor, means you need me along.” He nodded so emphatically that the dark glasses in his shirt pocket jumped out and clattered to the floor.

“*Thing-air-majig?* You’re going to have to come up with something a lot better than that to earn a place on the *CosmoSoar*.”

Bud’s jaw dropped. “The *CosmoSoar*,” he gasped. “You’re really going to build another of your dad’s rockets?”

Bud was referring to the giant rocket Damon Swift had designed a few years earlier. It had been hijacked by a spoiled rich kid from the Middle East and had launched almost with disastrous results. In the end, Tom and Bud had to fly Tom's brand new rocket ship on a rescue mission.

The radical design of Mr. Swift's rocket had proven its ability to lift off and fly its command/payload module out of Earth's orbit while vindicating the inventor's odd vehicle. Built in four rings, each succeeding 'stage' nesting inside of the previous one, and featuring a conical central payload module, it stood over ninety feet high and was about one hundred feet wide. At takeoff, the outer ring—or first stage—would get the giant craft off the ground and to an altitude of just a couple of miles. As it burned its fuel and fell away, to parachute down for recovery, the rocket's weight dropped by almost forty-five percent. The second and third stages would get it into orbit—also parachuting for recovery and reuse—and the fourth stage could get up to twenty-five tons of cargo on its way to the Moon or beyond. It was the one piece that could never be recovered.

"I thought after the Armalcolite mining mission up there last year that your dad declared the old girl to be physically stressed and retired her."

"He did, and she is, except that I've got a plan to trim her down and give her some new life," Tom declared.

"Do tell, skipper. I am, as you know, all ears at a time like this!"

Tom outlined his plan. It included shrinking the giant ship down by not using the outer two stages. Bud looked askance at his friend. He understood the enormous lift needed to get the rocket up. Lift provided by those now-missing rings.

"I'm going to replace the first two stages with a new generation of solid propellant rocket, Bud. I believe that five of

my new HLS-1 rockets—that's Heavy Lifting Solid, by the way—will get a reduced payload of about fifteen tons up a little past the altitude and speed that those missing stages could lift things. They produce about one-thirtieth the pollutants as the liquid motors and should end up costing a fifth the price."

Bud let out a little whistle of appreciation. "Neat. So what is coming first? The rocket or the atmos-maker?" he looked expectantly at Tom. "*AtmoSpew?*"

Tom, for his part, let out a little groan and shook his head. "I'm not going to name it that. Try again." he suggested.

Bud shook his head and pointed at the device on Tom's bench. "Later, maybe. Is that what the real thing will look like?" he inquired.

"Probably not. I'm experimenting at a small scale with using ionization to pull out all particulates from the air. Like my OzoNuts." He meant the ring-shaped floating devices currently scrubbing the air over the South Pole region and spreading a new layer of ozone.

"What about the rest of the things that need to happen? Actually, what *are* the things that need to happen?"

"The main thing is to scrub out the CO<sub>2</sub>, followed by balancing the humidity and controlling the proper amount of oxygen and other trace gasses, then ensuring they get spread evenly around each of the habitat buildings."

Bud's brow crinkled. "That's why the fan, then, I guess."

Tom nodded. "Yes. That plus a set of special vortex nozzles I have designed to accelerate the output while mixing it with existing air. If all we did was suck in the old and output the new, then the balance could fluctuate too much and that might cause nausea or other problems."

"So, you've cracked the whole thing?"

“Not really. I think I, that is we, need to go up to the Moon and check out the situation first hand. I just hope dad will okay the trip and the expense before we get any contract.” He furrowed his brow in thought.

“When does it get awarded?” Bud asked.

“Not for another two weeks, Bud. And, while I think we’re a shoe-in, any trip we take now can’t be billed as part of the project. It falls under the heading of ‘project investigation, non-reimbursable’.”

When he brought the subject up at dinner that evening, the older Swift looked directly at him. “Is it absolutely necessary?”

Tom looked into his father’s eyes and replied, “I’m *almost* certain, but not completely certain, Dad. I guess it comes down to one thing. If we go all out and I create an atmosphere machine that is overkill, it will end up costing several million dollars extra. One trip up in the *Challenger* will cost us about fifty thousand for a couple days up there. The research will have to be done anyway. We need to supply the colony with the proper level of air generation and conditioning. After all, their lives will depend on it!”

## CHAPTER 3 /

### TOO MUCH IS A BAD THING...

IN THE few days before Tom and Bud were to fly off in Tom’s cube-inside-rails Repelatron-powered *Challenger*, a flurry of activity went on both at Enterprises and at Fearing Island where the mighty space ship was berthed.

For Tom this meant a third check of all the specifications for both the colony as well as a colonist-by-colonist detailing of probable breathing patterns and needs. Fortunately, Perry Thomas had authorized that the list of colonists be provided to Tom if he asked for them.

He also contacted a scientist at Grandyke University who specialized in hydroponics. Dr. Waldron Linn had been a pioneer in the field starting almost fifty years earlier, and his voluminous papers on the subject had practically become the ‘bible’ for the water-based agriculture science.

It took three calls before Tom was able to connect with the doctor, but once the man understood the issues—and the specific project—he offered to drop everything and to come along with Tom and Bud.

“I can,” he explained, “certainly give my graduate students a few days or a week away from my grumpy old man approach to trying to beat some learning into their heads. And, just so that you know, I may be seventy-nine, but my doctors assure me that I have the constitution of a man twenty years younger. As my mother’s Russian father used to say of his wife, ‘I am strong like ox and smart like tractor!’”

Tom could almost hear the twinkle he imagined must be in the man’s eyes.

“I would value your advise and expertise, sir. Can you come

to Shopton the day after tomorrow, or may I send a helicopter to fetch you?"

The doctor said he would take the train up to Albany and then rent a car.

By the time he arrived, everything was ready. Tom, Bud and the man who insisted they call him 'Doc Wally' climbed into one of the Whirling Ducks that had been a part of the Swift air fleet for over two years and were soon scooting across the skies toward the coast of Georgia and out to Fearing Island.

Doc Wally sat in a seat behind the pilot's control station in the *Challenger* watching the takeoff procedures with absolute awe. "As my sainted mother's father used to say, 'Mein Gott! I have slipped the surly bonds of Earth...' well, maybe he didn't say that last part, but he always said, 'Mein Gott!'. 'Mein Gott, this is a vunderful steak,' or 'Mein Gott, this is the best peach I haff effer eaten.' He was a big 'Mein Gott!' man."

"From Germany?" Bud inquired.

"No. Passaic, New Jersey, bred and born. Parents from Jersey and Iowa. He just like saying 'Mein Gott,' I guess." He smiled an infectious smile.

They discussed the doctor's work for the next hour.

With nobody manning any communications systems at the colony, Tom hoped that the eight colonist currently setting things up had received some notification. The *Challenger* set down about five hundred yards from the closest building.

A solitary spacesuited figure emerged from an airlock of the nearest building and waived at them. With the large view pane of the control room facing the buildings, the three men stood in front of it returning the waives. Two minutes later, the colonist had loped across the lunar landscape and climbed up the ladder to the 'porch' of the hangar level Tom, who had gone below, opened the outer hatch for the man, closed it once he

had entered and cycled the system to flood the airlock with air. A few minutes later the man entered the hangar and removed his helmet.

"Frank Williams, nominally the commander." He reached out a gauntleted hand to shake, then realized what he was doing and pulled it back. With a quick press of a release button and a quarter turn, the glove popped off and he re-extended his bare hand. Tom shook it and introduced himself.

"You're not the permanent commander, then?" Tom inquired.

"Nope. Just until we get everything set up and the colonist are all up here. A week after that and I go back down." He shrugged. "At least I won't have to be here when things begin to fall apart."

Tom looked pointedly at him.

"What I mean is, and please don't tell any of the men up here, I've spotted a few places where it is obvious that corners were cut and a few materials might come into question."

Tom nodded. "Let's go up to the main cabin and I'll fill you in on why we're here," he offered.

The other man's face clouded and he stared at the young inventor. "Mr. Swift. The head of our company, Mr. King, called before to tell me why you were coming up here. And, I have to tell you that, despite what I just said, we aren't leaving!"

Tom was taken aback by the statement. It confused him. "'I'm not sure what you mean by that, but I hope that this Mr. King of yours isn't Quincy King, the former Government official behind the project"

Now it Frank Williams' turn to look confused. "*Former?*"

Tom nodded. "If we're talking about the same person, he was

fired and replaced days ago. He had mismanaged things so badly that the new project controller believes tens or even hundreds of millions of dollars have been wasted and that your habitat buildings may not be one hundred percent safe. As you seem to have noticed.”

“Oh, poop! I knew things were wrong but I didn’t have any proof. Lead on,” Williams said pointing upward.

After being filled in on Quincy King’s ouster, Frank filled the trio in on what was happening at the colony.

“We were in the final group of the construction teams. Got here after all the buildings had all been finished and the liquid atmosphere had been pumped into the first two of them. Those are our primary hydroponics structures. We’ve had them operating for five weeks and the plants are doing fine. Fortunately, the temperature is right and the sprouts they brought up survived at about ninety-seven percent.”

Doc Wally smiled and said, “That is impressive. What is your mix?”

“Seventy percent *Dypsis Lutescens*, the arecia palm as you know it, for oxygen production, about twenty percent *Gerbera* Daisies for cleaning contaminants from the air, and the rest are algae. Once we get enough production from those two buildings, we will pump the extra into each of the others and then outfit three more of them with everything from cereal grains to grasses to more algae.”

Doc Wally nodded, a smile crossing his face. “Tell me, young man. How are things set up in your hydro buildings?”

“I can do more than tell you, sir. I would love to show you.”

Once they all suited up, the four left the *Challenger* and returned to the building Williams had first emerged from. Inside was an amazing arrangement of tubes, trays filled with plants and five levels of moving belts. Tom noticed the din of

dozens of fans being used to move the air around. It was warm and humid. They all watched for a moment as the serpentine belt moved hundreds of clear, plastic trays laded with plants.

Williams explained that the plants made a complete circuit from the lowest belts to the highest and then back down each three hours. It provided a balance between the best possible exposure to the sun’s rays as well as a chance to cool down.

“We can produce about a ton of oxygen each twenty four hours. Right now we are using about twelve hundred pounds between the eight of us. We’ll go up to two point five tons once the other buildings are running at capacity.”

Tom pursed his lips. “Well, that means you will only be able to sustain about thirty two to thirty four people, not the hundred the project is supposed to provide for.”

“Ah...” Williams held up a finger, “that’s just part of it. You see, once we get the first thirty up here we will be setting up the mining and processing plant. The ore we will be working with includes about three hundred pounds of permafrost water per ton. Our equipment will extract that water, break it down into hydrogen and oxygen, and then we use both gases.”

Tom guessed, “The hydrogen in fuel cells and the O<sub>2</sub> for breathing?”

Williams nodded. “Right. Once we are underway, about five months in, we’ll be producing enough extra O<sub>2</sub> to support eighty to ninety people and then we will be getting additional hydro systems to mount just under the roofs of all except the refining building.” He smiled as if everything were well and truly sorted out. Then, seeing Tom’s look, he sobered. “Something wrong, Tom?”

Tom told him about the mistake in the calculations of oxygen used per person. Then, to add to Williams’ sudden uneasiness, Doc Wally gave him more bad news.

“The only plants you will be able to use in your upstairs hydro beds won’t produce as much oxygen as you think given the constant heat and exposure to the sun. In fact, all that extra sunlight will only serve to about halve the output and increase your evaporation to the point where the temperature will go up in your buildings like un-vented greenhouses!”

Williams slumped against a nearby support post. “You okay, Frankie?” one of the other colonist asked him from about fifteen feet away.

“Not sure, Spider,” he told the wiry-looking man. ‘Spider’ shrugged and shinnied up another post and was soon out of sight above the upper hydroponics belt.

“That explains the name,” Bud said. Nobody commented.

“Can you tell me what it all means?” Frank asked Tom.

Tom pulled out a tablet computer he had in a sealed pocket of his suit. A minute later he looked back up. “Well, for one, Doc Wally is right. You can forget those upper hydro tanks unless you can figure out a way to get them into shade and cooled down for about fifty minutes out of every two hours. Given their absence, I’d say the maximum number of people in your seven sealed buildings is going to need to be kept under sixty.”

“That’s going to ruin things for the families. We’d hoped to have a couple full time teachers for the thirty or so kids.”

Doc Wally shook his head. “You can *not* bring children up here.”

“Why not?” Surprisingly, this question came from Tom, not Frank Williams.

“Three reasons. First, until a person reaches about nineteen, their lung development needs Earth gravity. Living up here they would soon begin having respiratory problems. A year here and they would never be able to go back home. Except

maybe connected to a respirator for a few months. Second, although hydroponically-grown foods and algae will work for adults, that diet will stunt the growth of children. And, unless everything is purified into almost nutritional submission, there are many hidden microbes in Earth plants, even those brought here as seeds, that could harm the children. But, the third one is paramount to the health of the adults. Children need to play and that means running around. That means extra burning of oxygen and *that* means less for everyone.”

Williams looked to be on the verge of tears, but he asked, “Can sixty adults live successfully with what we have, or will have?”

Tom and Doc Wally looked at each other and silently nodded.

“Yes,” the doctor proclaimed. “I would suggest, a rotation period putting everyone back on Earth and normal gravity at least two months for every six spent up here. Even at that it will be necessary to get a good hour of strength exercises for every individual each and every day. Mandatory for the heart and circulation. Absolutely mandatory!”

They spent another five hours checking out all of the equipment, taking measurements of the air in numerous places throughout the two occupied buildings and with Doc Wally investigating the entire hydroponics design and setup. Before leaving, he promised to transmit up a list of five relatively simple changes that could be made to the systems which he believed would increase output by more than five percent. He also suggested that a simple ultraviolet light bar be added to the lower level of the belt system. It would destroy any harmful bacteria that might begin to grow on the plants while also provided them with a light frequency that would assist in helping the plants trigger their own build-in defense mechanisms.

Tom promised to press the new project controller for more realistic personnel guidelines.

Knowing they would be consuming precious oxygen, Tom had installed a large tank in the hangar of the *Challenger*. Before departing, he moved the ship close to the buildings, unreeled a special pressure hose, and pumped back in more oxygen that the three visitors had used up.

## CHAPTER 4 /

### ... AND THEN IT WAS JUST RIGHT

MR. SWIFT looked at his son. “You certainly are taking this calmly,” he commented. The news had just been delivered that Enterprises won the bid for the atmosphere machines for the lunar colony. At the same time, a press release had gone out detailing a scaling back of the personnel arrangements. A semi-permanent group of sixty-two men and women would be assigned and would be rotated back to Earth every three months for a full month.

The careful wording citing both savings as well as advancements in the automation available had obviously been ‘spin doctored’ presumably in order to avoid admitting to mistakes made previously.

Tom looked curiously at his father. “I figured we had it from day one, Dad,” he admitted. “Otherwise I wouldn’t have been working on it so hard.”

“And, has that work paid off?” Damon Swift asked.

Tom smiled. “It sure has. Now that I know they will have the ability to draw oxygen from the water they bring in with the ore, even if they overestimated it by up to twenty percent, I figure by adding one extra flight of the *CosmoSoar* with a five thousand gallon tank about three-quarters full of water for emergency use and collecting overflow, that my atmosphere machines can be made to clean and balance the atmosphere in each building according to the conditions of that building.”

“So, different machines for each? Won’t that be more costly?”

“No, Dad. The same machine, just automatically adjusting to suit the room it is in. And, they’ll all be interconnected. The dry



rooms will get moisture from the hydroponics rooms and extra water pulled out of those rooms that isn't needed will be filtered, cleaned and put into the storage tank. I'm going to use a small version of the ERB technology to pull the moisture out of the air."

The Endless Rain Barrels, as Chow had named them, had originally been built to draw moisture from the air to keep a small African village from literally dying of thirst. By chilling a stainless steel column and allowing air to pass over it, moisture condensed on the column like it does on a glass of iced tea. It ran down into a collection and filtering system and could be dispensed as needed.

"And these will be powered how?"

"Solar, of course." Tom proudly answered. "I mean after all, there is nothing but sunlight up there. Why not harness it?"

"Do you have any idea how large these will be?"

Tom thought and then said, "Not really. Not yet, at least. They do have to accommodate a pretty large space if we use just one per building—which is what we bid—and before you ask how we could possibly bid on a system we don't know everything about, I did my homework. Using a worst case scenario I devised a unit that could do absolutely everything, and then added fifty percent to the cost. Of course we won't charge the top price, but that extra in the total bid will probably go to the extra flight. I sort of thought of that one after I submitted the bid," he finished a little meekly.

Damon gave him a wry smile and slowly shook his head. "The thing is, Tom, you will probably turn out to be spot on with the bid when all is said and done," he said with just a hint of pride.

Tom returned to his underground lab where he had been continuing to work on his model air machine. So far, it cleaned

particulates out of the air, was now sporting a small stainless column and a cooling circuit inside of a central enclosure, and had five velocity-enhancing dispersal tubes that also housed the CO<sub>2</sub> scrubbing canisters that would need to be replaced about once every week. These, Tom knew, were necessary to pull the carbon dioxide out of the air that the hydroponics plants did not absorb.

He had been toying with variable speed fans but realized just the previous day that such fans would need to be replaced more often than constant speed fans. They would also use more electricity every time the fan needed to speed up. Tom knew that a constant and steady fan would use less electricity. So, his latest addition had been to fashion a set of four diaphragms that could contract or expand allowing more or less air to flow into the fan chamber through a series of strategic holes he poked in the rubber diaphragm material.

Now, the thing that was baffling him was how to mount the finished machine. Well, that plus how to get the size down. As it stood, his computations indicated that the full-sized units would possibly be as much as thirty-two feet across and ten feet high. This, he knew, would not work for the space in which they would operate.

Yet, he wasn't certain how to downsize them. Or equip them so that maintenance could be easily accomplished.

And, although the contract specified a completion date of five months, Tom truly wanted to get everything to the Moon within half that time.

He swiveled around to his desk and picked up the phone. After dialing a number to Fearing Island, he hummed until it was answered.

"Neal Johnson, making things go boom, whoosh, zoom for over three years," the man on the line answered.

“Hey, Neal. Tom Swift here. How’s the project going?”

Suddenly serious, the Fearing rocket expert said, “Oops! Sorry about the flippant answer. I’ve been getting a few too many calls this past week, but answering, ‘Johnson’s Mortuary’ didn’t sound right. So, you want status? I’ve got status! We were able, as I reported last week, to completely salvage the command/payload module. Ring three had too many cracks in it. I think they’re vibration stress fractures. You did report she was a bit rough when you did the Moon prospector trip. And, we always have to replace ring four. Had a partial from before your dad put things on hold, and that got finished just this morning. It’s in testing right now.”

“That’s great. How about the new motors?” Tom asked.

“That carbon fiber and Durastress ribbon you came up with worked a charm, skipper. We wound it around the mold to form the propellant chamber and the ‘here’s where it goes boom’ chamber, and then slipped it into the outer casing. On a suggestion from your dad we spun-tested each one on a makeshift giant lathe and found that they were all out of balance. We did a little weight shimming and now have five absolutely beautiful and balanced rockets just waiting for the solid propellant. When do we get that, by the way?”

Tom laughed. “You’ve had it out there for two weeks, Neal. If you look out your office window you should see two large tanker trailers. One has a green stripe down the side and the other a red stripe.”

Johnson set the receiver down and could be heard moving his chair. When he came back, he said, “Sure, I see them. Uh... what are they?”

“Well, I’ll be sending you the specific instructions along with a brand new machine Hank Sterling just finished building, tomorrow, but the basic thing is this. You will turn your beautiful rockets upside down in their cradles and open the

port just above the combustion chamber. A brown hose will be coming out of the new machine and that connects to the motor tank. Then hoses from the two tankers will be connected to the machine and everything gets switched on.”

“And, now let me guess, we fill the motors with what comes down the brown hose. I thought these were supposed to be solid motors.”

“They will be with twenty hours of curing. Our chemical guys developed the two-part mix of fuel and oxidizer. Everything is fairly inert until it all gets together. Even then, it is not very powerful until it has cured. But, once it has, it has about twice the power of the mix used in the Space Shuttle’s solid rocket boosters!”

“Gadzooks, skipper. I was a little skeptical that just five of these things could replace the outer two rings, but you’ve convinced me. So, do we fill tomorrow?”

“Might as well. They’ll be fine for up to five years. This will get those motors off your plate and let you concentrate on finishing up everything else. I should have payload out there in five weeks.”

*I hope I haven’t set that date too close,* he told himself after he hung up.

With some occasional assistance from both Hank Sterling—Enterprises chief template maker and engineer extraordinaire—and Arvid Hanson—the man responsible for making just about every working and display scale model of Swift inventions—Tom was able to finalize the design of his atmosphere machines.

By abandoning the stainless steel inner column and replacing it with a wraparound dual-pane clear Tomasite window filled with super cooled refrigerant, he was able to reduce the height of the main body to just five feet and increase

the condensation capability by greater than thirty percent. A second barrier one foot inside of this allowed for the collection of water to be siphoned off. That still left the inner portion open for air circulation, so he mounted a thin turbine blade fan below the air and water chambers. It would power all motion functions as well and airflow.

Under this fan was the bottom of the unit and that was pierced by four of Tom's intake bellows, opened and closed by exterior arms instead of space-hogging inner hydraulic rams.

Air would be compressed inside the chamber and then exit through four lower and four upper arms that looked more like stylish propeller blades. Hollow, they also contained the special CO<sub>2</sub> scrubbing canisters and the ionic particulate cleaners for the machine. These blades—stabilized by outer rings that also acted to scoop in some of the surrounding air, turned by way of simple air pressure and that spread out the refreshed atmosphere.

In all, they were to be just twenty feet wide at the ends of the blades.

Initially Tom was certain that the size was still far too large, but had abandoned that thought when the conversation he once had with Chow came back to him in a dream.

“Ya got ta make ‘em so they can raise and lower themselves,” the cook had told him.

The next morning Tom placed a radio call to the Moon and spoke with Frank Williams. The call confirmed what he already believed; there would be sufficient floor space in all of the buildings, including the hydroponics ones, to rest four relatively small foot pads on the ground so that the actual machines could be raised about ten or twelve feet up allowing the rest of the floor underneath to be utilized.

Since they needed to be located as close to the center of each

building as possible, in three of the buildings the units would need to remain in their extended positions, but would have ample room to lower and raise up again in the others. Servicing would be accomplished at near ground level in those rooms and via ladder in the others.

\* \* \* \* \*

The scaled down *CosmoSoar* launched a week early and raced skyward. The new solid engines worked perfectly and the command/payload module left orbit and was heading for the Moon an hour later.

Three days of travel ended with a perfect landing close to the colony buildings. The low Moon gravity made it possible for Tom, Bud and the five-man Fearing Island crew to use the module's integral crane to offload each of the air machines that Bud was still trying to come up with a name for and transport them to the different buildings using a small, electric tractor all in a single day.

And, since all buildings had large cargo airlocks, it was a matter of a few hours more to get all of them inside their respective buildings and positioned.

The original eight-man team of colonist had already increased to fifteen and five of the buildings were occupied to various extents. Each man was given a personal orientation on the use and care of the machines. When Tom and his team packed up the following day and departed, the two in the hydroponics buildings were running smoothly and a third and fourth in what were being set up and the next two garden buildings had been started. The fifth occupied building would go on-line in three days.

In all, it was believed that seven of the eight buildings in the complex might be fully occupied in another month. A decision had been made to leave the eighth building open to the lack of atmosphere. It would house the ore processing equipment that

would work quite well in the almost vacuum of space.

The command module was closed back up and took off just twenty-two hours after arriving, heading back to Earth. The trip through the atmosphere went smoothly and the final bursts of the module's liquid propellant motors and its five giant parachutes slowed it to a crawl and a soft landing in the waters just off of Fearing Island.

A large, open-tailed tug backed around the module, picked it up and brought everyone back to shore within twenty minutes.

Mission, and project, accomplished!

## CHAPTER 5 /

### ... AND THEN IT WAS NOT!

A MONTH later, Tom was sitting with Bud in the staff lunchroom, munching on a roast beef sandwich, when his TeleVoc pin beeped.

"Tom," his father's voice came through. "You need to get over to the office right away. There's been a disaster on the Moon!"

Bud saw Tom's eyes go wide and then glisten with the first hint of tears. "What's wrong, Tom?" he asked as he jumped up and ran after his friend.

As they jogged down the path between buildings, Tom told him the little he knew. They made record time crossing the eight hundred yards between the Commissary building and the Administration building. Though both in good shape, they were breathless when they ran into the office.

Damon Swift sat behind his desk, gray-faced and silent. He looked up at the commotion of their arrival and pointed to the two chairs across his desk. The boys sat down quickly.

"They're here, Perry. Can you repeat what you told me a few minutes ago?"

After introducing himself to Bud—the two had never met—Perry Thomas said in a flat voice, "About five hours ago a six-inch meteor hit the Moon at a very acute angle. About five degrees. It skipped up instead of just impacting and plowing into the dust. By incredibly bad timing and positioning, it skipped right into the side of one of the buildings of our Moon colony." Tom looked about to speak but Damon held up a warning hand. "It was the housing building. Nineteen people were asleep, fourteen men and five women. It is likely that they only had a few seconds of time when they might have been

aware of what was happening. Probably not, though. They should have all been asleep..." The final word was choked off.

Tom looked at his father, who now nodded.

"Mr. Thomas? Were any of the other building damaged? Should we get up there to evacuate the rest of them? I can get my largest, fastest ship there in about four hours. Just say the word."

There was another moment of silence on the phone before Perry cleared his emotion-choked throat, "Um. Uh, I believe that won't be necessary. The evacuation that is. I would deem it a personal favor is you could get up there soon with humanitarian aid. And, probably body bags to return those we just lost."

"I'm on my way to get things rolling. We'll take off in about an hour. Let dad know if you hear anything between now and then that might dictate what we take up." With that, Tom and Bud raced from the room and down the hall to Tom's lab.

"Damon?"

"Yes, Peter."

"I need to know something. And, please don't sugar coat it. Straight up. If this agency had gone with your inflatable tent proposal, would our people be alive?"

A chill shudder ran down Damon's body and his face grew icy. He tried twice to take a breath before he could inhale. Finally, he stated in a flat tone, "Yes. With almost ninety-nine percent certainty. The shape and the materials and even the self-sealing aspects would have either shrugged that chunk of rock off, or minimized the damage. I'm sorry," he added after hearing the sharp intake of breath on the other end of the line.

"I want that miserable rat, Quimby King to pay for this, this *crime!*" he declared.

Damon gave it a moment and then said, "You will never make it stick, Peter. At best you can ruin the man publicly unless you can prove that he knowingly and willingly went with a bid that was substandard."

"That's just the thing, Damon. I can!"

\* \* \* \* \*

The *Challenger* arrived on the Moon to a sickening scene. The building that had been struck had literally exploded. The inside pressure had used the rupture point to break the structure apart and the atmospheric pressure inside had flung the pieces dozens of yards in all directions.

Five spacesuited figures were digging through the rubble. A brief radio call later and Tom found out that they were looking for the final two victims. He ordered six of the men with him to get out and help. Everyone had all suited up an hour earlier in anticipation of the need for fast action.

Bud, Chow and four of the men who had come up just weeks earlier to install the atmosphere machines joined in the search while Tom and Doc Simpson entered the first hydroponics building and went in search of Frank Williams.

When he did find the man, Williams was still in a state of shock. Doc took one look at the man and opened his little black bag. He extracted a small bottle, twisted off the top and handed it to the gray-faced man.

"Drink. Doctor's orders. Then, I want you to tell me where I can do the most good."

Williams took the small bottle, noted that the label stated that it contained: 2 oz. Medicinal Alcohol For Internal Use

He drained the little bottle, shuddered and then seemed to relax a bit.

"What's the old saying? Thanks, I needed that?"

Doc nodded. "Is there anyone injured?"

Williams shook his head. "No. Everyone else could probably use several of those little bottles, but we're all okay. Physically. Oh, and we only lost eighteen, not nineteen. One of the people we thought was asleep was taking a stroll in the adjoining hydroponics building. Actually, she *could* use your help. I'm not doctor but I was in the last Middle East conflict and I think I can spot survivor's guilt building up."

He told Doc Simpson where to locate the woman, and the young medico bounded off, finding out that the lower gravity could work both for and against him. His first push off sent him up where he grazed his head on an overhead beam. Landing, he pushed off at a lower angle and was soon gone.

Tom looked seriously at Frank Williams. "Do you foresee more cases of that in the other people here? In yourself, for instance?"

Frank stared back at Tom. It took a full minute before he replied, "I believe that five or six people here need to go back home. Two of them lost their spouses in there and the others probably were never meant for this sort of life."

They stood there for several more minutes before Williams concluded, "And, yes. I'm one of them."

Tom placed a hand on the man's shoulder. He could feel Frank shivering as they stood in silent contemplation for many more minutes.

An hour later Doc found Tom. The inventor had just come back inside after going out to see, first hand, the state of the disaster. With a rueful grimace, he told the doctor, "They'll be able to salvage the atmosphere machine. It had been bolted down to the floor and it looks like nothing hit it in the explosion."

"Tom. Look me in the eye and promise me you aren't feeling

any sort of guilt here," Doc ordered. "I mean that sincerely. From what I understand by talking to Damon, there is absolutely nothing either of you could have done differently. Not on the original bid, not on the structures up here. Nothing." he turned his head slightly to the right, still looking intently into his young boss' eyes,

Tom sighed and nodded. "I know you're right, Doc. It's just a real crappy situation here, that's all. But I'll tell you one thing. There is something I can do to keep this from happening again."

He outlined a plan he had come up with while standing with Frank Williams. It involved the creation an inflated skirt or wall to surround the entire compound. He also intended to suggest that Tomasite shielding panels be added to the sides of all the buildings.

"I'm certain we can put up a barrier that will catch anything like this skipping rock. At least it will deflect it back up and away. We can't do anything about a direct downward strike, though."

"I'm sure these good people will appreciate anything you do, Tom."

## EPILOG

### BEFORE TAKEOFF

TOM SWIFT stood looking out of the view port in the control room of the *Challenger*. The remaining six of the environment buildings plus the refinery sat in their tight cluster a thousand feet away.

Instead of being a happy place, full of promise and looking ahead to a great future, he felt they were leaving it a place of deep sadness. With the loss of one of the buildings had come the loss of eighteen lives. A terrible lesson to be learned in the most devastating manner possible, but space had never promised to be anything other than hostile.

"Penny fer 'em, Son," Chow's gravely voice said softly behind him. The old ranch cook placed a hand on the inventor's shoulder. "We all know ya know ya did ever'thing ya possibly could've. No man kin do more."

"Hey, Chow. Thanks. I was just thinking how the stupidity of a group of a dozen short-sighted men and women have been partly responsible for those deaths. And, the thing that really rankles me is that they won't ever take any responsibility. I know if Enterprises had been given the contract we would have built our strong inflatable structures that could have repelled that skipping meteor."

"Wahl, don't beat yerself up over it. Them's hardy folk over there." He pointed a finger at the cluster of buildings. In the end, only one had asked to be taken back to Earth. It wasn't Frank Williams. "They knew what they was up against from the start. You'll go back ta Earth and come up with somethin' that'll keep 'em safe. I have all sorts a faith in ya."

"As do I, skipper," Bud said from behind the inventor. He

was about to say something more when the radio announced an incoming call. Tom answered it.

"Tom here. Go ahead."

"Son? It's dad. I wanted to see if you had left yet."

"Not yet. In about five minutes or so. What's up?"

"The situation down here has a new wrinkle in it. A good wrinkle at that. Perry Thomas just called me to let us know that Quincy King has been arrested by Federal Marshals on charges of accepting bribes and forging engineering findings on the buildings up there. That, plus he's facing nineteen charges of involuntary manslaughter."

"Eighteen," Tom corrected him and told his father about the one survivor from that sleeping shift.

"Well, that's one good piece of news out of this nasty business. Anyway, Perry also tells me he wants us to come up with some way to keep this from happening again."

They talked for another minute before Tom announced their imminent departure.

"I'll talk to you when you get home tonight," Damon told him. "Good voyage!"

The *Challenger* lifted off, slowly and circled the lunar base. In the two days they had been on the surface, the workers had almost completely cleared away the debris from the shattered building. Sitting away from the cluster were six large, neat piles of things ranging from salvageable wall and window panels to structural supports right down to things that would never be of any use again.

In place of the building were eighteen small piles of lunar stones and broken window panels. Each panel had been etched with the name of one of the dead. They would remain as mute

evidence and to honor the fallen.

About half way back, Bud turned to his friend with a grin.

“Atmo-copter? Airy-go-Round?”

Tom shook his head with a small grin. “Keep trying, Bud. Some day.”