

# Breaking a Gnat

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For the year 1966 I wore two hats at work. My primary job (as I was told by my bosses) was to be the Station Flight Safety Officer of Ambala. My primary job (in my own eyes and according to the official posting order that I had received) was to be the flight commander of Number 18 Squadron. There was a difference in the two interpretations that had to be reconciled. I was therefore required to work cautiously lest there be a conflict. Unfortunately for me, I had never learnt how to be cautious. I therefore decided that the best way for me would be to remain what I always had been. Life however is sometimes tough. Situations arise where what needs to be done and what is convenient to do cease to be concurrent. Sometimes there are no beaten tracks to follow and one has to chart one's own actions with no guarantee that the effort will succeed. My tale today is about one such situation where I decided to act vigorously (and in some opinion foolishly) only to have the situation blow up on my face.

One afternoon, during my routine amble through the Repair and Servicing Section (R&SS), I found one Gnat belonging to 18 Squadron standing in one corner of the hanger. I was a bit surprised. That particular aircraft was not due for a periodic 50 or 100 hour inspection at the second line. Therefore its presence in the 2nd line would only mean that it had a serious defect needing second line investigation. However, I did not know of any such complaints. I therefore went back to the flight line to investigate. It transpired that for the last sortie, the aircraft was being flown by a senior pilot of the neighbouring number Two Squadron. The pilot reported serious lateral imbalance of trim. He also had some difficulty landing the aircraft. On landing it was discovered that fuel from the starboard (i.e. right hand) drop tank had not fed fully into the front group of tanks. As a result, the aircraft had less fuel available for flight and the aircraft had to be landed with a seriously displaced C of G. This was a very serious defect. I had missed the hubbub because during that period I was not present in the Squadron.

For a couple of days, the aircraft just sat around in the R&SS. Then one day I found it being ground-run and then it returned to the flight line. In 18 Squadron, the syllabus demanded a fair amount of flying in the clean configuration. For the next flying day, the aircraft that had the fuel transfer problem was presented in the clean configuration. A young pilot flew it and made no complaints. Another day passed. On the next day the aircraft was presented with drop tanks fitted. Once again the pilot complained of the right wing being heavy. On ground inspection it was found that the right hand drop tank had transferred fuel partially. Some fuel was left in it while the left drop tank was empty. The aircraft was sent back to the R&SS for rectification and it returned from there after a day as fit for flying. By now, the

aircraft was under a spotlight. It was tanked up and the drop tanks were partially filled. A senior pilot was detailed to fly it. The pilot was briefed to look-out for symptoms of fuel feed problem. Once again the pilot experienced symptoms of right wing being heavy. It was found that the right hand drop tank had some fuel left. This repeated defect called for specific rectification.

The Gnat was a simple aircraft. To make it so simple however, the designer had to trim out all margins ruthlessly. In other words, if something did not function as intended, the pilot was in difficulty in short order. If I describe the aircraft's fuel system it will be easy to understand what I mean. One has to remember that the Gnat was really a tiny aircraft and it was really, I mean REALLY tightly packed internally. It must have been very difficult for the designer to locate enough internal volume to carry fuel. To keep the process of manufacture simple, he had decided not to carry any fuel inside the wings. He squeezed out seven tiny pockets within the fuselage where he stored the fuel required. Tank 1 was the largest and was placed just behind the pilot. A smaller Tank 1A was located adjacent to Tank 1. These two tanks were located ahead of the Centre of Gravity of the aircraft and were called the front group of tanks. Tanks 3 and 4 were located somewhat further back in between the two air passages behind the air intakes on either side of the aircraft. Two more tiny tanks were wrapped around the air passage duct as they converged on to the engine inlet. Thus Tanks 3, 4, 5 and 6 formed the rear group of tanks. These were all located behind the Centre of Gravity of the aircraft. Tank 2 was a small collector tank located more or less just below the Centre of Gravity of the aircraft. It was connected to the two groups of fuel tanks as input sources and to the engine's fuel system as its logical output. It was however quite clear that the quantity of fuel carried by the front group was about ten percent more than the fuel carried by the rear group. Naturally, if the two groups fed into the central collector at the same rate, by the end of the sortie, the C of G of the aircraft will shift forward. This little mal-distribution of weight in the aircraft was enough to erode its safety of longitudinal trim as it would tend to become nose heavy as fuel was consumed. This little problem was of course easily rectified by introducing a fuel flow proportioner in the ratio of 1.1:1 between the front and the rear groups. As the development of the aircraft continued, it was found that the fuel capacity was not really enough. Two additional tanks, Tank 7 and Tank 8 were added in the removable rear fuselage. This addition to the rear group of tanks made it the bigger of the two groups, by about ten percent. The FFP was just reversed (to 1:1.1) to tackle the C of G shift. A little tinkering with the static ballast was also necessary. The next problem was to fit drop tanks to the aircraft to provide it with a useable radius of action. This too was simply solved by laying out a fuel transfer route where the right hand tank fed through the front group while the left hand tank fed the rear group. For the actual job of fuel transfer, a little air pressure was trapped from the engine downstream of the compressor, and was directed towards the tanks. A pressure reduction valve ensured that the tanks did not get over pressurized. A T junction then split the air flow into two. One of the two pipes downstream of the T went to the right wing drop tank

pylon and thence to the front group of fuel tanks while the other pipe went to the left wing drop tank pylon and thence to the rear group of fuel tanks. When drop Tanks were fitted and they contained fuel, the pressurisation air pressurised the drop tank and pushed the fuel therein to the fuselage tanks. As and when there was room in the fuselage tanks because of consumption of fuel by the engine, the fuselage tanks were replenished with fuels from the drop tanks. There after, when the drop tanks became empty, the pressurisation air reached the fuselage tanks through the same transfer pipes to help the transfer of fuel into the collector tank through the FFP. If the drop tanks were not fitted, a device in the pylon redirected the air to the outlet on to the fuselage tanks.

Some readers of mine might have become bored with this long paragraph on technical detail of the Gnat fuel system. My advice will be to request those readers to bear with me for a little longer; the story I am relating can be appreciated only if the basic structure of the fuel system is understood.

The symptoms given out by the aircraft led me to a few primary conclusions. It was quite clear that when drop tanks were fitted and filled, there was uneven fuel transfer between the two tanks. At the same time, no fuel transfer malfunction was noticeable in the clean configuration. It therefore indicated that the most probable cause for the problem would be a restriction the fuel transfer pipe between the right hand drop tank and the front group of tanks. I felt rather happy at having figured out the likely problem. All that was now required was to make sure that the fuel transfer line was free of any obstruction. I called the young engineer officer attached to the first line of the squadron and explained my line of thought to him. I then asked him to send the aircraft back to the second line for the required rectification. Emotionally I switched off from the problem; as far as I was concerned the problem was solved.

Something strange happened over the next week or so. I found the aircraft static at the first line. It was not serviceable. No one was rectifying it. No one was willing to give me an answer as to why it was so. After three or four days I began to force the pace. I was then told that the R&SS was over-loaded and was not in a position to take on this rectification. I naturally cut some slack and waited for the rest of the week for the aircraft to be taken in at the second line. I waited in vain. I attempted to meet the CTO and discuss the matter with him, but he avoided me like the plague. It was indeed a peculiar situation. Another couple of days passed and all my calls to the CTO were picked up by the technical adjutant. The CTO seemed to have just disappeared.

At this point of the tale it becomes necessary for me to look back and look at myself as I was then. I have to admit today that I was then a young man in a hurry. Because of circumstances beyond my control I was doing two jobs, two highly demanding jobs, and I just had to excel in both. It was an exciting challenge that I had created for myself and I was on an emotional high with my personal assessment that indeed I was succeeding in this challenge. The job of proving my self as a flight commander of 18 Squadron was

comparatively easy. I had done a similar job on a similar squadron earlier. I had very efficient and sympathetic colleagues. I had a bunch of youngsters who knew me by name because of my long stint as an instructor in the training command. On the other hand, the job of being a Station Flight Safety Officer was entirely a journey through uncharted waters.

The job of a 'Station Flight Safety Officer' was a new one in the Air Force at that time. There was no precedence to go by. The scope and the extent of the job content were undefined. The incumbent was nominated from the flying branch but very clearly his job content overlapped that of all other branches on the station. Naturally, there was a period cautious probing and adjustment of the boundaries of authority at the working level. Generally I was happy at the level of acceptance I found from most of the station staff on my interpretation of my job content. However, this acceptance was not totally uniform. I had to admit that the CTO did not take kindly to my 'poking my nose' into the technical aspects of the stations' functioning. He was an elderly man who had risen from the ranks to the rank of a Wing Commander. He firmly believed that the fly-boys should confine their activities to the cockpit in the air and perhaps to the high stools at the bar. He did not take it kindly if a pilot attempted to spend significant hours of his day in the hanger pottering around with the technicians at work. And he definitely disbelieved that a pilot could have any real technical knowledge about the aircraft he flew. Obviously, he had difficulty in pigeon-holing me in his stereotypes and found my attempt to make technical safety a par of my job irritating. I thought I had understood his position and was (I thought) working my way into his confidence and cooperation. I had misjudged the extent of my success with him.

A couple of more days passed and my irritation mounted. Then, in an answer to my repeated queries, the Technical Adjutant told me that the CTO would have no objection if I carried out the investigation and rectification to the aircraft at the first line under my care since the R&SS was unable to take on the task now. A trap was thus set; the impetuous fool that I was at that time, I walked right into it. Technical investigation and fault rectification as a task fell clearly under the jurisdiction of the CTO. In that matter I had no locus standii. On the other hand, as the station's flight safety officer, I was clearly within my rights to demand satisfactory explanation and rectification for a demonstrated mal-behaviour of an aircraft in the air on more than one occasion. My rightful course of action should have been to raise the level either as a Flight Commander to the CO and then on to the Station Commander or as the SFSO directly to my Boss. I did neither. I decided to investigate and rectify the aircraft in the first line under my personal care!

Mornings were always busy. I therefore chose an afternoon for this investigation. I asked the engineer officer of the first line to be present and make the services of five or six trusted technicians from the first line pool of manpower. The storage and transfer of fuel falls under the care of an 'Air Frame Fitter'. That speciality was then known as FitterII(A). The pylon carrying the fuel drop tank came under the care of a 'Fitter(Armourer)'. To make the cockpit instruments alive I needed an external source of electricity. To provide that support I

needed an 'Electrician(I)'. For a serious investigation like this I needed a senior floor supervisor. I asked for a Warrant Officer or Flight Sergeant from 'Fitter I' trade. To manhandle the aircraft and the ground equipment I needed a few more men. I expected a team of eight or nine to be waiting for me. What I found on the tarmac on that afternoon was substantially less. The young EO was absent. He was needed by the CTO 'else where' for 'some other important job'. No Fitter I Warrant Officer or Flight Sergeant was present either. They were needed for 'other' rectification work 'else where'. A Flight Sergeant (Instrument Repairer I) was standing in as the field supervisor. Two very young fresh and enthusiastic men were there from the main trades: one Corporal Fitter II(A) and one Corporal (Fitter Armourer I). There was one Electrician I with an electrical trolley to supply ground power and one Fitter II (Engines) to ensure engine safety. The aircraft had been positioned close to the flight office. There should have been a 'compressed air trolley' with control valves and pressure gauges fitted near the aircraft, but there was none. Instead, a naked compressed air cylinder was kept near the aircraft. The Fitter II A was gently playing with a spanner with which I presume he planned to control the flow of high pressure air into the aircraft which was connected directly to the cylinder through a length of a pressure hose! The crew crowded around me as I arrived, faces eager with curiosity.

I should have been a little more mature than I unfortunately was at that moment of my career. I should have called off the exercise and should have escalated the situation to the station commander citing the very obvious lack of cooperation for the inquiry and rectification from the technical side. But the sad fact was that instead of doing the right thing, the situation made me take the occurrence as a 'Dare'. Did 'they' think I was incapable of seeing this thing through without their help? Forty five years down the line to day I can shake my head and be bemused at my immature reaction, but on that day I took all the wrong decisions for all the wrong reasons foolishly.

I had the aircraft parked for rectification. I asked the engine fitter to vent the front group of tanks by opening the refuelling access on top of the fuselage just behind the cockpit. (This was in reality the job of the airframe fitter, but that lad was busy repositioning the compressed air cylinder and I let him be). I asked the electrician to connect the ground power trolley to the aircraft. I asked the Armourer to dislodge the right wing drop tank pylon pressure line coupler. Two little pipelines, one from the fuel-tank pressurisation air supply and the other for drop-tank fuel transfer popped out. I explained to the tradesmen the plan of action. Air pressure was to be applied very gently to the fuel transfer line. I expected the obstruction in the pipe line to be dislodged by the air pressure and fall into the tank. The engine fitter was asked to sit on top of the fuselage and monitor the open neck of the front group refuelling point to see if any solid object shot out of the transfer pipe that came into the tank at the refuelling neck. The Engine Fitter asked me whether he should vent the rear group of tanks also. I thought for a while and told him that there was no need as I was not going to pressurise the rear group. The Armourer connected a spouting pipe from the right drop tank

pylon to the compressed air bottle. He then asked me if he should disengage the pipes of the left pylon from the coupler. Once again I saw no reason to disturb the left pylon as I was not planning to touch those pipes in my operation. The Airframe Fitter took his position on the compressed air cylinder facing the aircraft. I looked around; every thing seemed ready to go. I jumped into the cockpit, stood on the ejection seat facing the rear right quarter of the plane and asked for a flow of compressed air. For a moment nothing happened. The Airframe Fitter increased the air flow; there was a little rir – jhin noise as if the engine was trying to rotate. Then there was a loud crackling noise and a small explosion. The aircraft started spewing out fuel from all over its bottom.

The Airframe Fitter shut the air flow off. The Electrician disconnected the trolley from the aircraft in a jiffy. I jumped off the cockpit. We all stared at the aircraft stunned, not knowing what hit us. It was such an unexpected situation. A few moments passed. It seemed like an eternity. The Engine Fitter and the Airframe Fitter made a quick survey below the aircraft and pronounced that the Tanks number 4 and 3 had ruptured and had damaged the fuselage frame in the process. Well, that would account for the massive fuel leak, but why did this happen? I stood there speechless and motionless immersed in wretchedness and disbelief. And then, slowly, my eyes settled on the right wing drop tank pylon. Blood drained off my face as the import of what I had seen hit me. The compressed air pipe from the air cylinder should have been connected to the fuel transfer line, the forward of the two pipe ends hanging down. Actually, the compressed air pipe had been connected to the posterior pipe of the pylon, the air pressure pipe!

As I began to comprehend what had happened, I could only consume the anger directed against my self that raged inside with an impassive face. I was the only officer present on the spot. I was in charge. I had messed up big time and had destroyed a perfectly good aircraft through a simple supervisory lapse! Let me take a moment or two to explain to my lay readers what had actually happened. The Fitter Armourer has connected the air pressure pipe from the compressed air cylinder mistakenly to the aircraft's fuel pressurisation pipe instead of connecting the air pressure pipe to the fuel transfer pipe. It was a human error. Both these pipes hung down from the right drop tank pylon one behind the other; thus such a mistake was plausible. The error once committed was not detected and rectified before the commencement of the next action. This was a supervisory error. No engineer officer was present. No Fitter I was present. The nominated supervisor was from the instrument repairer trade and had no knowledge of the fuel system. He did examine the connection made by the Fitter Armourer to one of the pipes available and did ensure that the connection was secure, but due to a lack of fundamental system knowledge he did not question whether the connection was made to the correct pipe! I was at the next level of supervision and command. In the absence of a Fitter I and an engineer officer for the job, knowing fully the limitation of the designated floor supervisor, and being the only officer available and

responsible for the job, I should have ensured that every step of a job is done under supervision. It was therefore my call to stand up. The buck had to stop at my feet.

The mechanics of the event was rather simple. Compressed air, released from the cylinder entered the air pressure pipe at the right drop tank pylon. This air pressure travelled towards the other end of the pipe and met a T junction. The stem side of the T contained a pressure reduction valve that acted as a resistance. The main flow of the compressed air therefore flew along the head of the T to the air pressure line of the left wing drop tank pylon. Unfortunately, in my wisdom, I had declined to decouple the air pressure line from the fuel transfer line. The high pressure air thus got a free passage into the left wing fuel transfer line and reached tanks 7 and 8. The aircraft was fully refuelled. The increased air pressure in tanks 7 and 8 tried to push the fuel in those tanks to tanks further down stream that is tanks 5 / 6 and then tank 4 and 3. Unfortunately, again in my wisdom I had declined the offer of venting the rear group refuelling point. The fuel in the rear group had no place to go to. This pressurised fuel ultimately ruptured tanks 3 and 4. Normal rules of physics will of course always prevail.

Instead of a malfunctioning aircraft I now had an aircraft destroyed through a ground accident on my hands. As the SFSO I had to initiate the require paperwork for it immediately. Filling in the details of the aircraft took no time. I then had to obtain the comments of the CTO on the form to send it off to the Command HQ. The CTO was easily found. He was in his own office even at this late hour. He did not exchange any words with me but wrote down his comments without any hesitation. Perhaps he had already drafted it mentally. It was clear and succinct. 'The investigating officer from a not technical branch authorised charging of a fuel system pipe cleared for an over pressure 7 lbs/square inch with direct air pressure of 1800 lbs / square inch leading to the rupture of fuel tanks inside the aircraft'. Technically the statement was correct. For a recipient of this message who had had no other inputs, it would have conveyed a very distorted picture of the event. I had no option but to complete the forms and despatch them to the Command HQ.

A court of inquiry was ordered. Wing Commander Bharat Singh was the presiding officer of the inquiry. I was of course Witness Number One. My initial statement was a long one describing the back ground and why I was investigating the aircraft. I went on to describe how the human error of a wrongful connection came about and how I had failed to detect the lapse. I admitted that the accident was caused due to my failure of supervision in that I did not detect a human error by a technician working under my command. My statement was corroborated by the statements of all technicians involved. The presiding officer asked the engineer officer about the tardy and ineffective rectification carried out on the aircraft. This tardiness clearly led to the investigation and the accident. No satisfactory answer could be elicited. I was warned that I was likely to be blamed for the accident based on my own statement. That was no big deal. I had already accepted my failure. The inquiry was wrapped up in quick time. On the second day after the inquiry began, the inquiry papers were

released to the clerical staff for final typing-up of statements. I was asked to come back after lunch for the formal declaration of the Court that I was to be held to blame for the accident. During the afternoon session of the court of inquiry a new drama unfolded. The engineer officer of the unit's DSS (Daily Servicing Section or the First Line Servicing Section) requested permission to submit an additional statement. The manner of his request gave me the impression that he had been prevailed upon by some one else to make this statement. His additional statement was duly recorded. Since I had already been officially blamed for the accident, I had to be present while he made the statement. I also had the legal right to cross examine him. In his supplementary statement the Engineer Officer stated that he wished to put on record his opinion that my planned investigation/rectification was technically flawed and was inappropriate from a field engineer's point of view. I was somewhat surprised. I also found it interesting that the officer was trying to avoid eye contact with me while he made the statement. I asked him to identify the steps of my investigation/rectification that he felt were technically incorrect. It seemed to me that he had not anticipated this question. He took a little time and then said that if indeed there was a blockage in the right fuel supply line, and that blockage got dislodged by the air pressure applied, then the object dislodged would fall into the fuel tank. The fuel tank was deep and its bottom was beyond one's reach from the top. Therefore, to clean up the tank, the tank itself would have to be taken out from the aircraft. That would be a very labour intensive job with grave risks that the tank would be damaged in the process. It was therefore a technically bad plan. To me it was clear that he has made the statement without pre-thought. I asked him if he was sure of his answer and he said that he was. I let him sign the statement before I proceeded with my next question. I asked him if he could describe the portions of low pressure fuel system that would be visible if the bottom panel of the fuselage was taken off. That panel covered the bottoms of tanks 1 2 and 3. Two large diameter pipes connected tanks 1 and 3 to tank 2. If the connector between tanks 1 and 2 was taken out, there would be a large hole at the bottom of tank 1. A technician could put his fist through and comfortably sweep the bottom of tank 1. I asked him whether my description of the situation was true. He had to admit that the process was workable.

At this moment, Bharat Singh lost his temper. He asked the engineer why he had specifically requested to make a statement against the technical process adopted by me while he now admitted that the basis of his objection was spurious. Very clearly, I my technical knowledge was not as detailed as it was I would have been crucified! The engineer was cornered and he blurted out that he had been 'advised' by his technical superiors to make this statement against me! The situation became very ugly. Bharat Singh wanted to put the blurted statement of the engineer on record and call for a bigger inquiry about the technical administration of the station. The situation was clearly getting out of hand. I appealed to WingCo Bharat Singh to calm down and suggested that it would be better if the Engineer was permitted to withdraw his tutored statement. Instead, he could explain how he concurred

with my stand that the accident was caused by a supervisory failure to detect a human error. WingCo Bharat calmed down. The Engineer withdrew his statement and issued a fresh one concurring with my statement. The inquiry came to an end. I was officially held responsible for the accident and was blamed for it.

Legal Closure for the incident was quickly obtained. The AOC in C, Air Marshal Shivdev Singh directed that his 'Severe Displeasure' be promulgated on me. The aircraft was initially categorised as 'Repairable'. A team from HAL down graded it to 'Totally Destroyed'. The social closure for the incident however took some time. The incident had veered too close for the organization's comfort to a technical/pilot confrontation. Too many limits of authority were tested. For some period of time jungle drums kept rolling deep inside the station. In their wisdom, the station and command HQ decided to push the matter out of sight rather than to precipitate a confrontation. However, both at the station and command HQ level, in-depth discussion took place informally. The so called 'Semi Centralized' maintenance organization was clearly dependent on mature handling at the field level. The 'rules' that existed were clearly neither adequate nor comprehensive. It was just about 'workable' if every one pulled in the same direction.

Personally, my social standing with the young engineer crowd on the station improved. Perhaps my throwing of a lifeline to the young engineer at the inquiry was appreciated. I got an official letter of appreciation from the command flight safety officer for the conduct of the court of inquiry and my very clear exposition of the dynamics of the accident. My CO and my Station Commander both approved of my behaviour after the incident. My career profile was not harmed as a result of this accident. I sometimes wonder as to what are the lessons that I carried from this incident. I am sure there were many lessons: pernicious effects of emotions over decision making, importance of team work, need for attention to detail, I am sure there are many more. We learn as we live and grow. Was a loss of 67 lakhs of Rupees to the exchequer too high a price for my learning? I do not know. Actually I want to forget that I needlessly destroyed an aircraft, but the Air Force won't let me forget. The Air Force has put that aircraft on display in front of the Vayu Bhavan as a permanent reminder for me!!