

Surveyor

Want to see all the darkest parts of Africa at 300 ft? Want to tour third world countries for months at a time? Want to live in confined accommodations with a collection of people that make the locals seem normal? Want to do all of the above while flying small aircraft for moderately good wages? Then Airborne Geophysical Surveying is for you!

As usual, I wanted to do some flying after finishing up my master's degree. Also as usual, everywhere I applied wanted me to have several thousand hours flying their types of aircraft, plus a doctorate in Aerospace Engineering, plus a couple of lunar landings. Well, I did not have the doctorate, but the nice folks at the Geophysical Survey company I chanced on did give me a call when my Master's Degree in Aerospace Engineering caught their eye. The only problem was my resume.

As I recall, the director of flight operations, chief pilot and general aviation director at the survey company called me up and said "well, you sent us a pilot-type resume, but our pilots generally have much more experience than you do, so we can not hire you as a pilot....BUT I see you have an engineering degree. Would you like to come and talk about an engineering job?" Would I like to work at a company that flies airplanes? Does it snow in Canada?

Now, I do not know what planet you are from, dear reader, but on mine here, to start out in a business, any business, not just aviation, you have to jump at any opportunity to break into it. Not only that, I was really interested in doing some aerospace engineering; after all, I had spent six years in university getting the degrees, so the work held my interest for a period of years, not seconds. It is not at all as if I joined specifically with the intention of wheedling my way into the flight operations department, raping the company for some flying time, then leaving town for a larger, more airline-orientated operation. No, no, no, that is not it at all. That is just what happened. Just a side effect. They actually laid me off partially when contracts ran a little thin after the Bre-X gold mine stock scandal, after which I went off to get doctorate degree, never dreaming that that someone else would offer me a flying job, which they coincidentally did. Any way, I digress.

Airborne Geophysical Survey is fun! What is it? Well, it is like flying a continuous instrument approach all day, except in visual conditions at a more or less constant 300 feet or so over the ground. An on-board global positioning system unit is linked to a computer with a digitized map of the block of land (or water) to be surveyed. Back at head office, a surface to fly is generated for the computer, much like draping a cloth over all the hills so that they are smoothed out. Obviously, you have to start climbing above 300 ft sometime before you run into the vertical mountains, and the performance of the aircraft is factored in to how steep the gradient is allowed for the digitized drape surface. Inside the plane, an instrument landing system indicator head is modified to accept the outputs from the computer. The survey block is divided into a series of lines, of which the pilot not flying selects one at a time. To fly the line, all the pilot flying has to do is keep the needles centered. It is easy, at least after a few hours practice. It gets harder with a lot of climbing and descending over mountains.

All sorts of instruments are mounted on the planes, but the most popular are "mag and spec", which means sensing of the earth's magnet field with a sensitive magnetometer mounted in the aircraft's tail boom and sensing of background radiation by means of a few hundred pounds of sensitive crystals in the belly of the aircraft. My first jobs as an engineer were designing and making pictures of the holes, wires and protuberances that all this equipment needed. All sorts of things had to be added to the planes: the tail booms to hold the magnetometers, ground wiring to get rid of the eddy currents that the aircraft's own electrics produce, holes for the video cameras. Video cameras? Yes, the whole flight is video taped so that when the aircraft flies over railway tracks or scrap metal yards, the magnetic signature does send the geophysicists on a wild search for a huge ore body. Some poor soul, usually a junior geophysicist, has to find the time of each anomalous spike in the data, then scan to that time on the video to see if there is something obvious causing the spike.

Theoretically, I was designing all this stuff in my capacity as a highly educated engineer. In reality, I was making up pretty drawings to get approval from the government engineering representative to fly with installations that had evolved over time, made up by mechanics and experimenters. My best source of information was "old Erv", a man who had made up every survey installation for the company from the time when no approvals were needed from the government. As far as I know, he had no formal engineering education at all, but he knew it all since he had been doing it since there was such a business. I would take my drawings into the back room where Erv would be bent over a mess of wires, soldering up some harness, and he would unfailingly take the time to set my designs straight. The aircraft mechanics were a great help as well, once they realized that I was actually taking their inputs, rather than attempting to either take over their little domains in the hangar or dictate that they build something impossible.

The only time I actually had a chance to build something absolutely new was when the company embarked on a research project to build a couple of gravity-measuring devices. Boy, did I botch it up. Several times, actually, but then as the design evolved, it started getting better and better. Sometimes the highly experienced mechanics were no help at all! I would make drawings of something, such as a window-mounted duct cover for ground cooling air, and the mechanics rejected it as impractical. Five designs later, the mechanics and managers told me that they had figured out a solution. It was my original design! Such is the nature of engineering work.

Now, since this installation was experimental, expensive and original, I was now one of only a few people who had knowledge of its inner workings. For the last year, I had been longing to be a field mouse instead of a lab rat. Now, with the equipment undergoing airborne trials and testing, it needed a babysitter for maintenance and repair. There also had to be a pilot around, but he would be sitting on the ground much of the time while the system was being readied for its next test. Having extra bodies staying in hotels and doing nothing is expensive. This was my first big bit of luck in my aviation career.

Why pay two people and only have one work at a time? Why not get Walter checked out on the Cessna Caravan and have him function as both the pilot and the on-site engineer? Fantastic! I was out of the lab and on my way around the world. Thanks to the kindness of the aviation manager, who allowed me to do the Cessna Caravan course at flight safety in Wichita, I became a marketable pilot rather than just another go-

nowhere instructor. I owe this man a great debt of gratitude and whenever I have a chance to repay these debts--to anyone--I try to do so.

I loved the Caravan. It is logical, simply, reliable, and fun to fly. The simulator in Wichita was level D-better than the jet simulators I would later fly. There are so many warning lights and safety systems in this simple airplane that you can be half-asleep and still fly safely. This was, of course, the design criteria that Cessna received from Federal Express when they made the plane for the night cargo market.

The gravity gradient sensing equipment that I was working with was brand new for airborne geophysics, but was actually 20-year old technology recently declassified from the US military. The instruments were previously installed in nuclear submarines, where heavier weights were a good thing. Accordingly, the engineers from the US defense firm who were working with us placed several hundred pounds of steel plates into the back of our weight-critical aircraft. These steel plates served the function of holding some computers, just like they did back on the submarine. Also, the equipment was water-cooled. It took some persuasion to change the system to a more airborne bent.

As pilots disappeared, surveys popped up and head office panicked, there were needs for pilots out in the field on regular surveys. I had the great fortune to spend a few months in Rennes, France, cruising over the French countryside at low level in an Islander, getting a good look at the castles and monasteries of Brittany. I especially enjoyed the female French air traffic controllers speaking English. The way they expressed themselves "Sierra Golf ex-ray....mmmm...you call me, mmmm?" it sounded like they were looking for dinner invitation rather than a call before entering their zone again. For greater comic effect, I mutilated the French language attempting to communicate on the radio with the language of the land. At least we had French copilots. Incidentally, French labor law stipulated that the survey company had to hire French pilots in order to work in France. So, the company hired a bunch of 200-hour brand new pilots to fly along with us. With the social tax and everything else, those kids ended up costing more than the Canadian captains. No wonder people who want to start businesses run away from Europe with its high costs.

The other plane out in France at the time was a Queen Air, which I flew rarely. That was too bad, since it was a comfortable ride compared to the vibration of the Islander. With survey lines a fair distance from the airport, survey is most productive when the planes can stay out for as long as possible. A fully-fueled Islander with the tanks we had could hang around for 6 hours or so. Can you sit down without urinating for that long? If you can, either you are dehydrated or you are causing damage to your bladder. The solution was a plastic jug. So, after transferring control to the other pilot, the procedure was to climb over the computers into the back of the plane, trying not to kick the mass of wires and screwing up the survey in the process. Once in the small space behind the computer racks and over the spectrometer crystals, you could then hunch over and attempt to urinate as the Islander bucked through the daytime heating turbulence and heaved up and down as it followed the contour of the ground. The turbulence at low levels made the French copilots sick, since they were not used to it. Did I return to base just because they were throwing up? Well...sometimes. They usually felt better afterwards, especially if I gave them control. Besides, they felt even worse about returning early and costing the company hundreds or even thousands of dollars by forcing us to spend extra days in the field.

Compared to the Islander, the Caravan was airliner-smooth. Even on a survey in the mountains of British Columbia, where the rugged terrain ensured some mechanical turbulence with any kind of wind, it was never as sickening, since the turbine engine was inherently many times smoother than the big pistons of the Islander. Maybe it was the pilot I was with on the survey who made it smooth by picking which parts of the block to do on particular days. This character had been surveying for years, having spent time in a couple of dozen third world countries. He had a year or so of vacation time built up from the years he spent in South America. I guess he got lonely out in the field, away from his wife and several children, since he ran off with some younger Spanish lady he met overseas. Being divorced was fairly standard for longtime survey pilots. Maybe it was the stress of staying away for three or four months at a time, but probably the kind of person that chooses the peripatetic life of a survey pilot is a good candidate for divorce to start with. The experienced guys were sure great to fly with though. First off, they were usually the biggest cowards out of the group of pilots, having survived years of low-level work in remote areas. Secondly, they knew what they were doing with the equipment, so things went smoothly even with a brand-new geophysicist. Oh, did I mention that geophysical survey is one of the most hazardous types of flying around? It is like crop dusting: you are close to the ground, so there are things to hit.

The best part of flying with highly experienced survey pilots had nothing to do with technicalities, though, it was their personalities. Anyone who stayed for years in survey had to adopt a relaxed attitude to life. This is not a typical flying job where the crew meets at the airport, spends a few hours, or even a few days, together flying, then abandons the ship and splits up the head home. No, survey means spending months together with the same pilots, mechanics and geophysicists, day in and day out, usually in isolated surroundings. In northern British Columbia, we were living in a logging camp, which was convenient to the survey block and had an airstrip. The walls of the prefabricated bunkhouse allowed everyone to hear their neighbors breathing. In the morning, everyone ate together in the dining area. Then we worked together all day, ate another couple of meals together, perhaps airborne, then had time to catch a movie on the satellite television in the common room, again together, of course. If anyone had personality problems with another person on the survey crew, it was impossible just to avoid them for a day. Experienced surveyors had learned the art of living with anyone, mostly just by tolerating any kind of behavior short of pathological.

It takes a while how to learn to deal with behaviors that are unacceptable. The nominal bosses of the survey in the field were the geophysicists, who could be young university graduates. The aircraft mechanics were sometimes thoughtful and intelligent, but others were rough and rather crude. One aircraft mechanic seemed quite self-centered, running up huge bills on the company credit card to furnish his personal living space. The company took back its credit card on some excuse, but then this man persisted in treating the communal vehicle as his own. Head office could not observe the vehicle in the field, but they did notice a long list of personal calls on the company cell phone. Naturally, the mechanic had taken over one of the field cell phones as his personal property as well. It fell to the young geophysicist, a bookish young man, to pry the cell phone away. An ugly confrontation ensued, with threats from both sides to "tell head office" about how bad the other was acting.

In situations of strife among the survey crew members, how can you tell if your mechanic or pilot or geophysicist is overstressed and unreasonable OR you are the problem?

Simple: first off, you are probably both stressed just from being out in the field too long. So you are both probably acting in a slightly less than reasonable and less than accommodating manner. To separate the mildly impaired from the truly disturbed, though, it is necessary to do a cross check. Phone other people at the survey company who have worked with your co-worker and find out what they think. If every one of them claims the virtues of a him or her while questioning your sanity and use of stimulant drugs, maybe it is time for you to have some chamomile tea, burn some incense and meditate for a few hours while listening to "Pink Floyd". You are bushed, man. Over the edge, whacked! You will get over it. Just get out of the field for a bit.

Just because you can not get along with a particular survey crew does not mean you have psychopathic urges. It could just be that two normally acceptable or borderline paranoid people who would interact fine with others in the office or during a regular day job bring out the worst in each other in the confined living spaces of the survey. If three survey crews you get put out with all seem to be filled with nasty people, chances are that you are not suited for survey work. As a pilot, you are probably getting ready to move on at this point anyway, since three surveys could be a year or more. Be prepared for a salary cut at your next job flying charters in light twins or sitting right seat at a commuter airline, though. Doing survey in the 1990's, Caravan captains could make 80,000 Canadian dollars a year-tax free if they lived out of the country for more than six months at a time. Not bad money for little airplanes and free tours of the world. Of course, anyone who wanted to keep a marriage and achieve stability in their lives moved on rather quickly, even if it was fun.

Once you are back from the field, at head office there is little for a pilot to do except plan the next survey, perhaps the routing for the ferry flight, or work on getting the various permits and permissions to fly in countries where the civil aviation authority is run by petty tyrants who rule their little kingdoms based on personal whims. Some of these little third-world tin-pot dictatorships are not paying their government employees well enough, so they delay giving permission to fly in order to solicit bribes, but in other countries, the aviation regulators just seem to hate both airplanes and foreigners. A good example of a country with capricious and unequal application of aviation law is the United States of America. One FAA inspector in New York State had several typed pages of conditions I had to meet and took several months to approve a limited amount of survey work over non-populated areas. In Arizona, the FAA man was asking what he could do to help us out and do the work more quickly. The good thing about third world country regulators versus first world bureaucrats is that the poor bureaucrats will get out of the way with the payment of an appropriate "fee". Survey companies pay for many "fees", "gratuities", "permits" as well as plain bribes, graft and corruption. Part of being an experienced survey field operator is knowing who to bribe and how much in order to achieve a particular result in a particular country. Our companies' specialist for South America was a man who had been working in South America long enough to claim citizenship in a few of the countries. After a few years, he spoke fluent Spanish with the appropriate regional accents and was on a close, personal basis with every corrupt petty official in the importation and aviation departments that gave out stamps and permits.

Survey companies compete fiercely. They undercut each other bidding for basic magnetic and spectrometer surveys, jealously guard their technical innovations from competitor's discovery and feel cheated when their experienced pilots float from one company to another. However, they share a common bond, an unspoken agreement.

They all lie on customs forms. Survey equipment is expensive. Third world countries impose ridiculous import duties on scientific equipment. So, as a customs officer, how would you know that the plastic cylinder as big as a can of beans is worth \$20 000 instead of the \$200 on the customs form? You would only know if you had seen another company import the same thing, and this is where the collective lying comes in: everyone aims low on the values of the scientific equipment so the customs officers get used to seeing magnetometers valued at \$200. Survey companies also got together in self-defense against government regulations by forming an international airborne geophysical safety association. The companies reasoned that with the miserable safety record of geophysical survey, they had better come up with some common safety standards before a bunch of bureaucrats who were clueless about the business imposed their own solutions in the form of regulations that would shut down the industry.

Airborne Geophysical Survey is great work. It is one of the few jobs on small aircraft that allows pilots to make a good living while flying to varied and interesting locals. Sure, nearly all the pilots end up divorced, but at least you have a chance to see the world. I was going to stay. With all the per diems and field pay added to the regular salary, my pay was higher than I would see later on the jets. Not only that, a collection of interesting and intelligent people are attracted to geophysical survey and working with them is an educational and entertaining experience.

Fate intervened though, with the collapse of confidence in junior mining companies after the Bre-X gold mine scam. The fax machine at head office started to spew out a series of apologetic letters from mining companies, putting their surveys on hold pending further market capitalization. What choice did the little survey company have? The accountant came around the office handing out employment insurance application forms. The idea was to have everyone go on part time, sort of job-sharing, while collecting employment insurance for the rest of the week. Once I had the employment insurance application in my hand, I knew I had to make some other plans, so that led to my application to the university of Toronto and several other little airplane companies. To my complete surprise, people were interested in hiring me now. Without those circumstances, I might have surveyed my whole life. I highly recommend it; go do it!