A friend in need is a friend indeed - a Long-Ez landing on Shetland Islands.

This is the story of a security landing on the Shetland Islands and of how helpful people are when you meet problems and need help to fulfil your task.

Aircraft type: Long-Ez

Speed: 167 kt@100% with 115 hp Lycoming 0-235. Cruise 135 kt@55%.

Normal range: 1.215 nm. Record (closed circuit): 4.171 nm.

Height record: 30.489'.

Designed by Rutan in 1979. Rutan also designed e.g. Voyager (9 day flight around the world without refuelling), GlobalFlyer (67 hours flight around the world without refuelling (single pilot) and the SpaceShipOne the first privately manned spacecraft to exceed 100 km twice within a 14 day period, winning the Ansari X-Prize.

From Faroe Islands to Shetland

I started 12th of August 2007 on my return direct flight from Faroe Islands to Landskrona in Sweden (726 nm). Well dressed with warm triple-layer Faroese wool socks and an insulated survival suit (necessary in these waters if you ditch), and fully fuelled. The fuel man was surprised of the amount of fuel used on the flight from Stavanger - 74 litres. Only once he had refuelled a plane inbound from Stavanger with less fuel – it was my flight in 2006 using 73 litres.

It is not every day a Long-Ez departure is displayed on the departure screen in an international airport, but then the airport is neither Heathrow nor O'Hara.

I climbed to FL070; it was too cold to go much higher due to some ice risk and with no heat to the feet - no idea to be stuck in the cockpit for nearly 6 hours with cold feet and limited possibility for draining the internal tank.

After 1h 20min I made a recalculation and increased the power settings. 30 minutes later the oil temperature started slowly to increase - I came into a warmer area and out of cloud so nothing to be alarmed about.

During the next 10 minutes things seemed fine. Then suddenly 18 nm north of the Shetland Islands the oil temperature went above and pressure below the red limits. The throttle was immediately pulled back to nearly idle and the fuel mixture set to full rich to get maximum cooling. The temperature decreased and pressure rose to the mid part of the yellow arc.

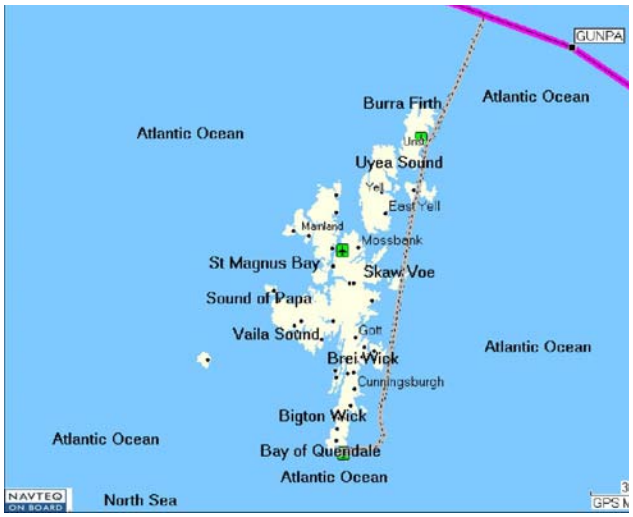
Icelandic control was called for permission to divert to Shetland, but was now out of reach. Stavanger was called on a previously received frequency and I was transferred to the Scottish control giving splendid support towards Sumburgh. The northern airstrips and airport in Shetland had bad weather conditions. Initially there were problems maintaining height and the low airspeed activated the automatic landing gear retraction system and therefore bypassed. A slight power increase was however possible and still having the oil temperature just below the red limit and the pressure in the mid yellow caution area achieving a rather stable but slow flight at 90 kt.

The flight controller asked initially if an emergency should be declared. As long at the parameters where stable I did not want to declare emergency. –.The Search & Rescue (SAR) people at Sumburgh received a pre-warning for a possible rescue operation. The question is when it is appropriate to declare

emergency and when it is best to inform “be prepared” – you don't want to be like the boy who cried “wolf”.

What was wrong with the engine? Had I forgotten to put the oil stick back after filling oil on in the Faroes and slowly had lost oil? – very embarrassing to explain to the people in the Faroes and ask if they could try to find my oil stick in the hangar. I realised however it was not that simple.

The ILS equipped runway 27 at Sumburgh was selected due to shorter distance and better flight guidance. The descent was deliberately well above the normal ILS glide path - you never know☺.



The oil pressure failure came at the right timing close to the Shetland shore.

Whole runway 27 used due to tailwind. A fire engine was on stand-by during landing – but no blue lights and sirens.

Shetland is a Non-Schengen country. I normally have my passport with me, but changed jacket when I left my home in Sweden 2 days earlier. I realised this on my way to the airport, but as all planned destinations where Nordic countries it was not a problem due to an old Nordic passport treaty. The immigration accepted the driving licence and pilot licence – and what harm could I do on the Shetlands.

The immigration contacted the SAR hangar enabling me to borrow tools. The SAR people gave however strict orders I couldn’t not do anything before I had got a “Nice cup of tea” – couldn’t get a better welcome – most likely they where happy not being forced to pick me up from the sea.

The cowling was removed – the outer inspection did not give anything. The engine was now cold and I tried to restart to see the behaviour at low oil temperature – the oil pressure came inside the green arc, but when the oil temperature came over 95°C the pressure slowly started to drop.

Specialists were contacted to help locate the failure. They expected the failure came from the oil pressure regulator - sometimes particles can accumulate the regulator seat causing oil to bypass, or the spring gets worn over the years.

The next morning the regulator was removed. No particles, but these could have moved on to the filter. The spring looked a little worn but there was not a new one for comparison - the ball had some roughness but only marginal. I cut up the filter to check for any particles – there were none; however some particles could have come out with the old oil when the sump was drained.

The oil pressure probe was checked – it would be perfect if it just was an indicator failure. The SAR instrument had just been sent to the mainland for calibration, but a check with the workshop air pressure system indicated the probe was fine.

As there were no spare parts in Shetland I had to plan my trip home.

Travel back home

When checking connections I discovered that the Atlantic Airways plane from Sumburgh would leave for London at 12:40 – the time was now 12:10 and only a runway between me and the terminal. A SAR mechanic drove me over to the terminal and I rushed to the counter, but there was a but. The girl at the counter was following rules and informed the check-in was closed. I tried to be polite - I didn’t want to make too much fuss. Through the big glass wall I could see all the happy passengers in the departure hall and knew the plane was not full. At 12:40 the passengers were still in the departure hall – also at 12:45, 48, 49 **and 50**. Now there was a real problem with my blood pressure. I called my brother in the Faroes to get the contact details to the Atlantic Airways maintenance people – very nice people always

willing to give hangar space. They contacted the captain and I was asked to rush to the security and come onboard. At 13:10 I was in my seat and a minute later we rolled out heading towards London.

When we had come into a comfortable climb I had a chat with the crew on the flight deck to thank them for their help – as the captain said “we must help each other☺”.

The next problem was London – how do you purchase a ticket and check in without a passport? Some explanation and I was bound for Copenhagen.

UK is outside Schengen and therefore strict passport controls at Copenhagen Airport. I showed the immigration officer my Faeroese driving licence as ID and said “Sorry I do not have a passport”. His remark was typically frank Danish “How in hell have you managed with that?” Then I explained and got through - finally in familiar surroundings.

The following week I visited the Lycoming maintenance centre and we could see there was a compression and side wear of the oil regulator spring giving a softer spring – the ball wear was marginal. They were quite convinced that the fault was the weakened spring - it was concluded that the higher power setting triggered the reduced oil pressure together with higher temperature, but of course there could also be other more internal faults. The plane had on oil cooler and had always run in the upper part of the green arc.

The new spring and ball and a new filter were sent with FedEx to Shetland and installed by the SAR mechanics who also made initial engine test showing sufficient oil pressure.

Back to Shetland

Sunday 2nd of September I went back to Shetland to fly home. Unfortunately when I made thorough ground tests, the oil pressure slowly started to decrease from 95°C and coming down to yellow arc at about 100°C. I added maximum allowable washers for adjusting pressures, but this gave only a small improvement. I could have asked the SAR mechanics to make this test, but I didn’t want to use too much of my “credit”. Nevertheless the engine could not be used for crossing the North Sea☹.

Shetland is remote and I should decide if I should take off the engine or the wings to transport the entire plane to Sweden. It is not cheap to send container from Shetland to Sweden – removing the engine and getting it home for repair is also a job. After carefully looking at pro-et-contras I removed and packed the engine the following day.

Now I should plan the 2nd return trip home (had been working nearly non-stop from early morning only with several “nice cups of tea” and some good chocolate). As always the internet is a great help and I found a good price and pressed accept – the screen just showed “time-out” – new try and the price increased with 2.000 DKK – couldn’t be true – I did a rebooking and now there was no space until 2 days later from Shetland – in some frustration I walked over to the hotel.

The hotel keeper was as always helpful - he first introduced me to a Loganair captain and the captain contacted operations – it appeared to be 3 seats left the following morning. As the hotel keeper also supplies the meals for Loganair at Sumburgh he double checked with the kitchen staff – he confirmed - 3 seats left. I should just join the captain in the morning.

Before I left Shetland I arranged with the Atlantic Airways to get the engine to Denmark. On the following Thursday the SAR mechanic should drive the engine across the runway to the baggage area, but due to extreme fog he did not get permission from the flight control – not unusual Shetland summer weather (many years ago my elder brother and I ended up in Shetland in a Cessna 172 bound for Faroes. We stayed 2 days at my uncle’s home in Lerwick, where we couldn’t see the end of their garden).

Friday the engine came across and I could from my desk in Copenhagen follow the process via the Sumburgh Airport Web-Cam. In the forenoon I had a grey screen - fog, but at noon I started seeing the terminal faintly, and suddenly the Atlantic plane arrived and I carefully followed the loading process via “remote” monitoring – big brother watching you.

The engine was shipped to Faroes via London and finally ended up at Copenhagen Airport where I picked it up 12th of September. The engine was transported as “Company Mail” – that is charity.

Engine repair

Aircraft maintenance is not the cheapest activity, however I got a good arrangement with the Danish repair station where I striped the engine and made a lot of the work myself – this reduced cost and gave a good chance to work together with a well qualified engine engineer doing a decent job for a fair price.

Following observations were made:

- Main bearings just within limits
- Crankshaft just within limit
- 3 cylinders had fine compression - one had 60/80 PSI.
- Non-original accessory housing. There should have been an orifice plate restricting the oil flow to the camshaft resulting in increased oil pressure.
- One camshaft tappet had not rotated and one had corrosion marks.
- 3 exhaust valves showed suspicious removal of material.
- The temperature probe was not reliable - the resistance changed when the wires were pressed against the probe (possible explanation of a sudden temperature jump from 119°C to 135°C and back again to 119°C (heat and vibration changed the electrical resistance).

The combination of crankshaft bearing wear with weak oil regulator spring was not the cause, but did not improve the situation – it was the missing orifice plate/non-original accessory housing that gave the low oil pressure. The fault trigger was probably the increased power setting 40 min before and leaning the fuel mixture in giving more heat and oil flow. There must have been some contaminates restricting partly the oil channel to the camshaft compensating for the missing orifice plate.

The plane was not used from 2002 to 2004. The previous owner had not preserved the engine during this period but ran the engine on a fortnightly basis. A quite long run is necessary to remove all moister in the oil and to prevent contaminates – if this is omitted more harm can be done.

To improve engine health the simple oil screen was removed in 2004 and a real oil filter installed. There was no pressure drop when the oil filter adaptor was installed, indicating there must have been something restricting the flow and keeping the oil pressure on the normal level. The oil pressure started to drop at a lower temperature after the accident (95°C vs. 118°C) indicating a permanent increased flow through the oil channel to the camshaft was created. A possible gasket restriction could also be a cause, but this was not observed during dismantle. The supplier of the oil filter adaptor informed that without the orifice plate the pressure could be as low as 15-20 PSI when the oil temperature is around (65°C) – my pressure was higher and at much higher temperature.

Disasters seldom occur by one single thing, but a chain of several minor malfunctions. An engine will often run “quite” happily with some parameters outside specification, but with several the engines will fight for survival. The engine was reassembled with new parts and having all parameters nicely within specification.

Engine installation.

The engine was reassembled late October. It was a challenge getting the engine back to Shetland. Atlantic Airways only flew during the summer period and none of the traditional transporters could offer flight transport to Shetland - using sea transport would take 1-2 week extra. This was not good as weather started to be bad for the region. British Airways who have the route to Shetland has a general rule not to take air cargo as they use small planes operated by Loganair. My Loganair captain friend came to my aid - as a result of this I made a special transport box distributing the engine weight over the entire box area and thus fulfilling the load restriction for the Saab 340 plane, and with special handles to fulfil the British Health and Safety at Work Act as there was no mechanical unloading equipment at Sumburgh.

The engine was then sent with KLM to Glasgow via Amsterdam. The Loganair handling people picked up the engine at KLM and ensured the engine came on the flight to Shetland as Loganair “company cargo” but paying standard pricing to British Airways. The fire people at Sumburgh ensured that the engine was finally delivered to the hangar.

Early Sunday morning 4th of November I was bound for Shetland via London Heathrow, London Gatwick, Aberdeen and Orkney. On arrival at Heathrow I received an SMS from my Loganair captain asking my travelling route – it turned out I should fly with him from Aberdeen. We had a nice flight with a short transit stop on Orkney and I got a nice chat with my friend and his Danish co-pilot. Loganair has many pilots from Sweden and Denmark and the flight conditions to Shetland give some good experience in bad weather flying. The weather for Shetlanders was fine, but maybe not for people on the continent.

The engine arrived well Sunday evening 4th of November .

All Monday was used to install the engine and Tuesday forenoon I had problems with the new oil temperature probe – there was no reaction. Software set-up was checked and all connections were fine. I had no resistor to use as a fake probe, but rolling out many meters of safety wire out on the hangar floor I created a resistor equal to normal oil temperature – the system showed now the "correct" temperature. Now it was just to connect the probe again and with a heat gun get the temperature up – that helped. The system didn't like the 6°C hangar temperature, but started first reacting around 15°C – like reptiles. As the engine had new pistons and rings and the cylinders had been honed full break-in procedures should be performed with several ground runs following a specific procedure to get the correct surface on the cylinder walls. Neglecting this could give high oil consumption in the future and the only repair would be a new honing of the cylinders. After each run the engine shall cool down to room temperature.

Ground test at Sumburgh - (Photo: Kieran Murray)

When I started on this article I expected a lot of text and no pictures as I hadn't taken anything apart from the picture above from the Sumburgh hangar. The rest I found on the internet and got from Shetland Times having a small article about my plane and indicating the special design is like a future airplane and it was the same aircraft type singer/songwriter John Denver was killed in – John Denver's plane had however a non-authorised fuel system causing a fatal error.

Tuesday evening the first ground test could be performed. Wednesday two additional ground runs. Due to a coming storm on Thursday the fire men offered to come with their fire engines to give shelter getting the plane over to the opposite hangar in lee of the North-westerly storm to continue the ground tests – a really kind offer. However, when I arrived in the morning the storm was really bad with a strong 86 kt wind. Too risky to take the plane out even with shelter from the fire engines – you never know what kind of UFO´s are flying in a real storm. Instead I hired a car and drove up to Leirwick and visited my uncle's grave.

The forecast said still windy Friday and Saturday windy and snow – not good. If Murphy's Law was not involved in my coming activities there was a chance to get away from Shetland on Friday – the only missing things were an additional ground run, test flight and inspection.

Flight test.

Taxing out for the flight test. (Photo: Kieran Murray – from Shetland Times)

The GPS plot of the test flight shows indeed a very local flight being in gliding distance from the airport. You never know what can happen on a test flight☺ – better to be prepared.

Early Friday I started the final ground run in the early light of the upcoming sun. All was fine and cowlings were mounted.

At noon I made the flight test. The engine got quite hot, but as the engine was tight and the baffling not fully sealed as previously it was accepted.

I had originally planned to fly straight over to Stavanger and check oil etc. but due to delay in getting the engine finished it was now in the beginning of November with icing conditions and other bad weather - therefore a route further south was selected.

The whether did not look very promising this Friday afternoon, but the MET office said the weather was better just 10 min flight south of Shetland - it turned out that I needed to be quite low the whole way south.

There was still a quite strong 34 kt wind from 330° - luckily directly along the runway. Just as I lined up heavy hail started. I stood on the brakes but the plane started to roar along the runway – what was wrong with the brakes? – I couldn't take this after all I had gone through – you come to the verge of tears – hmmm - just temporarily – the wind sock was vertical, but the mast did not move – a ugly optical illusion of the hail rushing along the runway. The hail got lighter however after some minutes and I took off.

Getting home.

As the engine was now in principle "new" I had to plan the flight carefully as the engine should run on high power settings and follow a special procedure. The tight engine and "un-tight" baffling resulted in a hot engine and therefore necessary to continue change the power setting between low and high giving pressure on the piston rings and still sufficient cooling. Combined with miserable whether and darkness I landed in Aberdeen and not Teeside as first planned.

At Aberdeen Dyce there was no hangar for general aviation, but what happens when you arrive in a Long-Ez? The marshal car directed me over to the apron just beside the ambulance plane hangar and one of the crew is a Long-Ez owner. They offered hangar space for the night (both my plane and I got a good night's sleep (I however was some hours out drinking juice at a local pub together with my cousin who lives in Inverness).

At Aberdeen – Dyce. Photo: Paul Chalmers

Saturday morning I re-fuelled and was bound for Esbjerg, Denmark. When closing towards Denmark, Copenhagen Control informed of high crosswind at Esbjerg and I diverted towards Århus, but after 40 minutes the wind dropped quicker than expected and I changed course again towards Esbjerg. When I parked at the apron the female controller burst out "nice plane" – touching.

I checked the oil - the consumption had only been 0,3 litre. Taking the short time since the overhaul into consideration, it was very good.

After an hour I started off to my home base Landskrona in Sweden. 5 minutes after take-off I heard again in the headset the pleasant South African dialect saying the horrible words "OIL PRESSURE - LOW" coming from the MGL Avionic EFIS glass cockpit and the alarm sign flashed. This couldn't be true – I knew the engine – I had had each part in my hands and carefully cleaned them and the mounting work had been done fully according to specifications. After a total dismantle there will however always be a risk of some particles from the sealing of the two engine halves and other sections giving possible dirt at

the oil pressure regulator valve during the first hours – a quick RPM decrease and increase did the job, lifted the ball – normal oil pressure again☺ - it is good to have detailed knowledge of your engine.

The weather was quite miserable approaching Landskrona; but I got a warm welcome. It was a real pleasure getting the plane back into the hangar where it belongs.

Epilogue

It is rarely that my Long-Ez flights do not follow the schedule, but this time it didn't. However, I realised how wonderful it is to meet people who offer you help without expecting anything in return – only the pleasure of helping another person. The trip was costly; but it gave an experience I wouldn't be without.

The problem could be solved quicker and cheaper; but as with all real problems it is often a combination of many minor things going wrong and you first see the problem after taking several circuits around it – experience is first obtained just after you needed it.

It is however annoying not to have a 100% fault conclusion and sitting with a broken part in your hands.

The plane is now getting double oil coolers, one in the back for normal cooling and one in the front as heat exchanger. In the future I want better margins on the oil temperature. Furthermore the engine air inlet is being changed, thus securing more equal cooling to all cylinders and also adding RAM air to the carburettor increasing slightly the power.

And the insurance – no help when it is an engine failure and the plane landed safely on an ordinary airfield. They would have paid out if I had ditched; but then I might not have been here to tell the tale☺