BAE Systems Regional Aircraft's Flight Safety magazine for its Jet and Turboprop fleets customers • March 2014

JETSETS

To land or not to land?
Turn to page 4 for full details

Unreliable Pressure Instrument Indications
Turn to page 9

Go-around decision making and...

...conducting a safe go-around

At our 2013 Regional Aircraft Operators' Conference delegates were asked to submit subjects for inclusion in the next edition of JETSETS, and go-around was one subject that they suggested. In the last issue we discussed rejected landings, and the need to decide on when you are 'committed to stop' so this article will discuss the decision to go.

The European Regions Airline Association hosted a go-around Safety Forum in June 2013, and many of its findings and conclusions have been incorporated into this article. Many more discussions and conclusions from the Forum can be found in Skybrary: http://www.skybrary.aero/index.php/Main_Page and search for go-around.

As most of you will now be following the 'stabilised approach' philosophy, some go-arounds must be expected when the required criteria have not been achieved. However, one of the conclusions from the Safety Forum was that few unstabilised approaches resulted in a go-around decision thus leading to the suspicion that there are still unstabilised approaches culminating in a landing being conducted. With the advent of more recorded supervision of all parameters I suspect that flight crews will tighten up their adherence to limitations and so reduce the need for go-arounds.

A go-around should be considered a normal operational manoeuvre, and pilots should be encouraged to go-around when conditions warrant. However, there will still be safety issues associated with going around since some go-arounds will induce a potentially hazardous outcome such as exceeding airframe/engine limitations or precipitating an emergency due to fuel shortage. These hazards are exacerbated by the fact that performing a go-around is a relatively rare manoeuvre for most pilots: short haul pilots can expect to conduct a go-around once or twice a year whereas a long haul pilot can expect one every 2 to 3 years. In

BAE SYSTEMS
INSPIRED WORK

Welcome>

JEt and **T**urboprop **S**upport, **E**ngineering,**T**raining and **S**afety.

I have not put pen to paper to produce JETSETS for a long time, and this edition is planned to be out just before our next Operators' Conference in March 2014. As it has been so long since I last wrote I think it would be a good idea to introduce myself to those of you who have recently started to operate our types. I spent my early career in the RAF flying fighters and completed my service as a test pilot. I then worked for British Aerospace (as the company was then known) as a test pilot on their commercial aircraft types, and finally joined an airline flying turboprops around the UK. Becoming too old for passenger flying I returned to BAE Systems Regional Aircraft as Product Integrity Pilot, where I now cover all the types still flying that were manufactured by the company. Although semi-retired I still instruct on single engine piston aircraft here at Prestwick when the weather allows!

Since I last wrote we have seen a change in 146/RJ operations as some of the larger fleets have been dispersed round the world. This movement of aircraft has given us many challenges, among them airlines who need to operate from less well prepared airfields and to operate from airfields well above 10,000 feet. We have also seen some of the jets being modified to become fire fighting water bombers, and military transports. On the other hand the turboprop fleet has been more static, although we have seen some movement in the Jetstream 41 fleet, and some of the Jetstream 31/32 fleet is also on the move. Our 748 fleet is now very small numbering around 20 aircraft left flying today.

It is always difficult to think up themes for JETSETS, but this time I have decided to use the UK CAA's 2011/13 Safety Plan in which they have listed their **Significant Seven Safety Issues**. These issues were identified following analysis of global fatal accidents and high risk occurrences involving large UK commercial air transport aircraft. The Significant Seven are listed below, and the document can be downloaded at: www.caa.co.uk

1. **Loss of Control**
2. **Runway Excursion**
3. **CFIT**
4. **Runway Incursion**
5. **Airborne Conflict**
6. **Ground Handling**
7. **Fire**

I will cover some of these issues in this edition of JETSETS, and will also discuss items that were suggested at our last Operators' conference in March 2013. I hope that the subjects chosen will interest you and might even give rise to some debate. I fear that in these hectic days the time to discuss items of interest is difficult to find whereas, in the past, safety concerns could be talked about in crewrooms when crews were resting (little chance of that nowadays!)

I've always believed that it is important to learn from others as you will never cover all the angles yourself.

Sadly, during the past three years we've seen some potential (i.e. not all have been classified yet) hull loss accidents with one 146 – an overrun, one ATP – a runway excursion which resulted in nosewheel collapse, two 748s – one caught fire whilst being unloaded, the second was damaged during a runway overrun in Africa, and potentially three J31/32s, two main gear problems and a runway excursion.

Since I last wrote we have updated the ATP Manuals and the Jetstream 31/32 Manuals. If you operate the J31 or 32 you may have noted that we've greatly reduced the number of different Crew Manuals (J31) and Manufacturers Operating Manuals (J32) that we used to publish, from over 50 to now fewer than 20. The 146/RJ amendment should be out early 2014 as should the Jetstream 41 and 748 updates. When we publish an amendment for any of the Manuals we also publish a full update of the changes. These update lists can be seen on iSapphire by whoever updates the publications in your airline. Our intention is to carry out reviews of the Manuals at regular intervals and so if you have any comments please address them to our Technical Publications Business Support Team at: rapublications@baesystems.com

From time to time Regional Aircraft gets information that must be transmitted to you. We either issue a Flight Operations Information Leaflet (FOSIL) direct to the airline, or an FCOM Bulletin for the 146/RJ or NTA for the turbo props is put on iSapphire. iSapphire information is open to all who can access the Regional Aircraft Portal. In 2012 we issued 21 FOSILs and in 2013 we issued 9 FOSILs, and I hope that you have all seen the ones relevant to your aircraft. FOSILs are issued sequentially, therefore 001 may be for an ATP, 002 may be for a 146, 003 Jetstream 41 and so on. At the end of each year we issue a FOSIL showing all FOSILs issued in that year. We send FOSILs to your management team for distribution as they see fit, and we also send them to all the Airlines that operate our types that we are aware of not just those with access to the Customer Portal. Information may be advice issued to all types to introduce drills following a complete engine failure at low level to cover a similar situation to the Hudson

Above: BAe 146 Airtanker drop (photo courtesy of Neptune Aviation Services)

Contact Details:
Flight Operations Support Department, BAE Systems Regional Aircraft,
Prestwick International Airport, Ayrshire, Scotland, KA9 2RW.
Tel: +44 (0)1292 675225, Fax: +44 (0)1292 675432,
E-mail: rafltops@baesystems.com
JETSETS is also available on our web site www.regional-services.com.

River Airbus accident, or may be a fuel low level drill rearrangement for the 146/RJ. Advice is also sent to Airlines via our Customer Support team, and one of their recent leaflets reiterated our advice to not cycle or reset circuit breakers unless this action is called up in a drill in the QRH.

One of the ways in which we can monitor what is happening to the various fleets is by researching the Air Safety Reports that we receive from you. These give us an understanding of the problems that you face, but we can only look at information received. Some Operators are very good at sending us ASRs, whilst others are less punctilious. So a plea to all of you: please let us have ASRs so that we can help resolve the difficulties that face you in normal operation. We also look at Occurrences that are reported to the National Authorities when we can access the data bases.

As always any comments or suggestions would be most welcomed, please send to: www.rafltops@baesystems.com and I hope to meet some of you at the Conference in March.

Colin Wilcock
Product Integrity Pilot

Go-around decision making and conducting a safe go-around

FROM PAGE 01

addition, the height at which the go-around is initiated presents different challenges and risks, and procedures and training should be developed to address these.

The Safety Forum formulated eight improvement strategies which are as follows:

Strategies to ensure go-around decision making:

1. Enhance Crew Dynamic Situational Awareness.
2. Refine the policy by refining the stable approach go-around and height parameters.
3. Minimise the subjectivity of decision making.

Strategies to ensure safe go-around execution:

4. Training and awareness to reflect the different risk scenarios.
5. Review policy, procedures and documentation to maximise effectiveness, clarity and understanding.
6. Do not allow low experience of crew to prejudice the effectiveness of cross monitoring.

Communication strategies:

7. Ensure industry leaders understand the safety issues.
8. Ensure operational stakeholders understand the go-around issue.

Strategies to ensure go-around decision making:

Pilots should be 'go-around' minded rather than 'land' minded, as is the case of being 'go' minded after V1 during a take-off, bearing in mind that a go-around can be performed from any altitude - not just decision height. Prior to the approach the briefing should cover instability threat factors. When briefing the approach and landing it would be useful sometimes also to brief the actions to be carried out by both crew members in the event of a go-around. During the approach critical stability factors should be confirmed, and any departure announced and monitored. Active communications procedures should be objective, progressive and sequential as in a TCAS system; in other words bring attention to the lapse, warn of action and, if nothing happens, ensure the action is carried out. The airline's policy for establishing stable approach criteria, and the go-around policy must be unequivocal and clear to all. Pilots must be aware of any special handling considerations such as pitch up when power is applied, and they should practice both auto pilot and manually flown go-arounds.

Strategies to ensure safe go-around execution:

Make pilots aware of the risks such as ineffective go-around initiation and failure to maintain control of the aircraft. When carrying out a go-around don't delay the decision, be positive and perform the complete evolution - in other words set go-around power for your type and clean up the aircraft. Be careful if your aircraft tends to pitch up when thrust is applied at low mass (mainly aircraft with low slung engines). Make sure you fly the required profile in both elevation and track to avoid CFIT. Be aware of the different circumstances depending on the height at which the go-around has been initiated. For example, a very late go-around or baulked landing from the runway might get you far closer to the obstacles than if the go-around had been commenced at decision height. Low experience of one pilot can lead to difficulty in performing and monitoring a go-around, so this must be recognised and mitigated. Don't let the 'startle effect' influence the conduct of the go-around.

Communication strategies:

Crews must be made aware of the stabilised criteria via Ops Manuals. By the same token management must ensure that there is a 'no blame, just culture' in existence, and that this is communicated to the crews. Clear guidance should be offered on the cross monitoring stages of noticing, alerting and taking control so that both crew members understand the roles.

I hope that this short article will enable you to initiate discussion among your crews, and that this will lead to safer go-arounds when they become necessary. The Go-Around Safety Forum concluded that the lack of a go-around decision is a leading factor in approach and landing accidents, and is the primary cause of runway excursions during landing. A correct decision would have a great influence on reducing the overall aviation accident rate so go-around training would seem to be a good addition to re-current training.

Above Max Landing Weight

To land or not to land? That is the question

On 2 September 1998 a McDonnell Douglas MD-11 aircraft departed New York, en- route to Geneva, Switzerland. On board were 215 passengers and 14 crew members. Approximately 53 minutes after take-off, as the aircraft was cruising at Flight Level 330, the pilots noticed an unusual smell in the cockpit. They determined that the odour was smoke from the air conditioning system.

They briefly discussed returning to New York, but decided to divert to the closest and most suitable airport, and were cleared to Halifax International Airport. Within about three and a half minutes the flight crew noted visible smoke and declared "Pan Pan Pan Pan" to Moncton Area Control Centre, advising ATC of smoke in the cockpit. The flight was cleared to proceed direct to Halifax International Airport from its position 58 nautical miles southwest of Halifax. Passing 21,000 feet more time was requested in order to descend the plane from its altitude, and at 01:20 UTC ATC were informed that the crew needed to dump fuel. ATC Halifax subsequently diverted the flight toward St. Margaret's Bay, where they could more safely dump fuel but still be only around 30 nautical miles from Halifax.

While the aircraft was manoeuvring, the crew advised ATC that they had to land immediately and that they were declaring an emergency. At approximately 01:31 UTC, the aircraft struck the water near Peggy's Cove, Nova Scotia, fatally injuring all 229 occupants. Both the Flight Data Recorder (FDR) and the Cockpit Voice Recorder (CVR) stopped recording whilst the aircraft was at approximately 10,000 feet, about six minutes before the aircraft struck the water.

Above: McDonnell Douglas MD-11

I seem to recall that this accident caused much speculation on whether it would be better to land above maximum all up landing mass or to burn off fuel. However, the Transportation Safety Board concluded that, even if the pilots had foreseen the disastrous consequences of the fire, they would not have been able to land safely in Halifax because the fire progressed so rapidly. Therefore this article has been written to facilitate discussions, and to assist crews in deciding whether to land overweight, or not.

Aircraft are usually designed and certified to be able to withstand a landing at MLW with a rate of descent (RoD) of 10 ft/sec, and with a RoD of 6 ft/sec at MTOW – please note that these figures are not targets to aim for, but limits to be adhered to. However, a gentle overweight landing is unlikely to damage the aircraft. A look at your aircraft's Aircraft Maintenance Manual (AMM) will give you the figures for your particular aircraft. If the landing has been at higher RoDs the AMM will demand that an inspection is carried out. Additionally, any landing over MLW will also require maintenance action, so both a heavy landing and a landing above MLW will incur a maintenance penalty regardless. The inspection will be carried out in four phases. Initially a general check of the aircraft will be made for obvious damage and leaks, after this the aircraft structure critical areas will be inspected for any damage. If anything is found then a more detailed inspection of the damaged area is conducted, and if any damage is found it might be necessary to remove components for a more detailed inspection and tests. Thus a problem arising shortly after take-off might face the crew with deciding whether to remain airborne

and burn off to MLW or to land immediately, but over weight, as none of our types offer the facility to jettison fuel. There are several considerations before such a decision can be made. The most important, and overriding issue, is safety. If there is any doubt about the continuing airworthiness of the aircraft an immediate landing must be made – it will be far easier to carry out an overweight landing check than to reassemble the wreckage. **Therefore the need for an inspection should not be a concern if the safety of the aircraft is in doubt**.

However, there are also other considerations:

At high weight the aircraft's performance margins will be reduced so in the event of an engine failure or critical system failure it may be safer to reduce weight to ensure adequate go-around performance or adequate runway length margins. However, delaying the landing may expose the aircraft to further system deterioration - only the crew are in a position to judge the best course of action. Whatever the decision care must be taken not to exceed any placarded limitation for the flaps or landing gear if manoeuvring at high weight, the crew must also respect the resulting higher stalling speed. The runway distance requirements will need to be assured, and the go around ability should be confirmed. Normally brake energy should not be a consideration as the brakes are designed to be able to stop the aircraft following an RTO at MTOW. However, whilst this would be true at normal flap settings the same cannot be said for non-normal flap settings. For those lucky enough to have auto land, this should not be used for an overweight landing.

In this short article I have covered some of the considerations that will face you following a malfunction just after take-off, and hopefully will have provided some food for thought. Remember you can land at MTOW provided you land gently.

‘IT WILL BE FAR EASIER TO CARRY OUT AN OVERWEIGHT LANDING CHECK THAN TO REASSEMBLE THE WRECKAGE’

Honeywell Aerospace advice to Operators of Jetstream 31, 32 and 41 aircraft

BAE Systems issued advice to Jetstream 31, 32 and 41 Operators following the issue by Honeywell Aerospace of an Operating Information Letter (OIL), and the engine shutdown changes recommended in this OIL have been incorporated in the CM/MOM Abnormal and Emergency Checklist. A Pilot Advisory Letter (PAL) has also been issued, and this information has been distributed in FOSIL 008/13 dated September 13th 2013.

The OIL (01331-26 dated March 2nd 2012) covers changed engine shutdown actions to guard against incorrect shutdown actions in the event of a gearbox uncoupling. If an uncoupling occurs the Power Lever must remain where it is until the engine is shutdown and the propeller stopped. The Power Lever can then be retarded. The J31/32 and the J41 checklists have been amended to reflect this OIL.

The PAL (PA331-09 dated July 2013) covers unintended operation with engine speed controls (RPM/Condition Levers) in any position other than the full forward position during take-off or landing. The BAE Systems Regional Aircraft checklists cover this PAL procedurally by calling for the RPM/Condition Levers to be fully forward prior to take-off and landing, and the first QRH action in the event of experiencing engine torque/EGT oscillations is to ensure that these levers are fully forward.

Jetstream 41 Systems Reversionary Switches

We recently received a report that indicated a crew had difficulty in selecting the AHRS reversionary switch to BOTH 2. Usually each EFIS is powered by its on side system. However, in the event of a failure of an AHRS, SG or DADC, both EFISs can be powered from one system. This is achieved by turning the appropriate reversionary switch, located on the right coaming panel, to BOTH, 1 or 2 as required. These switches require to be pushed in before they can be rotated to the desired position as indicated on the panel below the switches.

Above: typical J41 flight deck with the Reversionary Switch Panel highlighted.

Post Maintenance Check Flights

With the advent of EASA there has been a formalising of the terms Test Flight and Check Flight. None of our Operators are likely to conduct Test Flights as these flights now require a qualified test pilot to be in charge of the flight. However, Check Flights might be flown if required by a National Authority to confirm airworthiness, as required by the maintenance manual, or if the Operator wants to confirm serviceability post maintenance.

Each BAE Systems Aircraft Maintenance Manual specifies whether a post maintenance Check Flight is needed or not. Although the 146 and RJ do not require any Check Flight and some of the turbo props do, BAE Systems do not recommend any uncalled for Check Flights. However, as a result of requests from a number of operators, Regional Aircraft agreed to host a Check Flight Workshop at Prestwick in October 2011. As a result of that Workshop and feedback from a subsequent scoping document, Regional Aircraft agreed to publish some guidance on how to carry out check flights on Regional Aircraft manufactured aircraft. This article provides general advice and the individual Flight Operations Information Leaflets (FOSILs), which were issued in 2012 to address type specific conditions, can be sourced from: www.rafltops@baesystems.com

If Operators require, there are providers who offer training to pilots to enable them to carry out these Check Flights, and the Empire Test Pilots' School www.etps.qinetiq.com gave a presentation at our workshop. Usually an Operator will specially select crews for Check Flights, and prior to carrying out aircraft check flights we recommend that these pilots be fully familiar with the contents and philosophy in the **UK CAA Check Flight Handbook** (CFH) **CAP 1038** which is available on the UK CAA web site www.caa.co.uk. This document offers good advice on the selection and training of crews as well as on performing the various tests. The appropriate **Check Flight Schedule** (CFS) is also available from the same source. These documents used to be downloadable, but now must be requested. In the preparation of our guidance material, familiarity and compliance with the CFH has been assumed.

Note the statement in the CFS Introduction: the minimum flight crew shall be increased by one observer to record the results of the tests. BAE Systems would consider that this is a mandatory requirement to enable the flight crew to fly the tests and to look out of the aircraft, whilst the observer writes. It would be beneficial if the observer was also trained. The guidance we offer in the appropriate FOSIL is aimed at helping you carry out the appropriate CFS. Responsibility for training crew, establishing safety systems and a Quality Management System remains with the Operator.

Proximity of suitable airfields and fuel requirements should be considered prior to testing with gear and or flaps extended in the event that they do not fully retract on completion of testing, it is also important to establish the exact weight of the aircraft, especially if stalls and climbs are to be carried out.

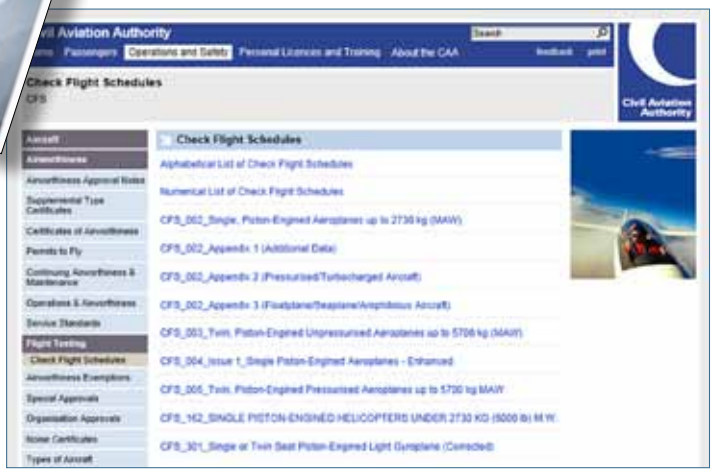
BAe 146/Avro RJ

If stalling is to be carried out you should have the appropriate Appendix in your Aircraft Flight Manual. This calls for the use of a stall panel which can be supplied by BAE Systems through: www.rafltops@baesytems.com.

List of FOSILs outlining the BAE Systems Check Flight policy and advice:

J31	007/12
J32	008/12
J41	009/12
748	012/12
ATP	010/12
BAe 146	004/12
Avro RJ	005/12

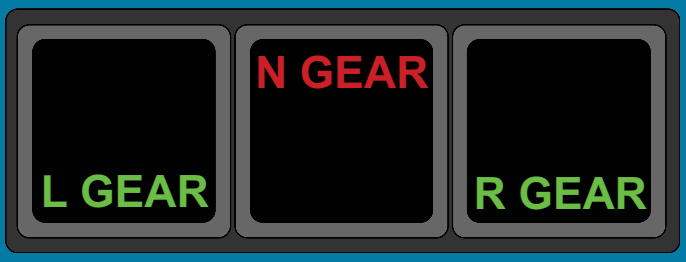
Left: the CAA Check Flight Handbook and below, their Check Flight Schedule web page.



Above: the Empire Test Pilots' school offers Check Flight training.

Landing Gear Faults on Initial Retraction

Over the last few years Regional Aircraft have been trying to stop crews recycling the landing gear when a red remains after retraction in an attempt to get rid of the UP selection red, or when one or more legs show red on a DOWN selection. Some years back recycling among operators of our aircraft was quite common, and so we started to include an instruction not to recycle in the gear not locked up/down drills in the QRHs. We still see the occasional attempt to get rid of a red by recycling, and this has been almost always unsuccessful.



A red after DOWN selection may be a micro switch which might make on reselection, but it could be caused by damaged jacks or legs, and recycling could exacerbate the situation.

Most red lights after retraction are the result of a misaligned or contaminated micro switch, but sometimes there is evidence that one of the legs has not moved such as yaw and noise. If consulted, the Abnormal and Emergency Checklist for the 146/RJ and ATP will instruct you to reselect the landing gear down (the Jetstreams will be amended at the next opportunity. In the meantime FOSIL 003/14 will be issued to remind crews not to recycle the landing gear). The reason that we have included this instruction is to guard against any further fault occurring if the gear is recycled. From the cockpit it is not possible to ascertain why the gear has not locked up, and so if 3 greens are obtained on the subsequent down selection they should remain down. We have had a recent report where the gear was recycled and on the lowering it was very slow to lock down. Failing to obtain 3 greens on the second selection would not be a good thing.

FOLLOWING A LANDING GEAR RED DO NOT CYCLE THE LANDING GEAR

Jetstream 31 and 32 Correct Operation of the FEATHER LEVER

A reminder to our Jetstream 31 and 32 Operators: when carrying out the FLIGHT DECK PREPARATION Checks on the FEATHER LEVER the lever must be pulled fully up and allowed to rotate 90° anti-clockwise to engage the detent.

The lever must remain in this position without resetting. Pulling the Lever out, checking that the HYD and LP COCKS show OPEN, and just letting the Lever go back in can cause wear in the detent. This wear can ultimately result in the Lever not remaining in the COCK OPEN position and the COCKS could close allowing fuel and hydraulic fluid to get to the engine.

This information was advised to Operators on 12th May 2013 as Notice to Aircrew 007, and the Crew Manual/Manufacturers Operating Manual have been updated to include this information.

Inertial Reference System Alignment

Recently we have had reports from some of our Operators of poor navigation accuracy from the IRS fitted to the Avro RJ. Whilst Honeywell are looking into whether there is a problem I thought it worth reiterating some of the advice we give in the FCOM. The IRS is covered in Volume 1 Chapter 19, and in Volume 3 Part 1 Chapter 9. We also issued FOSIL RJ 005-13 in March 2013 to advise crews to monitor IRS drift.

Prior to use, the IRS needs to be aligned and if starting from cold it is important to follow the correct switching:

- **Select both IRS mode selectors to ALN.**
- **Power up both the GNSs and initialise.**
- **Put both IRS mode selectors to NAV.**

If already up and running a Down-mode Alignment is made. Going to ALN and returning to NAV only corrects attitude, heading and velocities – the IRS position is not corrected. To correct position, the new position must be entered via the GNS, and it is recommended that a Down-mode Alignment should always be made with a position update. To achieve this make the following selections:

- **Select both IRS mode selectors to ALN.**
- **Enter the correct position on navigation page 4 of a GNS.**
- **Put both IRS mode selectors to NAV.**

If on selecting NAV the NAV OFF annunciator flashes the position has not been accepted. Go back to ALN and insert the correct position otherwise just selecting OFF then back to align will cause the IRS to assume that the position at the OFF selection, the Power Off Waypoint, is correct. Therefore when selected to NAV the position will still be wrong but the IRS will assume the position is correct, and give no error indications.

Between flights it can be advantageous to switch the GNSs off to avoid problems with the VPUs. Thus initialising the GNSs and carrying out a Down-mode alignment. Again the sequence is important:

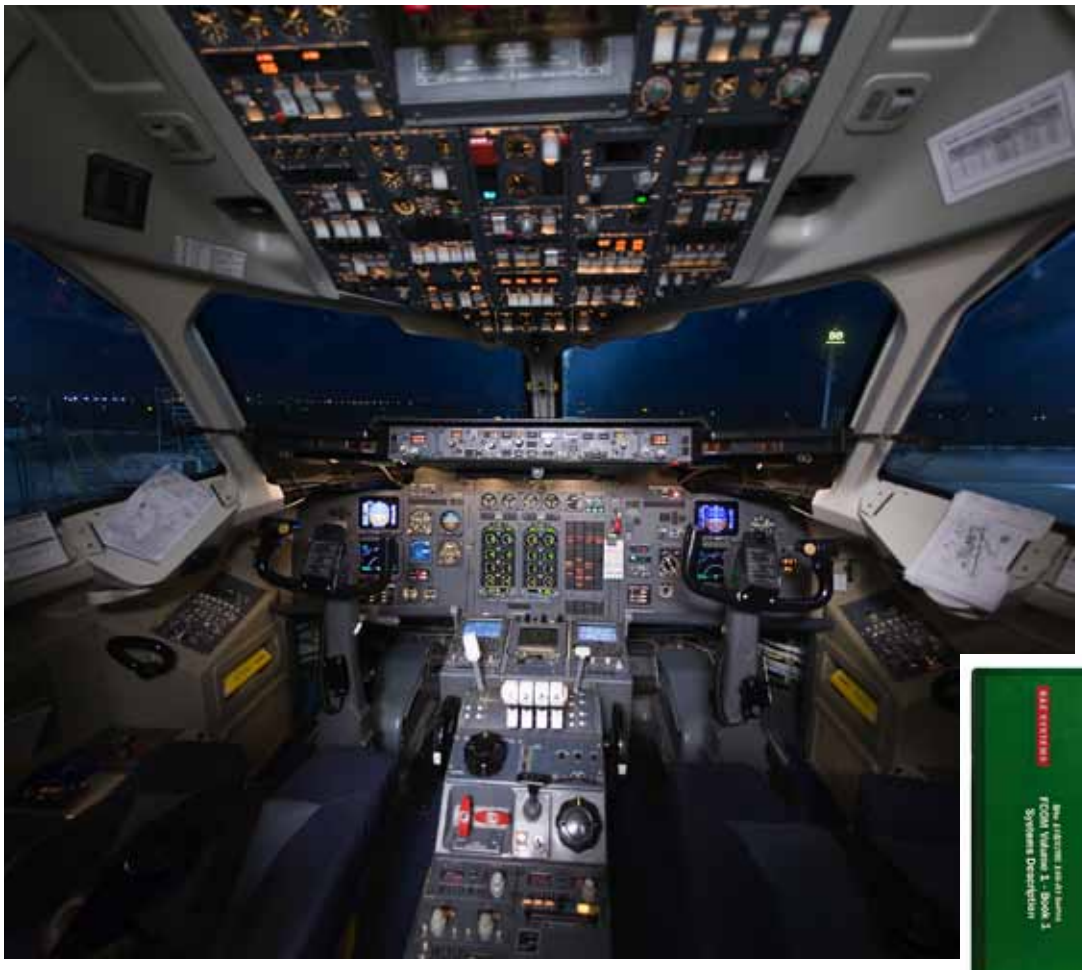
- **Select the GNSs OFF.**
- **Select both IRS mode selectors to ALN.**
- **Power up and initialise the GNSs.**
- **Put both IRS mode selectors to NAV.**

When the IRS is in align it can establish the latitude, but cannot establish longitude. Therefore the accuracy of the subsequent navigation depends on the crew inserting a position during the initialising process, this position must be as accurate as possible.

An IRS will give accurate navigation data, but this accuracy degrades over time. This degradation starts when NAV is selected, and so selection of NAV should be left as late as possible. The error accumulation is not linear i.e. it is not 1 mile in 1 hour 2 in 2 etc, but follows a sine curve first described by a German engineer called Maximillian Schuler. Schuler Tuning means that the IRS will oscillate to a period of just over 84 minutes. As this oscillation is a sine wave the error will also vary over this time and so at 2 minutes the error might be at a maximum whilst at 63 minutes it might be zero again. However, this error wave is not possible to predict with any accuracy.

As the IRS drifts another system is used to bound this drift, and on the RJ this is the VPU or GPS (if fitted). The FMS uses this information to display the present position. An IRS should not drift at a greater rate than 1 nm per hour, but IRS performance will degrade with time as the unit wears. This increase in drift can be monitored by crews recording the residual errors in position and groundspeed. When these errors become excessive the unit should be replaced.

The above is a short discussion that I hope has offered some insight into the IRS fitted to the Avro RJ, and may offer ways to get the best out of it.

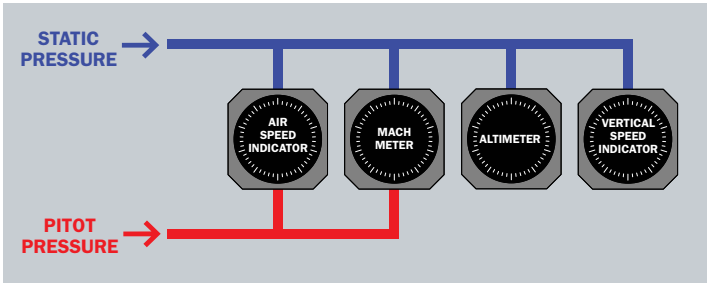


Left: the IRS is covered in Volume 1 Chapter 19, and in Volume 3 Part 1 Chapter 9 of the FCOM.

Unreliable Pressure Instrument Indications

Following an Airbus accident over the Atlantic Ocean, much effort has been expended in making flight crews more aware of the need to detect, and cope with, unreliable pressure instrument indications. The European Regions Airline Association Air Safety Group published STAR-014 to provide guidance on troubleshooting problems, and this article is based on that STAR.

Most of our aircraft use an Air Data Computer to provide airspeed, altitude and vertical speed information to the flight deck instruments or EFIS. However, there are still aircraft out there that rely on basic pitot static instruments, and for an analysis of problems that can occur in these systems, the basic pitot static set up is easiest to understand as, even on the most modern of aircraft, airspeed altitude and vertical speed measurement relies almost exclusively on the aircraft's pitot static system. The pitot static system uses the atmospheric pressure gradient to measure airspeed and altitude. The pitot tube provides total pressure (i.e. the pressure of the air being forced into it) and this information is only utilised by the Airspeed Indicator (ASI) and Machmeter. Whilst the static vents provide information for all the pressure instruments. Opposite is a diagram of a very simple pitot static system which I am sure you will all remember from your ATPL exams?



Above: diagram of a simple pitot static system.

Problems can occur with the instrument readings for a variety of reasons including:

- Covers not removed from the pitot head or static vents.
- Blockage by for instance insects or ice.
- Disconnected or leaking hoses.
- Water freezing in the pipes.

Airspeed Indicator

The diagram shows that the ASI has inputs from both pitot and static systems. Airspeed is a measure of dynamic pressure which is total pressure minus static pressure. Thus the faster you go the greater the pressure, and so the airspeed. In a mechanical ASI the pitot tube is connected to a capsule and the instrument case is connected to the static vents thus subtracting the static pressure from the total pressure.

Machmeter

A machmeter displays the Mach Number, (M), which is the ratio between the aircraft's True Air Speed (TAS) and the Local Speed of Sound (LSS). The machmeter uses both pitot and static pressure to generate mach and displays it as a decimal fraction. The machmeter consists of an altimeter capsule coupled to an airspeed capsule.

Altimeter

The altimeter shows changes in air pressure as the aircraft's altitude changes. Inside the altimeter case there is a partially evacuated capsule which is held open by a spring, and static pressure is allowed into the case. Changes in static pressure cause the capsule to expand or contract when the surrounding pressure varies.

Vertical Speed Indicator

Vertical speed is measured through a mechanical linkage connected to a capsule which is fed static pressure. Static pressure is also fed to the interior of the instrument case via a metering unit. Changes in static pressure are fed

Unreliable Pressure Instrument Indications

FROM PAGE 09

immediately to the capsule, but the pressure is caused to lag behind in this case due to the metering unit. So that when these two pressures are equal the instrument shows level flight.

SYSTEM MALFUNCTIONS

Blocked Pitot Tube
A blockage of the pitot tube will only affect the ASI and the machmeter. The total pressure will remain constant whilst the static will vary with changes in altitude. Thus, on the take-off roll, the instrument readings will not increase, but as the static pressure drops during the climb the airspeed indications will start to increase. A blocked pitot tube in the climb could lead to spurious overspeed indications, even when the actual speed is constant, which might make the pilot increase the pitch, reduce power or both. During a descent the opposite happens and the indications decrease as the altitude decreases.

Blocked Static Vent
The altimeter will freeze at the altitude at which the blockage occurred. The vertical speed indicator will return to level and not show any further climb or descent.

‘BE PREPARED AND HAVE A STRATEGY TO DEAL WITH UNFORESEEN SITUATIONS’

The speed readings will reverse and cause the speed to read higher in a descent and under read in a climb. This could result in a pilot lowering the nose to increase speed and possibly increasing thrust which might allow the aircraft to fly above its limiting speed especially as the aural warning could be linked to the unreliable source.

Total Pitot Static Blockage
As there will be no changes in the input to either system all pressure instruments will be in error.

STRATEGIES

First of all carry out a good preflight check to make sure that all the openings are clear of anything that might block them. Be aware of the potential errors within the pitot static system and guard against them. If in doubt cross check, and consider using other sources such as radio altimeter GPS or INS if available. Know the basic power and attitudes that your aircraft requires in the various configurations and be prepared to select these. Warn ATC as you will probably not be able to maintain a constant altitude and try and find more favourable conditions – they might be able to help. Be prepared and have a strategy to deal with unforeseen situations. Despite the great steps in increasing system reliability such failures might still occur.

Previous issues of JETSETS

The issues below are available on the BAE Systems Customer Portal www regional-services.com under Flight Safety. Alternatively, issues may be obtained by emailing a request to: www.rafltops@baesystems.com

Issue	Main Articles
February 2008	• Turboprop flight with precautionary power reduction • Overruns • Turboprop asymmetric flight
November 2008	• Overruns • Use of Oxygen • Turboprop icing
March 2009	• Turboprop icing • Oxygen • Rejected take-offs • Upsets
March 2010	• 146/RJ flight control restrictions • Threat Error Management • Use of BAE Systems Checklists
March 2011	• Unpaved runways • WAT • Rejected landings • Emotionally enabled

Guide to Abbreviations used in this issue of JETSETS

AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
ALAR	Approach and Landing Accident Reduction (a toolkit provided by the Flight Safety foundation)
AFM	Aircraft Flight Manual
AMM	Aircraft Maintenance Manual
APU	Auxiliary Power Unit
ASR	Air Safety Report
ATC	Air Traffic Control
CBR	California Bearing Ratio (a measure of firmness of surface)
CFIT	Controlled
C of G	Centre of Gravity
DADC	Digital Air Data Computer
DH	Decision Height
EFIS	Electronic Flight Information System
FCOM	Flight Crew Operating Manual
FOSIL	Flight Operations Information Leaflet
ICAO	International Civil Aviation Organisation
IRS	Inertial Reference System
LDA	Landing Distance Available
MAUW	Maximum All Up Weight
MLW	Maximum Landing Weight
MTOW	Maximum Take-Off Weight
NTA	Notice To Aircrew
NTSB	National Transportation Safety Board
OIL	Operating Information Letter
PA	Passenger Address
PAL	Pilot Advisory Letter
PCN	Pavement Classification Number
Pdf	Portable Document Format
PF	Pilot Flying
PM	Pilot Monitoring also PHF
PNF	Pilot Not Flying (also PM)
QRH	Quick Reference Handbook (Abnormal and Emergency Checklist)
RTO	Rejected Take-Off
RTOW	Regulated Take-Off Weight tables
RLW	Regulated Landing Weight tables
SG	Signal Generator
UTC	Coordinated Universal Time
Vapp	Approach Speed
Vmca	Minimum Control Speed in the Air
Vmgc	Minimum Control Speed on the Ground
Vref	Reference Speed at Threshold
WAT	Weight Altitude and Temperature

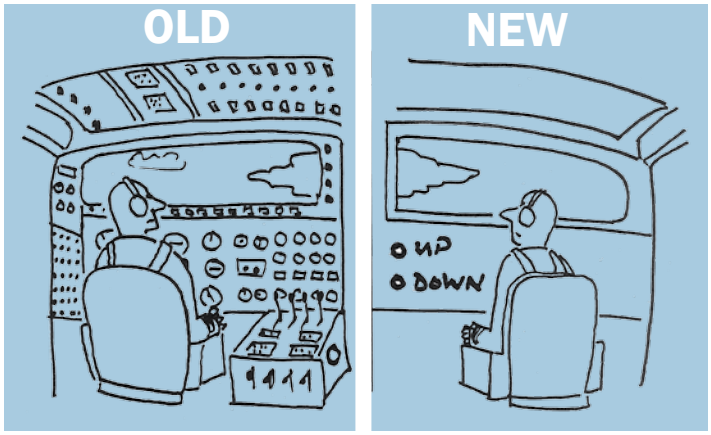
JETSNIPS

A light hearted look at the aviation industry

A man on the last flight to Rome
Didn't switch off his cellular phone
The spoilers extended
The airplane descended
And before he knew he was back home

Madam, you're asking me to tell you if this old aircraft is safe to fly? Just how do you think it got to be so old?

The less carry-on luggage space available on an aircraft, the more carry-on luggage passengers will bring aboard.



On reaching his plane seat a man is surprised to see a parrot strapped in next to him. He asks the stewardess for a coffee where upon the parrot squawks "And get me a whisky you cow!" The stewardess, flustered, brings back a whisky for the parrot and forgets the coffee.

When this omission is pointed out to her the parrot drains its glass and bawls "And get me another whisky you idiot". Quite upset, the girl comes back shaking with another whisky but still no coffee.

Unaccustomed to such slackness the man tries the parrot's approach "I've asked you twice for a coffee, go and get it now or I'll kick you".

The next moment, both he and the parrot have been wrenched up and thrown out of the emergency exit by two burly stewards. Plunging downwards the parrot turns to him and says "For someone who can't fly, you complain too much!"

I hope there's a place way up in the sky,
Where airmen can go when they die.
A place where a guy can buy a cold beer,
For a friend and a comrade, whose memory is dear.
A place where no doctor or lawyer can tread,
Nor a management type would ere be caught dead.
Just a quaint little place, kind of dark, full of smoke,
Where they like to sing loud, and love a good joke.
The kind of a place where a lady could go,
And feel safe and protected by the men she would know.
There must be a place where old airmen go,
When their paining is finished, and their airspeed gets low.
Where the whiskey is old, and the women are young,
And songs about flying and dying are sung.
Where you'd see all the fellows who'd flown west before,
And they'd call out your name, as you came through the door.
Who would buy you a drink, if your thirst should be bad,
And relate to others, "He was quite a good lad."
And then through the mist, you'd spot an old guy,
You had not seen in years, though he taught you to fly.
He'd nod his old head, and grin ear to ear,
And say, "Welcome, my son, I'm pleased that you're here,
For this is the place where true flyers come,
When their journey is over, and the war has been won.
They've come here at last to be safe and alone,
From the government clerk, and the management clone,
Politicians and lawyers, the Feds and the noise,
Where all hours are happy, and these good ole boys,
Can relax with a cool one, and well deserved rest,
This is heaven my son...You've passed your last test!"

If you are assigned a middle seat, you can determine who has the seats on the aisle and the window while you are still in the boarding area. Just look for the two largest passengers.

FACT FILE REGIONAL AIRCRAFT SUPPORTS AROUND 190 GLOBAL CUSTOMERS IN 80 COUNTRIES