BAE Systems Regional Aircraft's Flight Safety magazine for its Jet and Turboprop fleets customers • March 2010

JETSETS

Push back procedures

Care and vigilance required
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Threat and error management
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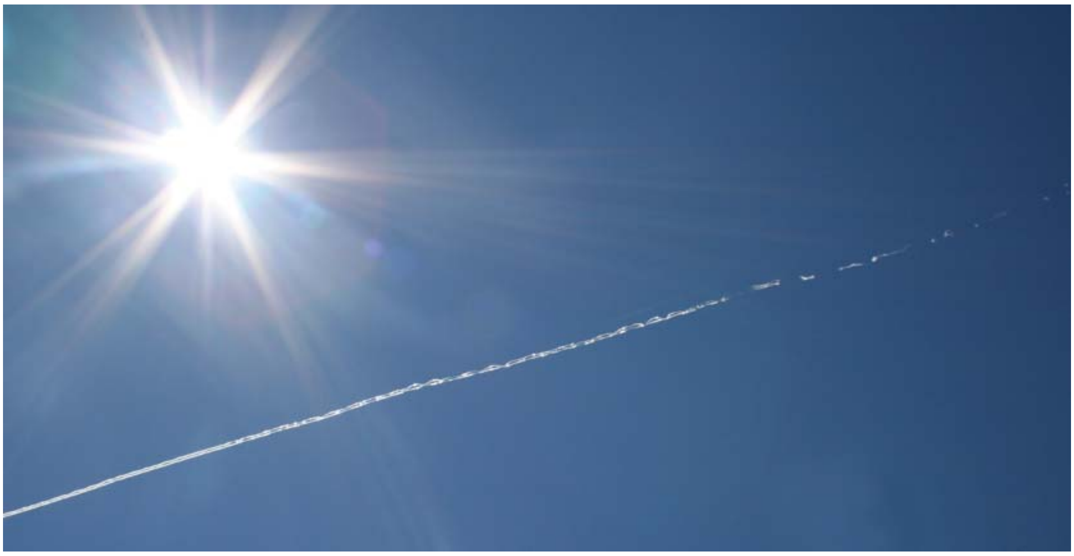
Spotlight>

Over the last few winter seasons, a number of flight control restrictions have occurred caused by the build-up of frozen contaminants on BAe 146 and Avro RJ jets as well as some turboprop aircraft.

More info: see page 06

Rough airspeed buffet margins at high altitude



As the only BAE Systems Regional Aircraft types cleared above 31,000 feet, Avro RJ85 and RJ100 operators have raised questions on how to interpret our advice to fly at 0.6 IMN when in rough air with regard to maintaining a safe margin over the buffet boundary. Up to 31,000 feet 0.6 IMN gives at least a 0.3g margin. However, above 31,000 feet there is also a limiting weight.

Information on how to calculate this weight is given in the Aircraft Flight Manual Part 6 and in the FCOM Volume 2 Chapter 4. To save you the trouble of thumbing through these documents a simple table has been produced for inclusion in the FCOM at the next revision. The information will be in the Flight Deck Handbook. The instructions and the table are reproduced opposite.

If severe turbulence is encountered, and the aircraft weight exceeds the buffet limited weight for the rough airspeed speed (0.6 IMN) at the present altitude, descend until the aircraft weight is less than the limiting weight for the new altitude. During the descent reduce the airspeed slowly to 0.6 IMN. This will ensure that the required 0.3g margin to buffet is maintained.

	Altitude	Limiting Weight
For the RJ85		
	31,000 ft	43,100kg
	32,000 ft	41,400kg
	33,000 ft	39,500kg
	34,000 ft	37,800kg
	35,000 ft	36,000kg
For the RJ100	30,000 ft	45,600kg
	31,000 ft	43,800kg
	32,000 ft	41,900kg
	33,000 ft	40,000kg
	34,000 ft	38,100kg
	35,000 ft	36,300kg

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Welcome>

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

Welcome to JETSETS. This issue highlights the need to use checklists and procedures as accidents can and will occur if complacency sets in.

An article on page five of this issue covers the use of BAE Systems checklists, and recommends: first fly the aircraft, then everything else. Included in flying the aircraft is the concept of keeping the aircraft flying in a safe environment and resolving any malfunctions. The Quick Reference Handbook (QRH) is designed to assist in this endeavour. Pilots must understand that the QRH is designed to address expected malfunctions, but there will be occasions when the faults that occur are not exactly replicated. In this instance some form of decision tree is needed where the fault is thoroughly diagnosed by both crew members before any action is taken. Obviously there are malfunctions which do not allow the luxury of time such as an engine failure during take-off, a loss of control, GPWS warning or a TCAS RA. In these cases action must be taken immediately by PF. Once the aircraft is in a safe environment however, no precipitate action should be taken before consultation. Diagnose the fault and consider the action that needs to be taken. Supplementary to this article is a short discussion on Threat and Error management - mainly aimed at selecting the correct take off configuration.

Since the last issue of JETSETS there have been four fatal accidents involving BAE Systems aircraft. One was a 748 overrun where people on the ground were fatally injured and another was a Jetstream 31 fatal accident which involved an illegal flight. The other two accidents are covered in factual reports on pages 10 and 11. It is always sobering to read these reports, more so when it seems that human failings have contributed to the accident. Additionally, an RJ suffered a nosewheel collapse on landing, a BAe 146 overran the runway on landing and two Jetstream 31s were involved in runway take-off incidents. An article on runway safety appears on page nine.

By the time you read this all 146/RJ operators will have received the complete suite of AFM 5.1 and FCOM. For us it has been a long hard road - certainly much longer than was envisaged when the re-write project started. I feel that the result has been worth the wait, and I hope that all of you agree.

The ATP Manuals are in the process of revision, and you should see the results later this year. The ATP QRH will still have references to cabin crew in the freighter aircraft versions, and this is because the freight interiors were installed by STC (Supplementary Type Certificate). This means that a third party, not BAE Systems, installed the modification, and since BAE Systems were not party to the modification we are not able to reflect the drills in our publications. Part of the certification of the modification that should be completed by the STC house, is to provide changes to the publications. Modification installers vary greatly in how thorough these changes are, and the changes often do not seem to get into the appropriate publications. We are also processing work on the Jetstream Manuals.

I hope that you find the other articles interesting - as always I would welcome feedback, and any articles that could be included in the next issue.

In the meantime; fly safe!

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Here it is split up to make it easier for you to download an individual article.

Push back procedures

From the UK AAIB December 09 Bulletin regarding a Boeing 737:
'A cross-bleed engine start procedure was initiated prior to the completion of the aircraft push back. As the power was increased on the No 1 engine in preparation for the No 2 engine start, the resulting increase in thrust was greater than the counter-force provided by the tug and the aircraft started to move forwards. The towbar attachment failed and subsequently the aircraft's No 1 engine impacted the side of the tug, prior to the aircraft brakes being applied'.

From the September 2009 UK AAIB Bulletin regarding a BAe 146:
'During push back from the stand, a loud bang was heard on the flight deck of the aircraft. The push back continued, but the towbar became disconnected from the tug due to a failed shear pin. The tug then stopped, but the aircraft could not be halted in time to prevent it colliding with the stationary tug. The nose of the aircraft penetrated the windscreen of the tug, but no injuries occurred'.

As can be seen from these two reports - care and vigilance are needed during push back. BAE Systems issued a Flight Operations Information Leaflet a few months ago, and this article is intended to reinforce the message.

In the past BAE Systems types have suffered serious incidents where aircraft were damaged while being manoeuvred off stand by a tug. On these occasions only the aircraft were damaged, in slightly different circumstances the ground crew members could have been seriously injured as well.

The following thoughts are offered as ways to try and mitigate these problems:

1. No headset available

- Consider delaying start until off stand, or only starting a minimum number of engines.
- Monitor the ground crew for signs - incidents have occurred because the pilots' heads were inside the cockpit.

2. Taxiways contaminated or reported as being slippery

- The slippery surface will reduce the tug traction and also the stability of the aircraft. Only start a minimum number of engines until the push back is complete.
- Consider carrying out all starts whilst stationary.
- Make sure the all running engines are at idle or minimum torque.
- The surface might be slippery due to other contaminants such as fuel.
- Strong and/or gusty winds might be a factor.

3. Pull forward required

- If a pull forward is required as part of the manoeuvre off stand or if the crew are unsure if a pull forward is required (possibly due to communication difficulties), only one engine should be started on stand prior to push back. Other engines may then be started after the push back has been completed and the parking brake set.

4. Only push back required

- If the manoeuvre off stand only requires the aircraft to be pushed, with no pull forward required, and if the surface conditions allow, then engines may be started during push back.

At all times, while an aircraft is being manoeuvred by a tug, the pilots should be extremely vigilant. If they feel that the manoeuvre is not progressing as planned or as expected, they should ask the ground crew on the headset to stop the manoeuvre, set the aircraft parking brake and get clarification. Ideally the ground crew should know not to stop the push back in a turn; the aircraft should be moved several feet in a straight line first.

'CARE AND VIGILANCE ARE NEEDED DURING PUSH BACK'

When the ground person in charge requests that the parking brake be set, this should be done as quickly as possible, always allowing for the requirement to monitor the engine during start to ensure that the start is progressing as expected.

Use of BAE Systems Checklists

The philosophy behind our Normal, Abnormal and Emergency Drills

BAE Systems have become aware of occasions when an emergency situation has not been handled as we would expect. We have also been notified of an incident which occurred because both crew members did not confirm that a vital action had been completed correctly. Therefore we have decided to reiterate the philosophy behind our Normal, Abnormal and Emergency Drills.

A maxim of aviation, since its earliest days, has been:

'FIRST FLY THE AIRCRAFT, AND THEN EVERYTHING ELSE'

Normal Drills

Vital checks are normally carried out as challenge and response, where PF calls for the checklist and PNF reads aloud the appropriate challenges. PF checks the selection before making the appropriate response. Implicit in using the BAE Systems Checklists is the philosophy that one pilot operates the system/selection and confirms that the required outcome has been achieved, and the outcome is also confirmed by the other pilot. In other words both crew members confirm that the result is the desired one - for instance following an undercarriage down selection both crew members must confirm that the correct indication (usually three greens) has been obtained. Some checks, such as the preliminary checks, the after take-off, the after landing and the shutdown checks may be delegated to just one crew member as say and do checks.

Abnormal and Emergency Drills

Whilst dealing with any situation the aircraft must still be flown and navigated in three dimensions. Therefore it is vital that it is clear who is flying and who is dealing with the situation.

When an emergency occurs PF's task is to control the aircraft. If unable to do so - for example jammed controls - PNF must be informed immediately. Assuming it is possible, PF initially controls the aircraft and usually retains control while PNF deals with the failure. There may be rare circumstances when it is necessary to change control – for example total loss of information on PF's side, but in general control should not be handed over until the situation has been resolved.

At the failure PNF should cancel any attention getters and announce the failure. PNF should also monitor the aircraft's flight path. Should the captain decide to change roles the change must be clearly announced and acknowledged. There must be no doubt as to who is controlling the aircraft.

Do not disconnect the autopilot if this can be avoided. Use the autopilot, if possible, to reduce workload.

Always take the utmost care to ensure that the correct procedure is selected and performed. Whilst airborne no switch or lever should be moved without first obtaining confirmation from the other pilot. Most malfunctions are easily dealt with, but on occasion there are complicating factors such as multiple failures or a simple failure occurring during a critical phase of flight. Do not rush into completing the procedures. Remember that the top priorities are to ensure that the aircraft is on, and maintains, a safe flight path, and correct diagnosis and resolution of the malfunction.

A suggested aid to arriving at the correct solution is to use some form of decision making process such as DODAR. This process is usually initiated by the Captain and normally carried out after any checklist drills have been completed. The process is valid for technical and non-technical occurrences. DODAR stands for the following:

- **D**iagnose - determine the nature of the problem.
- **O**ptions - consider all the courses of action available.
- **D**ecide - decide which course of action to take.
- **A**ssign tasks.
- **R**eview and risk assess.

Remember:
AVIATE, NAVIGATE, COMMUNICATE
In that order.

Dealing with distractions

Threat and error management when confronted with a distraction

One of the (many) problems that face crews today is distraction when part way through completing a task. In some instances this has no effect or the crew restart the task correctly after the distraction. In a few cases the distraction is enough to cause the task not to be carried out. The following two incidents highlight this:

Incident 1
The Spanish Commission of Investigation of Accidents and Incidents of Civil Aviation Preliminary Report into the Accident involving an MD-82 at Madrid-Barajas Airport on 20th August 2008 reports as follows: The aircraft taxied and was cleared for take-off, but a problem caused it to return to stand. According to the DFDR the flap had been extended to 11°. The aircraft was parked on a remote stand and the fault rectified in accordance with the MEL. The aircraft was then refuelled and dispatched again. On the take-off the stall warning and horn activated after lift off, and the aircraft subsequently impacted the ground. During the entire take-off run until the end of the CVR recording, no noises were recorded involving the Take-Off Warning System advising of an inadequate take-off configuration. During the entire period, from start up to the end of the DFDR recording the flaps were indicating 0°.

Above: an MD-82 similar to the aircraft involved in the Madrid incident

Incident 2
One of our operators reported that environmental conditions necessitated a re-calculation of take-off data by the FO, and so take-off checks were delayed. ATC offered an earlier line up position with an immediate take-off which was accepted. The Configuration Warning sounded as the thrust levers were advanced, and a low speed abort was carried out, and the next take-off was successfully completed once the flaps had been selected.

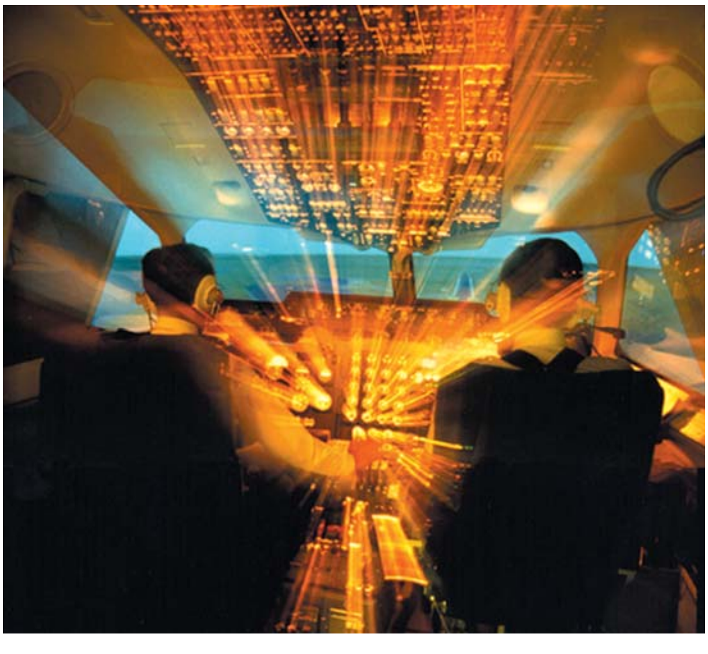
The different outcome to these two human factor incidents was due to a mechanical input to the second event, otherwise the results could have been similar. Distractions during completion of the drills seems to have caused flap selection to be missed.

Unfortunately it is not possible to insulate the crew from external distractions, and there will be many occasions were drills have to be interrupted to carry out some other task or talk on the radio. Distraction is the main Threat, and the Error is not completing the drill when the distracting task has been completed. There are other threats in this environment which add to the risk of incorrectly completing a drill. Once a check has been missed it might not be picked up as the crew have moved on to doing the next check in sequence, for instance the line up checks, because they have both forgotten that the previous checklist was not completed or the line up check might have been cued as they entered the runway. It is possible that a lever has been moved into a position, but the surface has not moved. However, the crew expect that the flap has been set, and do not notice that it hasn't.

Distractions can also be inside the cockpit, and this is why sterile cockpits are recommended at certain stages of flight. Irrelevant conversation, at the wrong time, has been implicated in several accidents. It is not the fact of talking that is the problem, but rather the fact that conversation can lead to too much input thus overloading the listener. This in turn can lead to checks being missed.

Most of us have learnt strategies to mitigate these threats, but being human we do not always succeed fully. However, if we are aware of where the threats might come from we are better able to avoid making errors. Knowing that interruptions can affect us we should treat them with caution. Make sure you are both in the loop when an interruption occurs, and possibly state how the task will be completed once the distraction is over. Realise that your memory is driven by cues and that this can help to complete a task. Consider re-running a checklist if you've been interrupted. Make sure that what you expect has happened by using all means of confirmation, and try not to be rushed; five minutes late taking off with all checks complete is preferable to on time but with checks omitted. Carry out checks as called for in your company SOPs.

Today's checklists talk about pre take-off and pre landing checks but when I started flying these checks were called Vital Actions. Perhaps we should get back into that way of thinking.



Flight control restrictions

The importance of de-ice/anti-ice fluid residue contamination inspection and cleaning procedures

Over the last few winter seasons, a number of flight control restrictions have occurred caused by the build up of frozen contaminants in the gaps between fixed and flying control surfaces and between the surfaces and tabs.

This article has been prepared from the 146/RJ Service Information Leaflet which is sent to all jet Operators' Maintenance Departments. However, the turbo props are not immune as we have also had a report of a Jetstream 41 that suffered an ice related restriction to the elevator and an ATP where hail froze in the elevator gap after take-off. This article has been written as it shows photos that are of interest to flight crews to explain why the problem exists.

Natural Contaminants

Snow and/or ice has been known to remain on the airframe, between flying control gaps, in temperatures well above 0 deg. C. As the normal parked position of the 146/RJ elevator, in particular, is leading edge down, the gap between the surface and the stabiliser can potentially create a void to accumulate solid precipitation such as snow, ice pellets and frozen anti-icing fluid residues. Since the contaminants are partially protected from the sun and wind, they melt at a slower rate than contaminants on more exposed areas of the airframe. The two photographs opposite show ice pellets in the elevator hinge of a 146 which, if not treated, could lead to a control restriction once airborne.

Therefore, even if de-icing does not appear to be required, consider the weather conditions, such as earlier sleet or snow showers in which the aircraft may have been parked, even if the current temperature is above freezing. The use of suitable equipment will be essential to inspect upper and lower surfaces of the wing and tailplane for contaminants such as snow or ice pellets prior to departure.

De-Icing and Anti-Icing Fluids and Methods

Prior to the northern winter season, BAE Systems Regional Aircraft advise operators regarding the latest approved anti-icing fluids, and the latest revisions of relevant SAE, AEA, FAA and fluid manufacturer's information. Operators must be aware that anti-icing fluids contain thickeners that dry-out in cold, dry and low air pressure environments, forming a residue which can remain on the airframe. This residue will rehydrate on contact with moisture, either from rain, during cleaning or from water in the air, and form a gel that can subsequently refreeze, causing restrictions of the flying controls during flight. As Type I fluids do not contain thickeners, BAE Systems recommend the use of Type I fluids for de-/anti-icing whenever available and operationally viable. If the use of thickened fluids can not be avoided, operators must implement and evolve effective inspection and cleaning procedures to prevent the build-up of fluid residues. The above advice is also given in UK CAA FODCOM 31/09 which is on the UK CAA web site.

Over recent years ALL of the relevant control restriction reports have originated from Europe. The significant difference between operations in Europe and outside Europe is the use of a single stage process in Europe as against a two-stage de- and anti-icing process where the first step is performed using hot water or hot Type I fluid. Accordingly, BAE Systems strongly recommend the use of two-stage de-icing/anti-icing wherever this is available.

Studies of control restrictions showed that in a previous year there was a sudden increase in reports of aircraft operating from one particular airport, specifically where predictive anti-icing was routinely carried out overnight based on forecasts of icing conditions. Predictive anti-icing can lead to the formation of residues and therefore BAE Systems advise against the use of this practice. However, if predictive anti-icing is used, it is recommended that a further de-icing step with hot water and/or Type I fluid is carried out before departure of the aircraft, and that the frequency of inspection and cleaning procedures is increased accordingly.

Above: example of a anti-icing residue in trim tab

Above and inset: examples of ice pellets in the elevator hinge of a BAe 146, which if not treated, could lead to a control restriction when airborne

Anti-icing fluids are a mixture of glycol, water and thickeners. Glycol prevents the build-up of ice and the thickeners hold the fluids on the aircraft surfaces. When 20% of the glycol and water is lost by evaporation, the fluids are designed to reduce in viscosity and run off the aircraft. If the fluids are unable to run off and are in aerodynamically quiet areas, the fluids can dry out and form residues. These residues absorb water from rain, cleaning processes, or water in the air, and may expand and subsequently freeze, even at relatively mild temperatures, as the active ingredient of the anti-icing fluid is no longer present. A period of

Above: example of a anti-icing residue in the leading edge of the elevator trim tab

cold weather, where frequent applications of anti-icing fluid are made, followed by a period of warm wet weather such as often occurs in late winter/early spring maximises the build-up and thus effects of the residues.
You should be aware of this mechanism of residue formation as your maintenance staff will be conducting frequent inspections for the residues. If you see anything untoward on walk round bring it to their attention.
Residues have been found in many forms, including dry, grey-to-white powdery substances, a thin dry film, hardened black deposits or a gel ranging through green-blue-grey-black in colour. Spraying the surfaces with warm water or Type I fluid, and leaving for up to 15 minutes, expands the residues making them easier to detect.

It has also been suggested that the residues may be more severe if aircraft are operating on runways de-iced with potassium and sodium formate and acetate runway de-icers. Contact of the latter fluids with Type II, III and IV anti-icing fluids, causes rapid precipitation of the thickener, and it has been noted during laboratory tests that the rehydrated residues are larger and adhere more to the surface. Residues have been found in many areas of the aircraft, some of which are potentially more critical than others. The critical and less critical areas where residues have been found are outlined below.

Critical areas are those for which the build-up of residues could potentially cause control restrictions after a small number of thickening anti-icing fluid applications without proper cleaning taking place. There is also a list of less critical areas which would require a larger number of applications.

Critical Areas

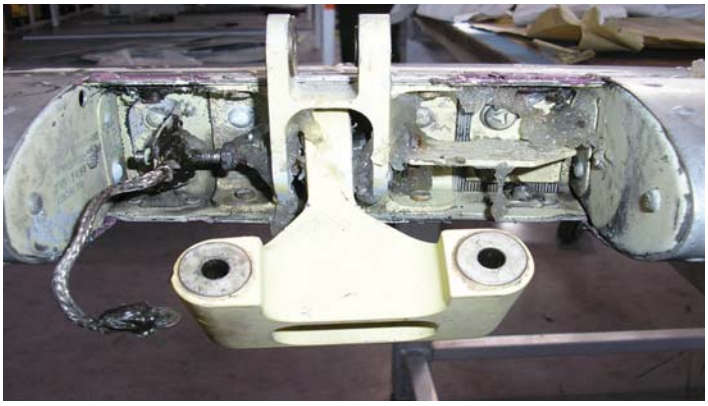
- Aileron - aerodynamically quiet areas such as gaps between control surfaces and servo/trim tabs.
- Aileron and tab bearings, hinges, gust damper, control rod areas, interconnect rods and rod ends.
- Aileron and tab drain holes, adjacent to the control runs.
- Aileron trim jack and drive area.
- Elevator - aerodynamically quiet areas such as leading edge gaps between aircraft, control surfaces and servo/trim tabs.
- Elevator and tab bearings, hinges, gust damper, control rod areas and rod ends.
- Stabiliser, elevator and tab drain holes (including inside control surface adjacent to the control runs.
- Horizontal stabiliser, elevator trim jack area.

Less Critical Areas

- Aileron and tab drain holes (including inside control surfaces AWAY from the control runs).
- Elevator and tab drain holes (including inside control surfaces AWAY from the control runs).
- Rudder drain holes (including inside the control surface).
- Wing and horizontal stabiliser.
- Rudder aerodynamically quiet areas and cavities (gaps around the control surface).
- Rudder bearings, control runs, hinges and rod ends.

Cleaning needs to be carried out frequently to prevent the build-up of these residues on the aircraft. Use either hot water or hot Type I fluid sprayed onto the surfaces. Note that frequent use of Type I fluids for de-icing, or as the first stage in a two-step process, will help to prevent the build-up of residues. Low pressure dry air can also be effective in removing the residues. Residues from the exterior should be washed or brushed off, taking care not to remove the grease from sealed-for-life flying control bearings.

Internal surfaces, such as wing and tailplane access panels, should be checked and washed out as above. Drain holes should be checked on control surfaces for signs of residues and cleared. If contamination is suspected within the flying control, access panels must be removed for further examination. All residue and gel must be removed using hot water or hot Type I fluid. The surfaces should preferably be dried with warm, dry air after this procedure to minimise the risk of corrosion.



Above: an example of a anti-icing fluid residue inside primary control structure

Conclusions

- All operators, especially those who use thickened anti-icing fluids during the icing periods should instigate a programme of inspection and cleaning to remove fluid residues, specifically targeted at the aerodynamically quiet areas.
- Operators should be aware that the two step processes are preferred, as they tend to prevent the build-up of fluid residues. However, if the use of thickened fluids is unavoidable, it is essential that all residues are washed away on a regular basis.
- Checks should be made for residues at a frequency determined by the operator's experience, and their operating environment.
- After extensive cleaning it may be necessary to re-lubricate aileron, elevator and rudder mechanisms.
- BAE Systems has also received several reports of failures of electrical components apparently as a direct result of contamination by de-icing/anti-icing fluids. Operators should take precautions to minimise contact of electrical equipment with these products. Any occurrences of this problem should be reported back to BAE Systems. Cleaning should be carried out using warm air, such as workshop air or a hairdryer.

An update from Regional Aircraft's Flight Operations Support Service

2009 was another busy year in Flight Ops, running the March conference attended by around 60 delegates from nearly 30 Operators, running several Performance and Dispatch courses for the 146/RJ including one in Peru, and the inaugural one for the ATP. We also visited various airlines, attended conferences, and met with European Jetstream Operators.

During the year our FTEs were involved in over two dozen flight tests and demonstrations, including those for the Air Tanker simulating fire-bombing over the hills of Galloway and Loch Doon just south of our home base here at Prestwick, Scotland.

We cleared around 500 smaller tasks and queries from around 100 Operators, as well as maintaining focus on Flight Safety and Integrity matters.

There are now four issues of the JETSETS Flight Safety magazine available, covering our turboprops and jets, along with our Fuel Management Guide for the 146/RJ. Flight Ops Support Information Leaflets (FOSILs) were issued covering a number of topics such as 2 and 3 engine taxi procedures on the 146/RJ and the propeller speed warning system on the Jetstream 41.

The services on offer from Flight Ops Support include:

- Supply of Flight Test Engineer / Flight Test Observer.
- The JETSETS Flight Safety magazines, and Flight Ops Support Information Leaflets (FOSILs).
- Performance and Dispatch courses - over 3 days for the ATP, 146/RJ, over 1 day for Jetstream.
- The Navtech / European Aeronautical Group EAG Take-off Data calculation (ToDc) software to generate airport Regulated Take-Off and Landing Weight (RTOW and RLW) charts for all our turboprops and jets.
- OPECS RTOW program for the Jetstream, HS748 and ATP.
- CAPECS Route Study software for marketing Fuel Management Guide, the Intelligent Fuel Calculator and Wind Effects Tables for the 146/RJ.
- ToDc datasets for 3 engine ferry, flaps up ferry and gear down ferry for the 146/RJ.
- Take-off Full Flex N1 setting tables – Engine Anti-ice OFF and ON – for the 146/RJ.
- Airport Critical Performance & Obstacle determination.
- All Engine Climb Gross Gradient charts or tables.
- Gross and Net Driftdown Profiles for One Engine Inoperative.
- Weight and Balance Report and Trim Sheets
- Marketing Route Studies and general consultancy including short, narrow and unpaved runways.

Looking forward into 2010, this issue of JETSETS has been published to coincide with the Flight Ops Support conference which will be held on the 16th and 17th of March in the Western House Hotel and Ayr Racecourse near our Prestwick headquarters.

A 146/RJ Performance and Dispatch course will immediately follow on the 17th to 19th March, with a second one in September. The ATP course will again be offered in September, and these courses for Jetstreams, ATP, and the 146/RJ are available on request at your home base. The conference will see further focus on Flight Safety and Integrity, and on ways to save fuel. With Operator support and input we'll seek to develop a theme of '100 Ways to Save Fuel' leading to publication of another magazine.

For any Flight Ops Support queries on any of the above, including conference and course places, or on other matters, please contact us on: rafltops@baesystems.com or on +44 (0)1292 675225, where one of our current staff, Stephen Morrison, Gordon Jackson, Alan Pettersen, Mark McArdle, Colin Wilcock, Peter Richardson and Mark Reid will be pleased to help you.

Above: BAE Systems Regional Aircraft's Flight Ops Support Service was involved in the Air tanker simulated fire-bombing trials that took place over the hills of Galloway and Loch Doon in South Ayrshire, Scotland during 2009

Runway safety

Recently the Flight Safety Foundation (FSF) has been working on a Runway Safety Initiative to refresh the Approach and Landing Reduction Initiative that they completed some years ago.

As well as overruns, the recent initiative also considers the take off case and runway incursions, and covers a 14 year period up to 2008. FSF publish a monthly safety magazine. AeroSafety World which always contains good articles; they can be reached on www.flightsafety.org

As indicated in previous JETSETS articles, there are still around 30 runway excursions a year in the commercial transport fleet. In relation to other accidents, runway accidents accounted for 30% of the accidents, and of these 97% were excursions. Therefore I make no apology for returning to this subject when BAE Systems have seen two overruns in the past year to our types, and the recent cold spell in the northern hemisphere has produced a number of overruns.

The FSF Report on this initiative is available on their website together with an updated toolkit, and I commend it to management staff and all pilots. Interestingly, the FSF found that turboprops were involved in the largest percentage of take-off accidents whereas jets were involved in more landing excursions than turbo props.

There is no new message coming out of this work. Runway Excursions (which include going off the paved surface to the side) are still mainly caused by a combination of factors, and the leading factors include:

- Unstabilised approach.
- Go around not conducted.
- Touchdown long/fast.
- Ineffective braking/ contaminated runway.
- Landing gear malfunction.
- Approach fast.
- Touchdown hard/bounce.
- Wind (tail, cross or gusts).

To mitigate these factors most operators have instituted stabilised approach requirements and now routinely monitor all approaches to ensure that each one meets their stabilised criteria. Of vital importance is for both ATC and management to adopt a 'no fault ' policy following a go around. Additionally, operators should have an on going process to identify critical runways within their destinations. Crews must understand fully the performance calculations that they make, and be aware of changing runway conditions.

Stabilised approaches help to improve your situational awareness by ensuring that the aircraft is at a known position and in a known configuration, and so CRM is enhanced because both pilots see what they expect. The aircraft is configured to go around with the engines at a reasonable power level.

Finally, and most importantly, the landing will be at the correct position and speed thus ensuring that your pre landing performance calculation is also correct. It takes 1 minute to cover three miles at 180 knots and 1.5 minutes at 120 knots. I do not think that this 30 second time saving is worth the chance of a poor landing.

Undercarriage failure to retract

Every year we get ASRs from operators of our types concerning failure of the undercarriage to retract. In many cases the crew have attempted to recycle the gear, but this is usually a futile exercise as the gear remains stubbornly down.

Some of our types have drills that include a procedure for retracting the gear if the handle hasn't moved, but none include a recycling drill. If the ground lock override drill is included in your Abnormal and Emergency Checklist then the intention is to allow the 'on ground' solenoid to be bypassed so as to enable the crew to raise the gear handle if it is stuck in the down position after take-off.

There are many reasons as to why the gear has not retracted including ground locks left in and hydraulic jack failure. The crew are not best placed to trouble shoot this whilst airborne, and so on obtaining three greens the wisest course of action would be to land and have the fault investigated.

South Africa J41 accident

Reproduced below is part of the Interim Report of the South African CAA. (For a full report go to: www.caa.co.za/resource center/ accidents & incid/reports/2009/Merebank Prelim.pdf
BAE Systems are continuing to work with the authorities to assist in concluding this investigation.

The aircraft was configured for a flap nine take-off. The take-off roll appeared normal until a few seconds before rotation, when the right engine torque indication started to progressively reduce. The right engine RPM remained normal at this time, as did indications for the left engine. The right engine torque continued to reduce and as the aircraft climbed through about 400 ft AMSL, it reached zero. Shortly after this, the flaps were retracted and at about 500 ft AMSL the aircraft momentarily levelled before both the left engine torque and RPM indications rapidly reduced to zero. The aircraft then descended. Approximately two seconds before impact, the right engine RPM was 55 %, with the left engine torque and RPM indications remaining at zero.

Description of Events

The last 1 minute and 6 seconds of the CVR were analysed and combined with the information obtained from the FDR. The First Officer was the pilot flying (PF) with the Captain as pilot not flying (PNF).

From the FDR data it is evident that the right-hand engine failed after 70 knots but prior to V1 as indicated by the right hand engine torque which started spooling down. This occurred as the Tower advised the aircraft of a smoke trail behind the aircraft. All hydraulic and oil pressures were still normal at this stage.

During rotation at 05:57:01Z, an unknown aircraft transmitted the words "Severe smoke". A warning sound [ping] is then heard and the First Officer (FO) stated "right oil contamination". The FDR data indicated that the aircraft was at a pressure altitude of approximately 100 feet and at an indicated airspeed of 140 knots.

The Captain stated at 05:57:10Z that "we have lost an engine" and then "we are losing an engine". The FO responded at 05:57:14Z that "I have it, I have it" -"Keeping runway track six thousand feet"- "Flap is zero""and confirms "we have lost an engine".

The FDR now indicated a pressure altitude of approximately 350 feet with an indicated airspeed of 140 knots, the right-hand and left hand engine rpm was at 100%. The left hand engine torque was still at approximately 100% with the right hand engine torque reducing rapidly. The hydraulic and oil pressures were normal.

At 05:57:25Z the Captain notified the Tower "Okay we've lost an engine". The associated pressure altitude was approximately 480 feet with an indicated airspeed of 120 knots, The right-hand and left-hand engine rpm was at 100% with the left-hand engine torque at 100% and hydraulic and oil pressure normal. The FO comments "We're not maintaining".

At 05:57:28Z three audible warning sounds [pings] are heard and the Master Warning switch is activated. The right-hand engine beta goes to zero. The left-hand engine torque is at 100%. The pressure altitude is at approximately 490 feet and indicated airspeed 120 knots. An unidentified transmission advises "Your gear is still down".

At 05:57:30Z the FO stated "gear up", followed by the Captain saying "ok gear up". However, the left engine now spools down from 100% to zero within seven seconds. The pressure altitude was approximately 450 feet with an indicated airspeed of 125 knots.

At 05:57:33Z three audible warning sounds [pings] are heard together with stick shaker activation. The indicated airspeed reduces to approximately 117 knots with the angle of attack of 14 degrees. A low hydraulic pressure as well as low oil pressure recording is activated on the right-hand engine.

A clicking sound like a switch or handle moving is then heard on the area microphone with an associated sound of an engine running down. The FO stated "wait, wait pitch forward Allister" with the pressure altitude at approximately 450 feet and indicated airspeed of 130 knots. The pitch attitude was 7.5 degrees nose up. A GPWS warning of "Don't sink" was followed immediately by three pings.

At 05:57:39Z the stick shaker can be heard again followed by three audible warning sounds (pings). The associated pressure altitude was approximately 350 feet with an indicated airspeed of 110 knots. The pitch attitude is -2.5 degrees nose down angle of attack 14 degrees and flap setting zero.

The FO comments "fly it out of here" followed by the GPWS stating "Too low". Another three audible warning sounds [pings] are heard together with a stick shaker sound in the background and the FO states "gear is up flaps is***" whereby the Captain confirms "gear is up flaps***". The FDR now indicated a pressure altitude of approximately 150 feet and an indicated airspeed of 70 knots. The pitch attitude is 2.5 degrees nose up with a flap setting of zero and a further three audible warning sounds [pings] are heard.

At 05:57:52Z the CVR recording stops.

FDR loss of power

FDR power was lost approximately two seconds before impact due to both generators dropping off line. The no 1 engine generator due to the engine being shut down and the no 2 generator due to the spooling down of the failed engine. Recorded data of the last two seconds of the fight is therefore not available.

Above: the J41 which crashed shortly after taking off from Durban International Airport, South Africa in September 2009

BAe 146 PK-BRD accident

The article below is part of the Indonesian National Transportation Safety Committee final report into the accident of BAe 146 PK-BRD. The full report can be found at: www.dephub.go.id/knkt/ntsc_aviation/aaic.htm (The report is contained in Case Archives 2009). BAE Systems fully support the conclusions of this report and encourage operators to ensure crews are appropriately trained.

Synopsis

On the morning of 9 April 2009, a British Aerospace BAe 146-300 aircraft, registered PK-BRD, was being operated as a scheduled passenger and cargo flight from Sentani Airport Papua to Wamena Airport Papua. The crew consisted of two pilots, two flight attendants, an engineer, and a load master.

The aircraft performed a go-around from the initial landing approach on runway 15 at Wamena. The flight crew positioned the aircraft on a right downwind leg for another landing approach. As the aircraft was turned towards the final approach for the second landing approach at Wamena it impacted terrain and was destroyed. All of the occupants were fatally injured.

The Enhanced Ground Proximity Warning System (EGPWS) manufacturer performed simulations using data from the flight recorders, and two separate terrain data sources.

The manufacturer informed the investigation that "the GPWS/ EGPWS alerts recorded in the CVR were issued as designed". However the enhanced Look-Ahead function appeared to have been inhibited following the go around. There was no evidence from the CVR that the crew had deliberately inhibited the terrain function of the EGPWS.

The investigation determined that the EGPWS issued appropriate warnings to the flight crew, in the GPWS mode. The pilot in command did not take appropriate remedial action in response to repeated EGPWS warnings.

The investigation concluded that flight crew's lack of awareness of the aircraft's proximity with terrain, together with non conformance to the operator's published operating procedures, resulted in the aircraft's impact with terrain.

Below: the crash site of BAe 146 PK-BRD at Wamena, Papua

Guide to Abbreviations used in this issue of JETSETS

AGL	Above Ground Level
AOA	Angle Of Attack
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
CAA	Civil Aviation Authority
CAPECS	Consolidated Airplane Performance Economic Calculation System
CAT	Clear Air Turbulence
cm	centimetre(s)
CRM	Crew Resource Management
CVR	Cocpit Voice Recorder
CWP	Central Warning Panel
DFRD	Digital Flight Data Recorder
ECS	Environmental Control System
EGPWS	Enhanced Ground Proximity warning System
FDR	Flight Data Recorder
FL	Flight Level
FSF	Flight Safety Foundation
hPa	hectopascals
IMC	Instrument Meteorological Conditions
km	kilometre(s)
LDA	Landing Distance Available
LDR	Landing Distance Required
m	metre(s)
MEL	Master Equipment List
MSA	Minimum Safe Altitude
NTSB	National Transport Safety Board (USA)
OPECS	Operational Performance E Calculation System
PF	Pilot Flying
PNF	Pilot Non Flying (now PM – Pilot Monitoring)
psi	pounds per square inch
QRH	Quick Reference Handbook
RA	Resolution Advisory
RLW	Regulated Landing Weight
RPM	Revolutions Per Minute
SOP	Standard Operating Procedure
STC	Supplementary Type Certificate
TCAS	Traffic Collision Avoidance System
VMC	Visual Meteorological Conditions

JETSNIPS

A light hearted look at the aviation industry

ATC: Trainer 1 have you captured the localiser?
Trainer 1: Negative, but we've got it surrounded.

I hate to wake up and find my co-pilot asleep.

Trust your captain, but keep your seat belt securely fastened.

You cannot propel yourself forward by patting yourself on the back.

"Have you ever had that feeling of intimidation?"

Pilot on the PA, after a very heavy landing: Good morning ladies and Gentlemen, welcome to London...and if any of you were asleep...I'll bet you're not now.

"How on earth did you not see that baggage trolley?"

From the pilot during his welcome message: "We are pleased to have some of the best flight attendants in the industry. Unfortunately none of them are on this flight."

You know you've landed with the wheels up when it takes full power to taxi.

Helicopters don't fly. They beat the air into submission.

Flying is the second greatest thrill known to man...Landing is the first!

The only thing that scares me about flying is the drive to the airport.

Jetsets competition

BAE Systems would like to thank those that took the time to enter the competition in our last issue. Due to the number of replies it was decided to award three prizes. The prize winners were scattered round the world from mainland Australia, Tasmania and South Africa. Congratulations to the winners all of whom have now received their copy of Handling the Big Jets.

Remembering the forgotten mechanic

Those with long memories will recognise this poem from JETSETS published over 10 years ago. However, I feel that the guys/gals who look after our aircraft rarely get acknowledged, and this is in their memory.

Through the history of world aviation
Many names have come to the fore
Great deeds of the past on our memories will last
As they're joined by more and more.

When man first started his labour
In his quest to conquer the sky
He was designer, mechanic and pilot
And he built a machine that would fly.

The pilot was everyone's hero
He was brave, he was bold, he was grand
As he stood by his battered biplane
With his goggles and helmet in hand.

But for each of these flying heroes
There were thousands of little renown
And these were the men who
Worked on the planes
But kept their feet on the ground.

We all know the name of Lindbergh
And we've read of his flight into fame
But think, if you can, of his maintenance man
Can you remember his name?

And think of our wartime heroes
Garbeski, Jabara and Scott
Can you tell me the names of their crew chiefs?
A thousand to one you cannot.

So when you see mighty jet aircraft
As they mark their way through the air
Remember the grease-stained man
With the wrench in his hand
Is the man who put you up there.

FACT FILE REGIONAL AIRCRAFT IS RESPONSIBLE FOR THE WORLDWIDE SUPPORT OF APPROXIMATELY 900 AIRCRAFT