BAE Systems Regional Aircraft's Flight Safety magazine for its Jet and Turboprop fleets customers • March 2009

Turboprops and airframe ice

A recent incident highlights the importance of understanding icing conditions See page 04

JETSETS

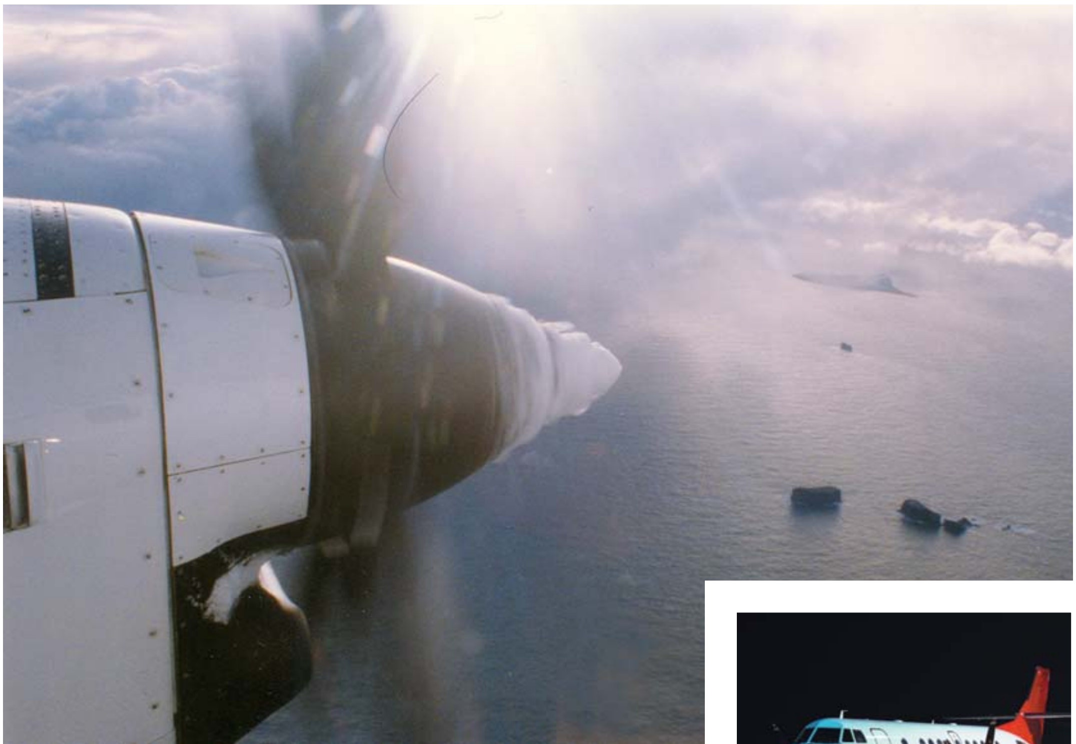
Do I stop or do I go?

Making the right decision for a rejected take-off Turn to page 06

A timely reminder

Jetstream 41 ice incident

Below is a report that we received from the UK Flight Safety Committee concerning a Jetstream 41. It is a timely reminder that even very wispy clouds can be full of ice, and thus dangerous.



Above and inset: a J41 encountered a temporary power loss incident due to ice

The report

During the cruise at FL 180, the aircraft had encountered occasional light icing from high level cloud that covered much of the flight planned route. Most of the sector had been in and out of IMC with little or no ice build-up, and only the occasional ice warning. The ice warning had not illuminated for some time and, now it was fully dark, visual clues to icing conditions were limited. The light density of the cloud provided little reflection from the strobes to indicate potential icing conditions. The crew noticed that the engine EGTs had dropped 30-50 degrees C without input to the power levers. This prompted a check of the wings via the ice observation light. Since there had been no cockpit ice warning, the Crew was surprised to find extensive, heavy rime ice over the wing leading edges and prop spinner. The "late selection of eng/prop ice protection" drill was carried out, starting with the LH engine. Both engines in turn suffered ice ingestion with RPM drop, followed by recovery. The RH engine slowed to about 12% before recovery, a cycle that took approximately 4 seconds. The monitoring of the engine panel was complicated by a double IEC failure which occurred when the first eng/prop ice protection selection was made. This confused the gauge scales and readings at a time when the indications were fluctuating due to power loss. Once engine power levels had returned to normal, the IEC's were reset, and the pax reassured that icing had been the cause of temporary power loss with a normal recovery now in progress. The power loss was not wholly unexpected considering the heavy icing, but nevertheless this was an anxious moment that served to remind us that winter is around the corner. With hindsight, we could have been more pro-active with monitoring for icing, given the forecast (a front moving south). But the accretion was unusually aggressive and rapid given the lack of clues both in and outside the cockpit. I wonder how complacent we have become, given the benign icing environment of this summer just gone. Perennial lessons are to be

CONTINUED ON PAGE 02

pwk_0424 Produced by the Graphics and Media Team, BAE Systems Regional Aircraft, Prestwick
Tel: 01292 675825 Email: ragraphics@baesystems.com

BAE SYSTEMS

Welcome>

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

This is the third issue of JETSETS that I have edited and we are looking for comment from you as to the content you would like to see in future issues. My contact address is at the end of this editorial, and I welcome any suggestions. One positive outcome has been the publication of one of the articles in FOCUS, the official publication of the UK Flight Safety Committee (UKFSC), and they have also indicated interest in publishing other articles in a future edition of FOCUS.

What feedback we've had shows that JETSETS has been well received, and to encourage more dialogue BAE Systems are introducing a competition, details of which can be found on page nine.

In this issue we have a report on a late selection of engine anti ice, and another article on turbo prop airframe icing. There is a discussion on attitude upsets which I hope is pertinent to all aircraft. We have a follow up article on oxygen masks; in researching flight deck use of these masks we were helped by members of the European Regional Airlines Association Safety Group and UKFSC who provided some of the responses.

At the last Operators Conference we were asked to provide tailscrape data for the 146/RJ. This was provided to all Operators, but the information has also been included in JETSETS.

Finally, having discussed landing overruns in the two previous issues, I have gone to the start of the flight and included a discussion on RTOs.

I do hope that you find JETSETS interesting, and would welcome any comment. As I said in the last editorial, this issue is available on the BAE Systems web site: (www.regional-services.com) as a complete edition, or as individual articles if you only want to read one aspect. The previous issues are also available although you will need to be registered to gain access to the portal. JETSETS is to be found by following the links: Services/Flight Safety/ Flight Safety Material.

Colin Wilcock
Product Integrity Pilot
colin.wilcock@baesystems.com

Flight Ops Support events calendar 2009

17th and 18th March	**Annual Flight Ops Conference** For our BAe146, Avro RJ and Turboprop Operators Western House Hotel and Ayr Racecourse near Prestwick. This conference covers Flight Ops Integrity, operational issues, performance software, fuel management, manuals and publications. It will be supported by Honeywell, European Aeronautical Group, navAero, and Oxford Aviation Academy.
7th, 8th & 9th April	**BAe 146 / Avro RJ Performance and Dispatch Course** BAE Systems, Prestwick.
Late April	**BAe 146 / Avro RJ Performance and Dispatch Course** Dubai, for all comers.
8th, 9th & 10th Sept	**BAe 146 / Avro RJ Performance and Dispatch Course** BAE Systems, Prestwick.

e-mail rafltops@baesystems.com for details of these events.

Jetstream 41 Ice Incident

FROM PAGE 01

re-learned here, not least that icing is difficult to predict and waiting to catch you out!

Feedback

The crew carried out the correct check list items and this solved the problem. Also, crews should consider using the weather radar even if the clouds do not show up as reflective, if there is ice on the nose of the aircraft this may show as an arc on the radar screen. Although this happened to a J41 crew it could occur to other types – the last sentence agrees with the old adage 'there are no new problems, just new people to have them'. For this reason it is important to learn for the mishaps of others.

'THERE ARE NO NEW PROBLEMS, JUST NEW PEOPLE TO HAVE THEM'

Contact details

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

Oxygen Masks - a follow up

In the last JETSETS there was an article which discussed the apparent reluctance by crews to don an oxygen mask. After this article had been published we contacted some operators to see what their experience had been. This led to sufficient feedback to allow some conclusions to be drawn.

Rather than us asking leading questions, the operators were encouraged to provide feedback from within their own experience and their replies were analysed. The feedback obtained covered personal experiences of smoke or fumes in the flight deck, discussions with the crews after such an event, and comments from those involved with training procedures or flight safety. The comments revolved around problems associated in donning masks, issues with procedures during such events, or communication problems. These comments broadly fell into either a mask design issue or issues which could be highlighted during training.

Mask and Goggle Design

There are two basic types of mask design: one in which there are two separate pieces consisting of a mask with separate goggles, and an all in one design. From the responses it would appear that the all in one design is less common in BAE Systems types, but it is both easier and quicker to don and is the more comfortable to wear of the two designs. Comments about the two piece design were that they are generally not liked by the crews due to being uncomfortable and crews were reluctant to remove them from their containers as they were difficult to restow. The donning of these masks would also appear to take longer mostly due to difficulties in putting on the masks and goggles with further complications with headsets, straps and spectacles (if the crew member wears them) all of which involves the eroding of precious time in a smoke or fumes event.

Above and inset: the two basic types of oxygen mask designs

Both types could become contaminated with tea, coffee or other liquids because of their location in the flight deck and so required frequent cleaning if they were to be hygienic to use. Perhaps they should be cleaned more often?

By far the most common response was that communication was difficult whilst wearing the mask. This could impede the crews` ability to communicate, especially if they were also carrying out emergency drills, and some crews said they were reluctant to use the PA because of the poor quality of the spoken word via the mask microphones. We did try contacting the mask manufacturers but, so far, have received no reply.

When To Don Masks

The Emergency and Abnormal Checklist calls for oxygen masks to be donned immediately in the event of smoke or fumes, or aircraft pressurisation problems. The instruction to don the mask is to prevent the incapacitation of the crew due to the inhalation of fumes, or onset of hypoxia, which may occur without any obvious symptoms to the crew. However, there were also some comments from operators which suggested that in some cases of smoke or fumes in the flight deck, for instance with an electrical component failure, the troubleshooting of the problem became more difficult as the sense of smell was removed due to the donning of the oxygen mask. Reluctance to don a mask may also be a factor if the crew believe that they know the source of the problem particularly if it is something which they may be familiar with, or they are not experiencing any symptoms.

Emphasis on Training

Many of the responses were from those involved with crew training or safety procedures so the feedback included first hand experience of watching crews use the masks. Training usually involves a clear cut case of smoke in the flight deck and the crews donning the oxygen masks, or an emphasis on the drills associated with a smoke or fumes situation. Some of the training in the past included “touch drills” where the crew would indicate the point at which they would put the mask on but not physically don it. Clearly not putting on the mask during training induces bad behaviour patterns.

The feedback shows that where there has been an emphasis on making the crews

CONTINUED ON PAGE 04

Oxygen masks - a follow up

FROM PAGE 03

put the mask on in order to become more familiar with its operation donning the mask becomes second nature in an emergency and also reduces the time taken to put the mask on.

Conclusion

To identify what guidance could be offered on this subject it was necessary to obtain first hand experience from operators, for which we are extremely grateful. The comments covered a wide range of reasons as to why there may be reluctance to don masks. However, the overwhelming agreement was that the greater risk would be the consequences of not donning an oxygen mask immediately.

Many of the problems mentioned in the study could be resolved for instance with the all in one masks, or with improved communications with the masks on, or by introducing more frequent training to allow the crews to become more familiar with the masks.

By highlighting these issues it is hoped that you can discuss the options available within your own organisation and that this will assist in making aircraft operations as safe as possible.

BAE Systems would still welcome any comment on the use of the masks. Comments can be sent to: rafltops@baesystems.com

Turboprops and airframe ice

As a follow up to the article in the last JETSETS where I discussed problems that had led to turboprop loss of control in ice, the Norwegian Accident Investigation Board have just issued a report that covers just such an incident.

During the climb, the crew of an ATR observed a build up of ice on the aircraft which was not an abnormal occurrence over the terrain in question. All de/anti-ice systems were on and working and there was no significant turbulence. The commander stated that they gradually went into heavy rain with large drops that spattered the front windshield (SAT was -10°C). He saw significant ice formation on the evidence probe outside his window, and assessed the icing as more or less the same as the worst case he had experienced in the course of his six years experience of flying this aircraft type. He stated that the ice built up extremely rapidly. The side windows iced up, while the inflatable rubber de-icing boots appeared to keep the leading edge of the wings free of ice. From the cockpit it was not possible to see whether there was ice further back on the upper and lower sides of the wing. Neither pilot remembered afterwards if they saw ice on the propeller spinners. The aircraft climbed more or less normally until passing about FL 125. After this the ability to climb deteriorated significantly, and when the approached FL 140 the climb was marginal. To maintain the climb the speed was reduced from 160 KIAS to 150 to 155 KIAS. The autopilot was in use in IAS mode. Minimum speed in 'standard' icing conditions for the relevant mass was 143 KIAS, and the crew were of the opinion that they had maintained a sufficient margin above this speed. The rate of climb did not improve, and the crew suspected mountain waves. The fasten seat belt sign was switched on. The aircraft had reached FL 140, but began to descend. PF put his hands on the stick and felt the stick shaker come on and, just before he could disconnect it, the autopilot disconnected automatically. PF believed that he remembered that the aileron miss trim warning light came on. A second or two after this the aircraft suddenly rolled uncommanded 45° right and 7 - 8° nose low. PF pushed the stick forward and selected full power. He struggled to regain control of the aircraft and tried to roll wings level. The aircraft rolled from right to left before it gradually rolled wings level. When the wings were level and the airspeed had reached

Above and inset: turboprop operators need to be aware of icing conditions that may cause heavy accretion which could exceed the capabilities of the ice protection systems

approximately 175 KIAS, PF pulled the stick back to arrest the descent. The crew estimated that they had lost just over 1,000 feet, and felt that the situation had been resolved. However, the aircraft then rolled left in a similar manner to the previous uncommanded roll. The same recovery procedure was again utilised – this time with no further upsets. A post incident review of the ATC tapes shows that the initial height loss was around 1,500 feet.

Following the accident that occurred to an ATR at Roselawn, Indiana (reported in the last issue of JETSETS), we added advice to our turbo prop manuals to cover freezing rain and unusual icing conditions. The advice given in all the manuals was similar, and is as follows:

Freezing rain, freezing drizzle and unusual icing conditions may cause heavy accretion which could exceed the capabilities of the ice protection systems. Such ice can also accrete on the unprotected surfaces. This ice cannot be shed and it may seriously degrade performance and control of the aircraft.

Above: an ATR 42 similar to the aircraft involved in the Roselawn accident

Prolonged operation in altitude bands where temperatures are near freezing and heavy moisture is visible on the windscreen, should be avoided.

If the aircraft exhibits airframe buffet onset, unexpected loss of speed, uncommanded roll or unusual roll control wheel forces, immediately reduce the angle of attack (AOA) and avoid excessive manoeuvring, until the airframe is clear of ice.

If ice is seen forming behind the protected surfaces, or unusual roll trim requirements or autopilot trim warnings are encountered, then:

- Leave icing conditions as soon as possible.
- If flap is extended, do not retract the flap until the airframe is clear of ice.
- Hold the control wheel firmly and disengage the autopilot (if in use).
- Increase the airspeed as much as configuration will allow, but not above V_{RA}.
- Do not engage the autopilot until the airframe is clear of ice.

Above: ice accretion on a J41 wing following a simulated failure of the airframe de-icing boots

Above: ice accretion on a J41 wing during normal operation of the airframe de-icing boots

Above: rime ice accretion on a J41 tail as seen during the aircraft's JAA certification programme

Recent incidents

146/RJ
An aircraft lost an over wing panel during flight. Following this it was decided to issue some guidance to assist crews in carrying out an in flight handling assessment. This was issued as FOSIL 146-RJ-010-08 at the end of October last year. Low Speed Handling advice was also issued, via FOSIL, for all our turboprops.

146/RJ
We have had two reports of difficulties in extracting the new Abnormal and Emergency Checklist from its holder. BAE Systems have issued an FCOM Bulletin on this subject.

ATP
During ground testing of the fire extinguisher switches an extinguisher was fired inadvertently. I am sure that you are all aware of the possibility of the plastic cover slipping so that if it is raised the lip on the back of the cover will depress the switch and discharge the extinguisher. These plastic covers need to be fully home, and not allowed to slip down towards the windscreen.

J41
An undercarriage trunion was found damaged on a Jetstream 41 although there had been no reported heavy landing. FOSIL Jetstream 41-014-08 was issued to amplify the advice in the MOM covering landings. This information will be put in the MOM at a later date

Do I stop or do I go?

Making the correct decision for a rejected take-off

Landing overruns have been discussed quite extensively in the past two issues of JETSETS, and I would now like to look at the other end of the flight – the take-off. As with landing overruns, each year rejected take-offs (RTOs) kill people and damage airframes.

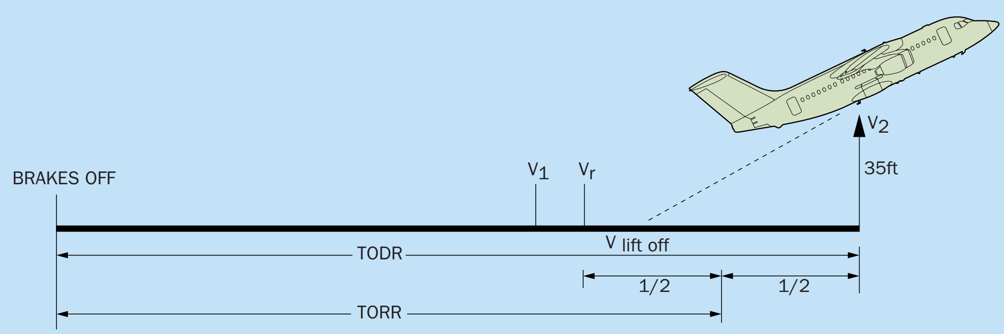
The aim of this article is to discuss some of the factors that you should consider before committing aviation in case the take-off results in an RTO. Each of us will have carried out RTOs in the simulator, but how many have carried out an actual RTO from V_1 on a limiting runway? Not many, I would hazard a guess, although several may have carried out RTOs at lower speeds say in response to a CONFIG Warning. Nevertheless your next take-off could end in an RTO! Historic data would indicate that you can expect to have to reject a take off about every five years on shorthaul.

During certification each manufacturer spends a lot of time, money and effort in trying to achieve the best figures they can to maximise the performance of their aircraft. The best efforts of the test pilots are then factored by the certifying authority to try and ensure that the performance is achievable by any pilot, and in aircraft that are no longer new. These are the performance figures that you see every day in the RTOW Tables, and these Tables are produced in various formats as required by each operator. In the main the Tables give the maximum weight (mass for the purists) that can be lifted from a runway given the actual OAT, pressure altitude and headwind. Most Tables will also show the various V speeds.

You may be familiar with most of the speeds, and how they are derived but, for those that may be a bit rusty, I will review them.

These speeds are a key element in enabling you to make decisions during the very dynamic situation of a failure during the take off roll, and V_1, V_R and V_2 will be very familiar to all of you. However, there are some other less well known V speeds as well.

V_{mcg} (minimum control speed on the ground). V_{mcg} is the minimum speed at which you will be able to control the aircraft (without reducing power on the live side) if an engine fails on the ground using rudder alone and a foot force that does not exceed 150 lbs (69 kg). This is to allow the take-off to be continued and the aircraft kept straight by use of rudder to oppose the asymmetric thrust from the live engine(s). The regulations allow for a 30 foot (9 m)

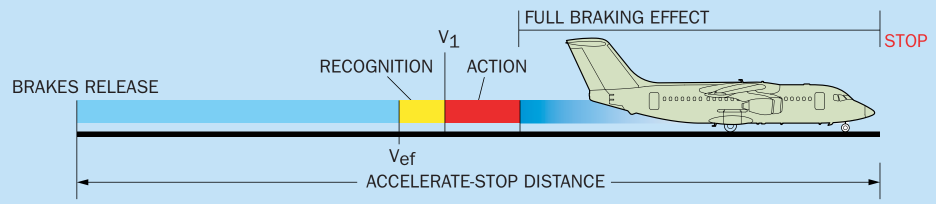


Take-off Distance Required (TODR)
Greater of
1.15 x distance to 35ft (all engines) or
1 x distance to 35ft (engine fail).

Take-off Runway Required (TORR)
Greater of
1.15 x distance to 1/2 airborne distance to 35ft (all engines) or
1 x distance to 1/2 airborne distance to 35ft (engine fail).

(JAR 25-113)

Above: TODR and TORR



Notes

- Start of distance is defined as brake release.
- Engine failure occurs at V_{ef}, rejected at V_1.
- Stop is made using brakes and ground idle with one engine failed.
- The interval between V_{ef} and V_1 accounts for the failure recognition and pilot's reaction to activate the first retarding device plus mandatory time delay (2 seconds).

(JAR 25-109)

Above: Accelerate Stop Distance Required (ASDR) - the distance to accelerate to V_1 and stop (engine failed)

lateral excursion after engine failure, and V_{mcg} is mainly dependent on the live engine(s) thrust. During the certification tests the nose wheel steering is not used, but it would be available to you (although it must be used with care as you may not have used it at high speed before).

V_{ef} (the speed at which an engine is assumed to fail). V_{ef} must not be lower than V_{mcg}

V_{mbe} (the maximum speed at which there is sufficient brake energy to stop the aircraft) V_1 must not exceed V_{mbe}

V_1 The maximum speed in the take-off at which the pilot must take the first action (e.g. apply brakes, reduce thrust, deploy speed brakes and spoilers) to reject the take-off. V_1 is also the minimum speed at which you can continue to take off following an engine failure. If the engine failure occurs after V_1 the take-off must be continued. This implies that the aircraft must be controllable on the ground following the engine failure.

So V_1 must be greater than V_{ef} plus the speed gained with the critical engine inoperative during the time interval between engine failure and pilot action (this is defined by the regulatory authorities as two seconds - not a lot of time for you to recognise the failure and react!).

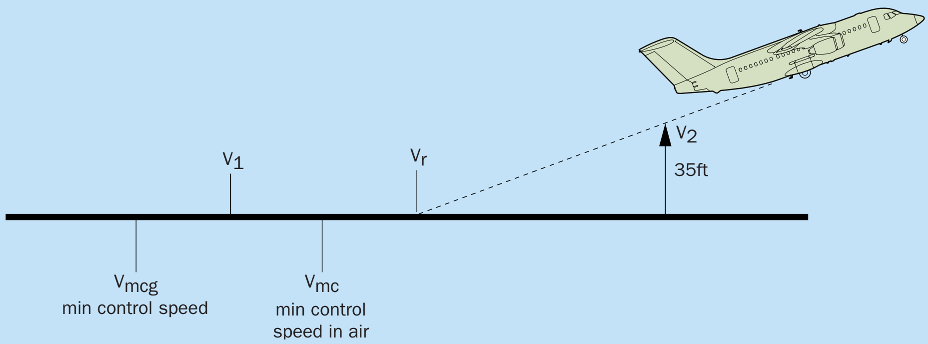
V_{mu} (Minimum unstick speed) V_{mu} is the speed at which the aircraft can safely lift-off the ground, and is found by dragging the tail on the runway for geometrically limited aircraft (You Tube contains some footage of V_{mu} tests with sparks coming from the tail of the test aircraft). The speed at which the aircraft first lifts off is V_{mu}, and therefore lift off is not possible before V_{mu}.

V_r (Rotation speed) V_r ensures that, in the event of an engine failure, lift off is possible and V_2 is reached at 35 feet V_r must also be greater than V_{mu}.

V_{mca} (minimum control speed in the air) V_{mca} is the speed at which, when the critical engine suddenly fails it is possible to maintain straight flight with an angle of bank not exceeding 5 deg and with rudder forces not exceeding 150 lbs (69kg). V_{mca} also may not exceed 1.2 V_{stall}

V_2 (Take-off safety speed) V_2 is the minimum speed that must be maintained up to acceleration altitude. By maintaining V_2 you ensure that the minimum climb gradient will be achieved, and the aircraft will be controllable. V_2 is always greater than V_{mca}.

In general all these speeds are not readily available to you, and so you must respect the speeds



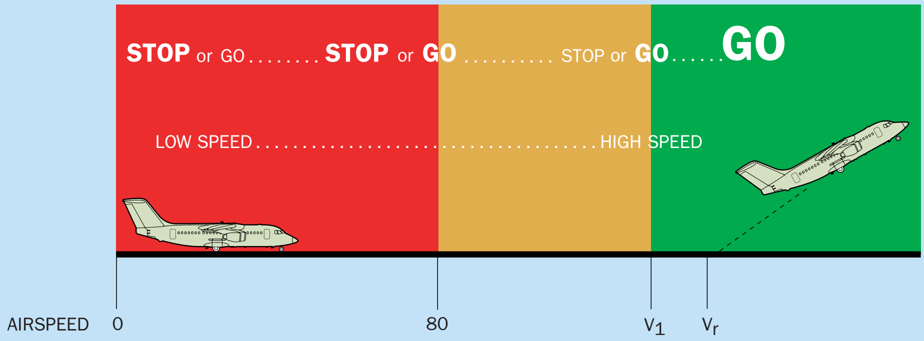
V_1 - Take-off Decision Speed, the maximum speed in the event of engine or other failure at which the pilot must take the first action to stop the aircraft. It is also the minimum speed following engine failure at which the take-off can be continued.
Minimum V1 is a speed such that V_{ef} is equal to V_{mcg}.
Maximum V_1 is a speed equal to V_R.

V_R - Rotation Speed, the target speed at which the pilot initiates a change of attitude of the aircraft with the intention of leaving the ground.
The minimum V_R that may be scheduled is not less than: a) V_1 b) 1.05 V_{mca}.

V_2 - Take-off Safety Speed, the minimum initial climb out speed one engine inoperative.
The minimum V_2 that may be scheduled is not less than: a) 1.10 V_{mca} b) 1.20 V_{ms}.
In addition V_2 shall not vary significantly from the speed at which the aircraft, being flown with the assumed operating technique, reaches a screen height of 35ft following engine failure.

(JAR 25-107)

Above: scheduled take-off speeds



This diagram illustrates the change from being ‘**stop minded**’ at low speed, where a stop will usually be called for any malfunction, to becoming ‘**go minded**’ as the aircraft accelerates, where a stop wlil only be called for a major malfunction such as engine failure.

Above: depiction of airspeed to develop ‘STOP or GO’ mindset

that you do have. For instance if you want to reduce V_1 you can only do so if it is allowed in your performance manual otherwise you could select inadvertently a V_1 lower than V_{mcg}.

Having discussed all the speeds, what other factors come into the equation? There are two factors that will help to ensure the success of an RTO. Firstly is the correct decision. By this I mean a timely decision by V_1. This usually involves a change from ‘stop minded’ to ‘go minded’ as V_1 is approached, and I used to signal this to myself when I was PF by removing my hand from the power levers at V_1. It is worth noting that all the testing and calculation assumes that an engine has failed: if this hasn't happened then there will be more thrust than was allowed for in the calculations; however, this should be absorbed in the safety factors that have been applied. Once the decision to stop has been made the stopping must be conducted with determination. During development testing the test pilot will apply full brake and use the nose wheel steering to assist directional control. When did you last experience full anti-skid action? Anti-skid operation feels harsh and snatchy - you will feel the brakes catching, and releasing as the system senses a skid. Full brake pressure will give you maximum

‘HISTORIC DATA WOULD INDICATE THAT YOU CAN EXPECT TO HAVE TO REJECT A TAKE-OFF ABOUT EVERY FIVE YEARS ON SHORTHAUL’

braking – make sure you really 'stand on the brakes'. On some aircraft this requires more foot movement than you might imagine, and so do take the opportunity, whilst stationary, to apply full brake pressure, and get a 'feel' for it. Do not attempt any form of cadence braking (i.e. you trying to cycle the brakes on and off by feel). Make sure that the engines are at the minimum setting and that any lift dump devices are extended. Following most RTOs you may be able to relax the braking as you reach a halt with runway remaining; on a limiting runway you will need to keep full brake until you reach the end of the runway and bring the aircraft to a halt (bear in mind that on some runways, stopway has been included in the calculation, and so you may roll over the actual runway onto this stopway). Your brakes will be hot – possibly too hot to taxi till they've cooled. The prop guys win here since they have large and effective brake fans on the front of any working engine.

It would seem that the vast majority of RTOs are initiated at speeds below 80 kt, and only a very small number are initiated at speeds above 120 kt. The overruns nearly always occur following a high speed (usually taken to be over 100 kts) RTO. So what is going to cause an RTO? I am sure that each operator has their own SOP, but the following will almost certainly be included:

- Engine failure, a CONFIG Warning, instructions from ATC, tyre failure, or systems warnings.

It is vital to keep an open mind as to the nature of the failure – don't automatically assume an engine failure (for instance, the yaw caused by a tyre burst in a crosswind might well feel like an engine failure). Anecdotal evidence shows that a large number of take-offs are continued successfully following an indication of aircraft system faults, but these often are not widely reported. Although such take-offs can result in diversion or delay the landings are usually uneventful.

Some of the lessons learnt over time include:

- Many of the RTO overruns were initiated from above V_1.
- RTOs on wet or snow/ice contaminated runways were more likely to lead to an overrun.
- Most RTOs do not involve the actual loss of an engine.
- A proportion of the overruns involved wheel or tyre failure.

Conclusion

A good understanding of the speeds involved in the take-off calculations and the factors affecting the aircraft's performance will help you in arriving at the correct decision. A good pre-take-off brief is essential in ensuring that everyone on the flight deck understands what is required, and what actions will be taken. Expect that you will have to carry out an RTO on every take-off so that you will be prepared in the event you actually do have a problem. Whether the decision is GO or STOP the correct actions must be carried out purposely with determination.

The illustration on page 8 is an attempt to illustrate the change over that should occur as the aircraft accelerates. Initially the decision is more weighted towards a STOP decision and as V1 is approached the decision becomes more weighted towards a GO.

Flight Operations Support Information Leaflets (FOSIL)

In the Recent Incident Section of JETSETS there is reference to FOSILs and so, by way of explanation, this short article introduces them.

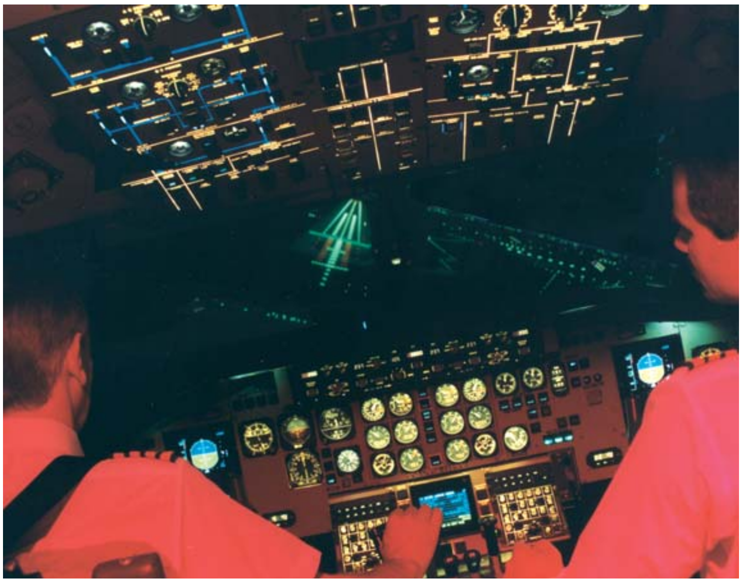
Flight Operations Support introduced the FOSIL about 18 months ago as a method of getting information to the senior pilot echelon of each of our Operators. FOSILs are sent out to all known Operators, usually to the Chief Pilot and Head of Training, via e-mail. However, we hope that this information is also passed to crews.

Information that needs to be seen by all crews is still published by way of Notices to Aircrew (or FCOM Bulletins for the 146/RJ) which go to all operators.

Abbreviations

AGL	Above Ground Level
AO	Angle Of Attack
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
CAA	Civil Aviation Authority
CAT	Clear Air Turbulence
cm	centimetre(s)
CONFIG	Configuration
CWP	Central Warning Panel
ECS	Environmental Control System
FCOM	Flight Crew Operating Manual
FDR	Flight Data Recorder
FL	Flight Level
FOSIL	Flight Operations Support Information Leaflet
ft	feet
hPa	hectopascals
IAS	Indicated Airspeed
IEC	Integrated Engine Computer
IMC	Instrument Meteorological Conditions
KIAS	Knots Indicated Airspeed
km	kilometre(s)
kt	Knot(s)
lbs	Pound(s)
LDA	Landing Distance Available
LDR	Landing Distance Required
m	metre(s)
MSA	Minimum Safe Altitude
MOM	Manufacturers Operations Manual
NTSB	National Transportation Safety Board (USA)
OAT	Outside Air Temperature
PF	Pilot Flying
PM	Pilot Monitoring
PNF	Pilot Non Flying (now PM – Pilot Monitoring)
psi	pounds per square inch
QRH	Quick Reference Handbook
RLW	Regulated Landing Weight
RPM	Revolutions Per Minute
RTO	Rejected Take-off
SOP	Standard Operating Procedure
VMC	Visual Meteorological Conditions

Don't get upset!



A reminder on upset recovery procedures

Every year there are reports of upsets that cause crews to lose control of their aircraft, and in some cases these upsets lead to fatal accidents. For many years there have been upset training programmes in use by various airlines. The FAA has a very comprehensive programme which covers an explanation of the causes and recovery as well as recommending simulator exercises. The FAA programme is available on their web site. This JETSETS article is intended to offer some discussion on upsets, and to offer advice on recovery from them.

Many of you may remember back to your basic training, and vaguely recall having to recover from unusual positions (some may say attitudes) whilst on instruments. This was usually part of your Instrument Rating training, was done on a relatively small aircraft, and you were prepared for the upset. However, there are stories in the aviation press that discuss upsets or loss of control incidents that have occurred to large transport aircraft, and generally the crews of these aircraft will have had little prior chance to practice recovery.

An upset is generally accepted to be where any of the following conditions occur unintentionally during flight:

- Pitch attitude of more than 25 degrees nose up.
- Pitch attitude of more than 10 degrees nose down.
- Bank angle of more than 45 degrees.
- Any flight within these parameters at airspeeds inappropriate for the conditions.

Above: high altitude engine failure on a China Airlines 747 resulted in a departure from controlled flight

Recovery from the upset will depend on the severity of the departure from normal flight, and the difficulty experienced by the crew will be exacerbated by surprise and disorientation. The upset is likely to have been initiated by one of three mechanisms.

Above: a TWA 727 suffered an upset involving a rolling decent

1 Environmentally Induced: Turbulence, CAT, mountain wave, windshear, thunderstorms, microburst, wake turbulence and airframe icing.

2 Systems Anomalies Induced: Flight Instrument failures, Autopilots or Flight Controls.

3 Pilot Induced Instrument: crosscheck, inattention and distraction from primary cockpit duties, vertigo and spatial disorientation, and incorrect use of aircraft automation.

If you think back to your flying training you may remember that a very early exercise that you were taught was recovery from a spiral dive. This would have been initiated by your instructor who would start a bank, and let the bank increase and the speed increase until at some stage he would give you control and tell you to recover. The recovery was:

- Power to idle.
- Roll wings level. Note: roll first and then:
- Pitch to straight and level flight.

You probably were also shown a recovery from a nose high situation in which you put the power on whilst rolling wings level.

This early training should give you a lead into upset recovery. The difficulties that will face you if an upset happens to you are the lack of familiarity with unusual positions, since you as airline pilots concentrate on providing a smooth service to your customers and do not usually see extreme attitudes, and the shock and disorientation you will experience. However, your early training will still help you to recover the situation. Of prime importance is the need to take time to assess the situation. You will probably have to rely on the attitude indicator unless you are lucky enough to be in VMC. What needs to be assessed is:

- Speed
- Pitch
- Bank Angle

Above: simulator exercises in recovery training are recommending by the FAA

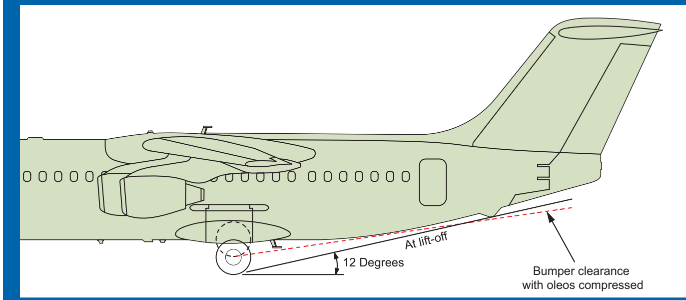
From your early training you know that if the speed is increasing you reduce power, and if it is reducing you increase power. In other words, correct energy management is very important. Therefore to recover from an upset:

- Analyse the situation, and confirm your analysis. If the auto pilot is engaged at this point you should leave it engaged until you've analysed the situation. If the autopilot is not engaged, or has disengaged or is malfunctioning, you should attempt to centralise the controls.
- Disengage autopilot and auto throttle.
- Adjust power as necessary (make sure that 'power on' is part of the stall recovery for your aircraft type as some types may have different procedures for recovery if the aircraft is stalled).
- Roll to wings level (it may be advantageous to apply a small amount of rudder to assist the roll, but do bear in mind that excessive rudder could cause a departure from controlled flight). Use the attitude indicator for rolling wings level (unless you are certain that it has failed) because your senses may well be giving you false information.
- Recover to straight and level flight – again on the attitude indicator.

There is an overriding consideration: an approach to the stall is controlled flight whereas an aircraft that has stalled is out of control and must be recovered. Therefore, if the aircraft has stalled, it will be necessary to recover from the stall before trying to initiate a recovery from the upset.

Unfortunately there is not one set of inputs which will recover every situation. Therefore your analysis of the upset is critical to regaining control of the aircraft, but by understanding the possibilities you will be better placed to recover to level flight. Upset incidents have occurred in the past such as the high altitude engine failure on the China Airlines 747 which resulted in departure from controlled flight. During the upset the aircraft lost about 30,000 feet and pulled around 5 g before control was regained and a safe landing made. A TWA 727 also suffered an upset involving a rolling descent (thought to be caused by a slat malfunction) through about 34,000 feet, very high speed (reportedly supersonic!) and g. Again the crew managed to land the aircraft safely. Closer to home one of our Jetstream 41s was subject to an upset, which involved a speed well in excess of Vmo and high g. This aircraft was also recovered by the crew. The message from all these events is:

Don't Give up - keep trying to recover the aircraft.



BAe 146 and AVRO RJ - limiting attitudes for take-off or landing

With the main oleos fully extended the limiting pitch attitudes for the 3 types are:

- 146-100/RJ70: a pitch attitude of 14° for aircraft fitted with tail bumpers, and 16° without the bumper fitted.
- 146-200/RJ85: a pitch attitude of 12° for aircraft fitted with tail bumpers, and 14° without the bumper fitted.
- 146-300/RJ100: a pitch attitude of 10° for aircraft fitted with tail bumpers, and 12° without the bumper fitted.

The tail bumper was removed from production aircraft after April 2004.

With the oleos compressed to the normal static value at maximum take-off weight the limiting pitch attitudes for the three types are:

- 146-100/RJ70: a pitch attitude of 9.7°.
- 146-200/RJ85: a pitch attitude of 8.3°.
- 146-300/RJ100: a pitch attitude of 6.9°.

Aircraft series	Extended oleos	Extended oleos with tail bumper	Compressed oleos
146-100/RJ70	16°	14°	9.7°
146-200/RJ85	14°	12°	8.3°
146-300/RJ100	12°	10°	6.9°

Jetsets competition

As a reward for reading this magazine, BAE Systems has decided to run a small competition. To allow time for everyone to get a chance to see the magazine the prize will be drawn in May. The prize will be a copy of David Davies book Handling the Big Jets. Although this book was published some time ago it is still considered to be a definitive text on the subject. The author was the Chief Test Pilot in the British Air Registration Board who were responsible for the certification of civil aircraft onto the British Register.
To win the book answer the following question:

What are the generally accepted conditions that would be classified as an upset?

The first 2 correct answers drawn on 1 May 2009 will each win a copy of Handling the Big Jets. Send your answer to rafltops@baesystems.com together with either a postal address or an e-mail contact.

Good Luck!

JETSNIPS

A light hearted look at the aviation industry

I'm a controller at an Air Traffic Control Centre. On a particularly rough day on the scopes...
C: American twenty-fortynine, turn right 30 for noise abatement.
P: AHHHH Center what kind of noise abatement can you have at Flight level 330???
C: The sound of two airliners smashing together...
P: Roger, we're turning 30 right... expediting

It's best to keep the pointed end going forward as much as possible.

The entrance to the cockpit of this aircraft is most difficult. It should have been made impossible.
- Flight Journal magazine, April 2000, regards the XF10F-1, Grumman's first attempt at a swing wing fighter.

Why I want to be a pilot

- When I grow up I want to be a pilot because it's a fun job and easy to do. That's why there are so many pilots flying around these days.
- Pilots don't need much school. They just have to learn to read numbers so they can read their instruments.
- I guess they should be able to read a road map, too.
- Pilots should be brave so they won't get scared if its foggy and they can't see, or if a wing or motor falls off.
- Pilots have to have good eyes to see through the clouds, and they can't be afraid of thunder or lightning because they are much closer to them than we are.
- The salary pilots make is another thing I like. They make more money than they know what to do with. This is because most people think that flying a plane is dangerous, except pilots don't because they know how easy it is.
- I hope I don't get airsick because I get carsick and if I get airsick, I couldn't be a pilot and then I would have to go to work.

Purported to have been written by a fifth grade student at Jefferson School, Beaufort, SC. It was first published in the South Carolina Aviation News.

ATP high flight

Oh! I have slipped the surly bonds of gate times
And held rigid by impossible air traffic controllers;
Upward I've climbed and joined the congested skies
Of fixes, missed approaches and done hundred things
My passenger did not care for — delays, turbulence, and held
In the holding pattern low on fuel. Waiting there,
I've chased the schedules, and flung
Myself against management and union rules.
Up, up the long ascent in seniority list.
I've topped and gone to the next aircraft
Hoping that I do not get furloughed.
And, while with worried mind I've trod
The difficult sanctity of regulation,
Waiting for the FAA inspector who is God.

Brian Caver, in honour of Phillip Valente,
Captain American Eagle Airlines

‘BOTH OPTIMISTS AND PESSIMISTS CONTRIBUTE TO THE SOCIETY. THE OPTIMIST INVENTS THE AEROPLANE, THE PESSIMIST THE PARACHUTE’

George Bernard Shaw

Pilot - “Folks, we have reached our cruising altitude now, so I am going to switch the seat belt sign off. Feel free to move about as you wish, but please stay inside the plane till we land…it's a bit cold outside, and if you walk on the wings it affects the flight pattern.”

Any landing you can walk away from is a good one. It's a bonus if you can also use the aircraft again.

Cartoons: Derek Paul, Graphics and Media, Prestwick

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