SAFETY BEHAVIOUR, PROCEDURES & KNOWLEDGE

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SAFETY BEHAVIOUR - THE CONTEXT

- 30 years of some dramatic (and essential) reductions in accident rates
- Attributable particularly to improvements in aircraft and airspace management system design and reliability and to leveraging this progress, especially the rise of task automaton, to deliver better and more consistent outputs on the front line.
- This essential consistency has been supported through a rapid growth in **standard procedures.**
- Standardisation in the flight deck has been especially helped by aircraft manufacturers recognising that it was in their own interests to give more guidance on how their products were operated and by regulators and operators recognising that deviation from this was now rarely justified.
- Safety Behaviour requires that these procedures are appropriately defined and trained and that compliance follows. There is room for improvement in both.

SAFETY BEHAVIOUR AND PROCEDURES

Procedures help deliver Safety Behaviour when:

- They are founded on and supported by skills, rules and knowledge
- They are not enforced by a ‘compliance culture’ alone
- They are presented and trained in relation to their likely frequency of use
- The emphasis on them does not interfere with informed judgements in situations which their formulation has not foreseen
- Compliance by one pilot (and where applicable) controller is effectively monitored by the other

Procedures are vulnerable to

- inappropriate adaptation in the presence of an increase in perceived or actual workload
- the influence of a “can do” mentality
- A lack of continued validity unless problems in their use with no ‘visible’ consequence are not detected

SOME PROBLEMS WITH PROCEDURES

Availability

- Absence of an appropriate or useful procedure
- Inappropriate form of procedures (checklist/text, memory/non memory)
- Specification
- Clarity of presentation
- Delivery of access - on screen or hard copy or both
- Unnecessary procedures

Use

- Passive, marginal or overlooked non compliance -
- Active and significant violation without justification with or without direct intent
- Correctly selected procedure then not properly followed or not completed

WHAT CAN POSSIBLY GO WRONG?

- Now for some examples of in service aircraft operation events deemed to have involved sufficient loss of safety to require independent investigation and where procedures have been part of the picture.
- They are not a representative set and for simplicity ignore the potential compliance effects of both variable flight crew monitoring effectiveness and variable pilot experience.
- All the aircraft operators involved are of flag carrier status or are reputable regional carriers and the lessons to be learned about the role of procedures are transferable.
- Most but not all involve flight deck procedures. More detail on all of them can be found in the SKYbrary Accident and Incident Library.

UNSTABILISED APPROACH

Airbus A340-300 Paris CDG France 2012

A Cat 3 auto-ILS approach with LVP in force was continued on a ‘we can recover this’ basis above the ILS GS until 2nm out when, still at 2500 feet aal, the ILS GS mode engaged a false upper lobe of about 10° causing a rapid pitch up and airspeed loss during which control was almost lost. After further confusion, a go-around was eventually initiated and the remainder of the flight was completed uneventfully. Universally rigorous Cat 3 procedures were ignored by the crew.

LANDING GEAR NOT DOWN

Boeing 767-300 Warsaw Poland 2011

A gear up landing resulting in an emergency evacuation, fire and hull loss was made after the crew could not lower the gear using either the alternate or free fall method, necessary after an earlier single system hydraulic failure. When following applicable procedures, the crew had failed to notice that a CB which controlled power to the uplock release mechanism was tripped and had also not recognised the lack of uplock release as common to the freefall case.

INTERSECTION TAKEOFF

Airbus A320 Basle Switzerland 2014

The takeoff was hurriedly commenced from an intersection using the reduced thrust intended for the originally-expected full length takeoff. After observing the end of the runway approaching, TOGA thrust got the aircraft airborne. The investigation concluded that a rejected takeoff from high speed would have resulted in an overrun and faulted the Operator's related pre-departure crew procedures which were subsequently amended.

FIRE ON THE GROUND

Boeing 767-300 Chicago O'Hare USA 2016

Debris from an uncontained engine failure during the takeoff roll damaged one wing and started a fuel-fed fire. A high speed rejected take off was followed by an emergency evacuation which was delayed by the absence of a specific ground fire emergency procedure for the flight crew which in turn delayed their evacuation command. Cabin crew non-adherence to procedure when they ordered the evacuation led to the only significant injury.

NEED FOR GROUND DE-ANTI ICING

ATR 72-200 Manchester UK 2015

Difficulty in maintaining controlled flight in pitch due to ice contamination of the horizontal tailplane upper surface led to a diversion. The flight was found to have been the only one departing from Manchester that morning without prior de/anti-icing. Its flight crew had limited experience of pre flight icing and judged it unnecessary despite the observed presence of frozen deposits on the airframe.

TAKEOFF PERFORMANCE

Boeing 737-800 Belfast UK 2017

During takeoff with the expected top-of-climb temperature entered into the FMS instead of the actual ground temperature, acceleration was less than expected but take off was continued. Once airborne, only a very shallow angle climb was possible. Having gained only 220 feet after almost a mile, engine thrust was increased and a normal climb followed. It was shown that a rejected takeoff could have been safely accomplished. A 2014 Boeing FMS software update which prevents this error occurring had not been mandated and was not installed.

OBSTRUCTION AHEAD DURING TAKE OFF

Airbus A330-200 Madrid Spain 2014

After seeing non-runway lights ahead during a night takeoff and being told by the TWR controller that they were unaware of anything on the runway, the crew continued the takeoff. An unlit vehicle whose driver had only realised he was lost when seeing the lights of an approaching aircraft was subsequently passed at the side of the runway. Operator SOPs were subsequently amended to mandate an immediate rejected takeoff should there be any possibility of an obstruction ahead.

INADEQUATE APPROACH PROCEDURES

A320 Halifax Canada 2015

A night non-precision approach was continued below MDA with inadequate visual reference and without the mandated autopilot disconnection. An undershoot which destroyed the aircraft followed without fatalities. Contrary to Company and Airbus Manuals, crew SOPs did not require monitoring the approach against the required vertical profile nor did the Company Manual specify that required visual reference at MDA should be sufficient to complete a landing. There was no regulatory consideration of installed approach lighting when approving an MDA and the actual lighting intensity did not comply with applicable ANSP procedures

LOSS OF PREVIOUSLY-ACQUIRED VISUAL REFERENCE BELOW DA

A330-200 Jakarta Indonesia 2013

After obtaining the required visual reference from a Cat 1 ILS approach, the PF Captain then lost it in very heavy rain below 100 feet agl, although the First Officer did not. A go around was neither called nor flown and touchdown occurred with the left main gear on the grass where it remained for 500 metres before the runway was fully regained. Prevailing Operator SOPs clearly required that a go around should have been flown when the PF lost visual reference.

COMMUNICATION OF LOW FUEL STATUS

Airbus A319 Santiago de Compostela Spain 2016

Whilst on diversion to the first alternate after a weather-related go-around at destination, ATC advised that it was no longer available due to lack of parking capacity and the aircraft was obliged to continue to its second alternate where it arrived with less than Final Reserve fuel. Contrary to Operator SOPs, the crew did not make a timely declaration of their low fuel status ahead of the eventual MAYDAY. Had they done so, special arrangements could have been made to accept the aircraft at the first alternate.

TCAS RA IGNORED

2 Boeing 757-200s north of Tenerife Spain 2011

Whilst descending at a high rate whilst following an incorrect ATC clearance, a 757 crew ignored a ‘CLIMB’ RA against another 757 ahead, below and on a converging track which had simultaneously received and complied with a ‘DESCEND’ RA. The two aircraft came within 0.9nm of each other as the first approached and passed through the same level, reportedly with visual contact. Controller error in respect of the first aircraft clearance was attributed to insufficient knowledge of radar display system faults.

FAILURE TO FOLLOW AN EGPWS ‘PULL UP’ WARNING

Bombardier DHC8-300 Adelaide Australia 2015

The selected FD modes dropped out during an RNAV approach and were reselected without the required cross checking and the approach was then continued which was also contrary to Operator SOPs. An EGPWS ‘PULL UP’ Warning occurred but was assessed as “spurious” and a go around rather than the mandated EGPWS response was flown. It was found that the PULL UP Warning was valid and due to an obstruction ahead and that a below-profile descent had occurred after VS rather than VNAV was engaged.

WEATHER RISK AVOIDANCE (VMC)

En Route Indonesia Airbus A330-200 2016

When a convective cloud formation described by the crew afterwards as ‘cumulus cloud’ but actually an isolated highly active thunderstorm cell was observed visually at FL390, a precautionary securing of the cabin was considered unnecessary but after the storm was not avoided by a sufficient margin, severe clear air turbulence occurred and multiple occupants were injured, seven seriously, with cabin fittings and equipment also damaged. The absence of proactive risk management procedures at the Operator was noted.

WEATHER RISK AVOIDANCE (IMC)

En route Alaska USA Boeing 777-300 2015

After deciding to follow a similar track to a preceding Company aircraft through an area of forecast moderate to severe jet stream turbulence, severe CAT lasting 7½ minutes occurred causing multiple occupant injuries including one serious, as well as a partial air conditioning failure subsequently attributed to maintenance error. The affected aircraft was 6000 feet below the one ahead which had been in the troposphere and thus clear of jet stream-generated mountain wave conditions, a distinction not covered by Company pilot and dispatcher training.

APPRECIATION OF RISK

En route North east USA Embraer ERJ 190 2016

After a major electrical system failure soon after reaching cruise altitude, ATC were advised of problems and a descent to enable the APU to be started was made. This action restored most of the lost systems and the crew, not having declared an emergency, elected to complete their international flight. Liquid contamination was found to have affected an underfloor avionics bay causing a complete loss of normal electrical power for almost 15 minutes during which an avionics bay fire had occurred without crew awareness because the smoke detection and air recirculation systems had been unpowered.

HOLD LOADING

ATR 72-600 Dublin Ireland 2016

Unusual handling when airborne led the crew to suspect their aircraft was unduly tail heavy. After flight they found that all items for the forward hold had been loaded in the aft hold despite the load and trim sheet showing the opposite resulting in the aircraft being outside its permitted flight envelope for all phases of flight. The ground handling contractor's departure supervisor had failed to confirm that hold loading had been completed as instructed and the Operator subsequently made multiple changes to their required procedures.

GROUND DE/ANTI ICING

Avro RJ100 Gothenburg Sweden 2016

Severe airframe vibrations a few minutes after takeoff following ground de icing prompted an uneventful emergency return. Significant quantities of ice not removed by the de-icing operation were found and deemed causal. Existing treatment procedures had not been fully applied by the contractor and the Operator had neither checked, evaluated and controlled the contractor's working methods nor adequately specified post-treatment inspection procedures. Routine pressure to achieve on-time departures also found to have been contributory.

TAXIING OFF STAND

Airbus A320 Ibiza Spain 2016

Whilst making a night departure, the clearly-specified and ground-marked self-positioning left turn exit from a regularly used gate was not followed and the right wing tip collided with the airbridge damaging both it and the aircraft. The manoeuvre had been attempted using the only the left engine for the Operator's normal 'one engine taxi departure' procedure. There had been difficulty with ground crew/flight crew communications and the potential difficulty of making the required turn using the inside engine appeared to have been overlooked.

CONTAMINATED FUEL

Airbus A330-300 Hong Kong 2010

After salt water-contaminated fuel had been uplifted from an airport where the hydrant fuel system was being extended, difficulties emerged en route in controlling the thrust of both engines. One had to be shut down and thrust on the other could not be reduced for approach and landing. A skilful high speed landing prevented an overrun but a landing gear fire prompted an emergency evacuation with injuries.

Sometimes knowledge-based judgement alone replaces procedural solutions……

SOME SAFETY BEHAVIOUR OBJECTIVES FOR PROCEDURES

- Greater awareness of procedure issues through actively seeking relevant lessons which may be available from the experiences of other entities.
- Sufficient corporate awareness of activity to be able to internally identify the potential need for new or altered procedures without relying solely on events with significant outcomes.
- Improved rates of procedural compliance by ensuring that users have a full understanding of the reason for them.
- A transparent process which can be used to determine whether procedures should be specified and if so how they should be presented/accessed.
- A method which ensures effective validation of both existing and new procedures and justifies their text/checklist format and memory or reference recall status.

SAFETY IMPROVEMENT STRATEGIES FOR PROCEDURES

The right procedures

Just enough but not too many procedures each presented in the most appropriate format requires that they are established and maintained using objective methods which are compatible with the level of automation within which they will be used.

A Corporate Culture which supports decision-maker awareness

Proactive Safety depends on every employee being confident that safety reporting extending to events and perceived but unaddressed risks which do not have otherwise detectable outcomes is welcome.

A comprehensive user understanding of 'their' procedures

Procedural Compliance should be supported by ensuring that all those who use them are fully aware of why they exist and why they are formulated in the way they are - more classroom time may be required.