Level Bust Briefing Notes
Aircraft Operators

OPS 6
Human Factors

1. Introduction

1.1. Human factors identified in level bust incidents (including accidents resulting from level busts) should be used to assess a company's risk exposure and develop corresponding company accident-prevention strategies, or to assess an individual's risk exposure and develop corresponding personal lines of defence.

1.2. Whether involving crew, air traffic control, maintenance, organisational factors or aircraft design, each link of the error chain involves human beings and, therefore, human decisions and behaviour.

2. Statistical Data

2.1. Human error is involved to a greater or lesser extent in all aviation accidents, whether predominately due to operational or technical causes.

3. Human Factors Issues

Standard Operating Procedures (SOPs)

3.1. Following SOPs and normal checklists is an important defence against human error.

3.2. Pilots sometimes deviate intentionally from SOPs; some deviations occur because the procedure that was followed in place of the SOP seemed to be appropriate for the prevailing situation. Other deviations are usually unintentional.

3.3. The following factors are often cited in discussing deviations from SOPs:

(a) Task Saturation;

(b) Inadequate knowledge or failure to understand the rule, procedure or action because of:

– Inadequate training;

– Printed information not easily understood; and/or,

– Perception that a procedure is inappropriate;

(c) Insufficient emphasis on adherence to SOPs during transition training and recurrent training;

(d) Inadequate vigilance (fatigue);

(e) Interruptions (e.g. because of pilot-controller communications);

(f) Distractions (e.g. because of flight deck activities;

(g) Incorrect management of priorities (lack of decision-making model for time-critical situations);

(h) Reduced attention (tunnel vision) in abnormal conditions or high-workload conditions;

(i) Incorrect crew resource management (CRM) techniques (for crew co-ordination, cross-check and backup);

(j) Complacency; and/or,

(k) Overconfidence.

Automation

3.4. Errors in using flight guidance systems (FGSs) and insufficient knowledge of FGS operation have been contributing factors in level bust incidents, including controlled flight into terrain (CFIT) accidents.

3.5. The following are some of the more common errors in using FGSs:

(a) Incorrect altitude entry and failure to confirm the entry on the primary flight display (PFD);

(b) Entering a target altitude that is lower than the final approach intercept altitude during approach;

(c) Inadvertent selection of an incorrect mode;

(d) Failure to verify the selected mode by reference to the flight-mode annunciator (FMA);

(e) Failure to arm a mode (e.g. failure to arm the approach mode) at the correct time;

(f) Inadvertent change of target entry (e.g. changing the target heading instead of entering a new altitude); and/or,

(g) Failure to monitor automation and cross-check parameters with raw data.

3.6. Other frequent causal factors in level busts include:

(a) Incorrect interaction with automation;

(b) Over-reliance on automation; and/or,

(c) Inadequate effective crew co-ordination, cross-check and backup.

Briefing Techniques

3.7. The importance of briefing techniques is often underestimated, although effective briefings enhance crew standardisation and communication.

3.8. Routine and formal repetition of the same information on each flight may be counterproductive; adapting and expanding the briefing by highlighting the special aspects of the procedure to be flown, or the actual weather conditions, will result in more effective briefings;

3.9. In short, the briefing should attract the attention of the pilot not flying (PNF) (pilot monitoring).

3.10. The briefing should help the pilot flying (PF) and the PNF to know the sequence of events and actions, as well as the special threats and circumstances of the procedure.

3.11. An interactive briefing style provides the PF and the PNF with an opportunity to fulfil two important goals of the briefing:

(a) To correct each other; and

(b) To share a common mental image of the procedure.

Crew-ATC Communication

3.12. Effective communication is achieved when our intellectual process for interpreting the information contained in a message accommodates the message being received.

3.13. This process can be summarised as follows:

(a) How do we perceive the message?

(b) How do we reconstruct the information contained in the message?

(c) How do we link the information to an objective or to an expectation?

(d) What amount of bias is introduced in this process?

3.14. CRM highlights the relevance of the context and the expectations in communication.

3.15. The following factors may adversely affect the understanding of communications:

(a) High workload;

(b) Fatigue;

(c) Interruptions;

(d) Distractions; and/or,

(e) Conflicts and pressures.

3.16. The results may include:

(a) Incomplete communication;

(b) Omission of the aircraft callsign or use of an incorrect callsign;

(c) Use of non-standard phraseology; and,

(d) Failure to listen and respond.

3.17. Just as the use of non-standard phraseology can affect the understanding of communications, the insistence on standard phraseology in high-stress situations makes a positive contribution to the elimination of error.

Crew Communication

3.18. Interruptions and distractions on the flight deck break the flow pattern of ongoing activities, such as:

(a) SOPs;

(b) Normal checklists;

(c) Communication (listening, processing, responding);

(d) Monitoring tasks; and,

(e) Problem-solving activities.

3.19. The diverted attention resulting from the interruption or distraction usually causes the flight crew to feel rushed and to be confronted with competing tasks.

3.20. Moreover, when confronted with concurrent task demands, the natural human tendency is to perform one task to the detriment of another.

3.21. Unless mitigated by adequate techniques to set priorities, interruptions and distractions may result in:

(a) Not monitoring the flight path;

(b) Missing or misinterpreting an ATC instruction;

(c) Omitting an action and failing to detect and correct the resulting abnormal condition or configuration; and,

(d) Leaving uncertainties unresolved.

3.22. All these errors have the potential to result in a level bust, perhaps leading to an Airprox, mid-air collision or controlled flight into terrain (as well as other possible undesirable outcomes).

Altimeter Pressure Setting Error

3.23. An incorrect altimeter pressure setting is often the result of one or more of the following factors:

(a) High workload;

(b) Incorrect pilot-system interface;

(c) Incorrect pilot-controller communication;

(d) Deviation from normal task-sharing;

(e) Interruptions and distractions; and/or,

(f) Insufficient backup between crewmembers.

3.24. Adherence to the defined task-sharing (for normal conditions and abnormal conditions) and use of normal checklists and SOPs are the most effective lines of defence against altimeter-setting errors.

4. Summary

4.1. Addressing human factors in level bust incidents must include:

(a) Defined company safety culture;

(b) Defined company safety policies;

(c) Company accident prevention strategies;

(d) SOPs;

(e) CRM practices; and,

(f) Personal lines of defence.

5. Resources

Other Level Bust Briefing Notes

5.1. The following Level Bust Toolkit Briefing Notes contain information to supplement this discussion:

GEN 2 – Pilot-Controller Communications;

OPS 1 – Standard Operating Procedures;

OPS 2 – Altimeter Setting Procedures;

OPS 3 – Standard Calls;

OPS 4 – Aircraft Technical Equipment;

OPS 5 – Airborne Collision Avoidance Systems;

ATM 2 – Reducing Level Busts.

Access to Resources

5.2. Most of the resources listed may be accessed free of charge from the Internet. Exceptions are:

ICAO documents, which may be purchased direct from *ICAO*;

Certain Flight Safety Foundation (FSF) Documents, which may be purchased direct from *FSF*;

Certain documents produced by the Joint Aviation Authorities, which may be purchased from *JAA*.

Regulatory References

5.3. Documents produced by regulatory authorities such as ICAO, JAA and national aviation authorities are subject to amendment. Reference should be made to the current version of the document to establish the effect of any subsequent amendment.

ICAO – Annex 6 – Operation of Aircraft, Part I – International Commercial Air transport – Aeroplanes;

ICAO Doc. 8168 – Procedures for Air Navigation services. Aircraft Operations (PANS-OPS). Volume 1: Flight Procedures;

ICAO Doc. 9376 – Preparation of an Operations Manual;

ICAO Doc. 9683 – Human Factors Manual;

JAR-OPS 1.943, 1.945, 1.955 and 1.965 and associated ACJs and IEMs concerning Crew Resource Management;

JAR-OPS 1.1045 and associated Appendix 1 – Operations Manuals – structure and contents.

Training Material

FSF Approach and Landing Accident Reduction (ALAR) Toolkit Briefing Note 2.1 – Human Factors;

FSF Human Factors and Aviation Medecine 5/93 – Hurry-up Syndrome

Training Material – Posters

Level Bust Prevention posters produced by the UK CAA:

2 Many Things

Low QNH – High Risk

No Rush – No Mistake

Wun Wun Zero.

Incident Reports

FSF Accident Prevention 4/98 – Boeing 737 Pilot Flying Selects Incorrect Altitude in Holding Pattern

Norwegian Air Accident Investigation Branch Report 17/2002 – Violation of Separation Minima due to Level Bust;

UK CAA Flight Operations Department Communication – 12/2003 – Airprox Report 105/02 – TCAS Incident – Level Bust.

Other References

FSF Digest 6/93 – Common Errors behind Altitude Deviation;

Proceedings of the Royal Aeronautical Society – Human errors that contribute to Altitude Deviations;

UK CAA CAP 710 – On the Level & Recommendations;

UK CAA CAP719: Fundamental Human Factor Concepts.

This briefing note has been prepared by the Safety Improvement Sub-Group (SISG) of EUROCONTROL to help prevent level busts. It is one of 14 briefing notes that form a fundamental part of the European Air Traffic Management (EATM) Level Bust Toolkit.

The authors acknowledge the assistance given by many sources, particularly Airbus Industrie and the Flight Safety Foundation (FSF),

in developing these notes, some of which draw on material contained in the

FSF Approach and Landing Accident Reduction (ALAR) Toolkit.