Level Bust Briefing Notes
Air Traffic Management

ATM 2
Reducing Level Busts

1. Introduction

1.1. This briefing note is intended to address matters in which the air traffic controller can make a positive, sometimes proactive, contribution to level bust prevention.

1.2. The purpose of briefing note ATM 1 was to explain the problems experienced by pilots, which may lead to a level bust. In contrast, this briefing note concentrates on issues affecting the performance of the controller.

1.3. Three situations exist:

(a) The pilot deviates from his flight clearance due to misunderstanding of his clearance;

(b) The pilot understands his clearance but nevertheless deviates from it; and,

(c) The controller issues a late re-clearance; the pilot cannot comply with the re-clearance in time and overshoots the re-cleared level.

1.4. In the first of these situations, the normal cross-checking process between pilots may have broken down. Alternatively, the controller may have expressed the clearance in an ambiguous way so that pilot(s) misunderstand his intentions. The controller has an opportunity to prevent a level bust by application of the readback/hearback procedure, although she/he will not be aware if the pilot places a wrong interpretation on a correctly read back clearance.

1.5. In the second situation, it is the responsibility of the pilot not flying (PNF) (pilot monitoring) to monitor the actions of the pilot flying (PF), and this may allow her/ him to prevent a level bust.

1.6. In both the first and second situations, the controller may be able to monitor the actions of the pilots if his work-load permits, while the short term conflict alert (STCA) and airborne collision avoidance system (ACAS) may provide a safety net.

1.7. The third of these situations can only be avoided by issuing re-clearances in sufficient time to allow the pilot to comply.

2. Pilot Misunderstanding of Clearance

2.1. A pilot may misunderstand his clearance for a number of reasons, such as lack of familiarity with the English language. The controller can reduce the chance of misunderstanding by:

(a) The way in which the message is transmitted; and by,

(b) The way in which the readback is checked.

2.2. Use of standard phraseology is of the utmost importance in ensuring that the message is clearly understood. Non-standard phraseology should never be used.

2.3. Transmitting the message in a way that is clearly understood by the pilot involves several steps[1]:

(a) Avoid the use of colloquial[2] language (particularly important when the pilots are clearly not strong English speakers);

(b) Adjust the pace of the transmission (a slow pace may be appropriate if the pilot appears to have poor familiarity with the English language);

(c) Limit the length of messages (lengthy clearances should be broken down into manageable chunks);

(d) Choose wording carefully so that numerical terms are not confused (e.g. heading and flight level);

2.4. When using expressions where a word may be confused with a number (e.g. “descend to

[1] For detailed discussion of communications see Briefing Note GEN 2 – Pilot-Controller Communications.

[2] Colloquial language is the every day informal language used by native speakers.

flight level […]", be aware that the word "to" may be interpreted as the number 2);

(a) Choose wording carefully so that an incorrect meaning is unlikely to be inferred (e.g. when passing a clearance including an expressions such as "Expect FL 250", repeat the cleared level afterwards (e.g. "Report reaching FL 210");

(b) Avoid reference to the level of conflicting traffic (this may be mis-interpreted as clearance to continue to climb [or descend] to the level of the conflicting traffic);

(c) Restate the assigned level on first contact with an aircraft. Some level busts are caused by pilots climbing directly to their requested cruise level when on an SID;

(d) Minimise opportunity for callsign confusion (use full callsign on first contact and whenever similar callsigns increase the chance of callsign confusion).

2.5. Correct readback of clearances is vital to avoidance of misunderstanding. Expressions such as "Roger" or "Copied" are not satisfactory substitutes for a full readback.

2.6. Correct readback checking involves several steps, none of which should be omitted:

(a) Listen carefully to the callsign used to ensure readback is from intended message recipient;

(b) Check to ensure that the readback content is the same as the message transmitted (the controller may detect from his choice of words that a pilot has misunderstood his clearance, e.g. confused heading with flight level);

(c) Check to ensure that the readback is complete (all elements of a clearance must be read back correctly);

(d) Request further readback in case of doubt (or repeat the uncertain part of the clearance) until confident that the message has been correctly understood.

3. Monitoring Aircraft Flight-path

3.1. The controller has no way of knowing if, after a correct readback, a pilot has misunderstood his clearance or is likely to deviate from it (e.g. because he has mis-set aircraft equipment).

3.2. The controller can reduce the incidence of level busts by monitoring the flight path of aircraft under his control to the extent that his work-load permits.

3.3. A busy controller cannot be expected to monitor continuously the progress of all flights under his control. Some form of prioritisation is usually necessary, and experienced controllers often do this subconsciously.

3.4. The controller will already have mentally sorted flights under his control into those which are "in conflict" and those which are "not in conflict"[3] and will have taken action to resolve any conflict by instructing the pilot to change level, direction or speed or any combination of these.

3.5. Priority in monitoring will be given to aircraft whose clearance has recently been changed from a stable situation (e.g. level flight on flight plan route) to a changing situation (e.g. climbing, descending, or changing routing). These aircraft may be either:

(a) Responding to instructions designed to resolve a confliction with other traffic; or,

(b) Proceeding in response to a clearance which they have requested.

3.6. In either case, the intention will be to ensure that they do indeed follow their ATC clearance.

3.7. At the same time, the controller will identify traffic that seems most likely to deviate from its clearance, or which may generate a dangerous situation if it does so. Usually, this is a subjective view based on the controller's impressions, and is hard to quantify.

3.8. The following categories may arouse special concern:

(a) Pilots whose verbal communications do not inspire confidence (e.g. took a long time to get the clearance right);

(b) Poor English speakers;

(c) Pilots unfamiliar with the environment (e.g. general aviation, the military, or airlines not previously encountered);

(d) Traffic new on frequency.

3.9. The monitoring process involves the following:

(a) Looking for deviation from cleared level or heading; instrument departure [SID], change of landing runway);

[3] For an explanation of this process see the Royal Aeronautical Society Human Factors Group Altitude Deviation Conference 15th May 1998: 3. Papers and Comments: *Level Busts and the ATC System* presented by Steve Sharp.

(a) Checking that traffic climbs, descends or alters heading when instructed (this may be at a specified fix or way-point);

(b) Checking that traffic stops climb or descent at the cleared level;

(c) Checking that rate of climb or descent is consistent with clearance.

4. Controller Action

4.1. Most level busts are the result of an action or omission in the cockpit. However, the action of the controller can sometimes result in a level bust.

4.2. The most likely scenario is that the controller issues a late re-clearance to an aircraft to stop its climb or descent. The pilot receives the re-clearance too late to comply and overshoots his level.

4.3. The controller should monitor the rate of climb or descent of aircraft under his controller to ensure that it is consistent with the clearance. In this way, it should be possible to issue a re-clearance in sufficient time to prevent a level bust.

5. Human Factors Issues[4]

General Considerations

5.1. Standard operating procedures (SOPs) are designed to reduce the chance of error or misunderstanding. This applies particularly to the effective use of communications.

5.2. Section 2 of this briefing note dealt with pilot misunderstanding of clearance and discussed effective communication in some detail.

5.3. Controllers sometimes deviate intentionally from SOPs; some deviations occur because the procedure followed in place of the SOP seems to be more appropriate for the prevailing situation. Other deviations are usually unintentional.

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

(a) Task saturation (high workload);

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

– Inadequate training; and/or,

– Perception that a procedure is inappropriate;

(c) Insufficient emphasis on adherence to standard procedures, phraseology, etc. during training;

(d) Inadequate vigilance (fatigue);

(e) Interruptions;

(f) Distractions;

(g) Incorrect management of priorities;

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

(i) Incorrect team resource management (TRM) techniques[5];

(j) Complacency; and/or,

(k) Overconfidence.

5.5. Sound management will identify any of these issues that become prevalent and will take action to address them. This action might include some of the following:

(a) Review of staff establishment, rostering and rest periods;

(b) Review of training, assessment and supervision;

(c) Review of working environment to minimise interruptions and distractions.

Automation

5.6. The increased introduction of automation into a controller's duties also raises human factors issues. The question of harmonisation between automation and the controller is addressed by the EUROCONTROL SHAPE project.[6] Seven main interacting factors have been identified:

(a) **Trust:** The use of automated tools will depend on the controllers' trust in the reliability of many factors such as reliability of the system and transparency of the functions. Neither mistrust nor complacency are desirable;

(b) **Situation Awareness:** Automation is likely to have an impact on controllers' situation awareness. It is important that new systems do not distract controllers' situation awareness of traffic too much;

[4] The EUROCONTROL Human Factors Team deals with a broad variety of topics aimed at the achievement of effective human performance in Air Traffic Management. For details of topics covered and list of publications see the EUROCONTROL Human Factors web-site

[5] See Section 6 below

[6] Solutions for Human-Automation Partnerships in European ATM (SHAPE). See also EUROCONTROL documents HF32, 33 & 34: Guidelines for Trust in Future ATM Systems.

(c) **Teams:** Team tasks and performance will change when automated technologies are introduced (team structure and composition change, team roles are redefined, interaction and communication patterns are altered);

(d) **Skill set requirements:** Automation can lead to both skill degradation and the need for new skills;

(e) **Recovery from system failure:** There is a need to consider how the controller will ensure safe recovery should system failures occur within an automated system;

(f) **Workload:** With automation human performance shifts from a physical activity to a more cognitive and perceptual activity;

(g) **Ageing:** The age of controllers is likely to be a factor affecting the successful implementation of automation.

6. Team Resource Management

6.1. Team Resource Management (TRM) is the effective use of all available resources for ATC personnel to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.

6.2. The corresponding concept of Crew Resource Management (CRM) has been in use among aircraft operators for many years and there is strong evidence to show that these programmes have been successful in reducing accident and incident rates.

6.3. There is also evidence to show that these principles can be successfully applied to air traffic management (ATM). TRM training can reduce teamwork-related incidents and enhanced task efficiency.

6.4. The EUROCONTROL Human Resources Programme[7] is active in the development of a TRM programme, including the development of syllabi, courseware, training modules, training methods and tools.

6.5. The TRM prototype course was prepared in eight separate modules:

- introduction;
- teamwork;
- team roles;
- communication;
- situational awareness;
- decision making;
- stress; and
- conclusion.

6.6. Further developments include two new modules on the management of error and violation and the impacts of automation.

7. Resources

Other Level Bust Briefing Notes

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

GEN 1 – Level Busts: Overview;

GEN 2 – Pilot-Controller Communications;

ATM 1 – Understanding the Causes of Level Busts;

ATM 3 – Safety Reporting: ATM.

Access to Resources

7.2. 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

7.3. 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;

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[7] EUROCONTROL Human Resources Programme offers, through the development of methods and tools, a harmonised and integrated approach for:

- manpower planning, recruitment, selection, training and the licensing process,
- the process for integrating human factors into the life cycle of ATM systems.

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

ICAO Doc. 9683 – Human Factors Training Manual;

EUROCONTROL Human Resources Programme.

Incident Reports & Training Material

EUROCONTROL Safety Letter: En Route to Reducing Level Bust;

EUROCONTROL: Presentation to 2nd Level Bust Workshop - Human Factors that contribute to Level Busts;

FSF ALAR Toolkit Briefing Note 2.1 – Human Factors;

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

NASA: ASRS Database Report Set – 50 Altitude deviations;

UK AAIB Report into Airprox at Lambourne;

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

Training Material – Posters

Level Bust Prevention posters produced by the UK CAA:

2 Many Things

Wun Wun Zero.

Other Resources

FSF Approach & Landing Accident Reduction (ALAR) Toolkit Briefing Note 3.2 – Altitude Deviations;

FSF Digest 11/98 – "Killers in Aviation": Facts about Controlled Flight Into Terrain Accidents;

IATA Report: Problems Around the World with English Language in Civil Aviation;

Proceedings of the Royal Aeronautical Society (RAeS) Human Factors Group – Altitude Bust Conference;

UK CAA Flight Operations Department Communication 2/97 – Altitude Violations;

UK CAA CAP 719: Fundamental Human Factors Concepts

UK NATS – Incidents Around Stacks: A Pilot's View.

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.

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FSF Approach and Landing Accident Reduction (ALAR) Toolkit.