Level Busts – ACEing the hazard by Tim Atkinson, easyjet

Since September 2001, a UK National Air Traffic Services Action for Continuous Excellence project team has been examining level busts, searching for their causes, and planning strategies for mitigation. At the 346th meeting of the UK Flight Safety Committee in May 2002, team members gave a presentation, describing the work done to date, and explaining future plans…

Level busts have a real potential to claim lives. The mid-air collision near New Delhi in 1996 killed 349 people, and was the result of a simple level bust. In the UK, there are approximately 300 level busts a year, many of which do not result in losses of separation, though all have the potential for very serious outcomes.

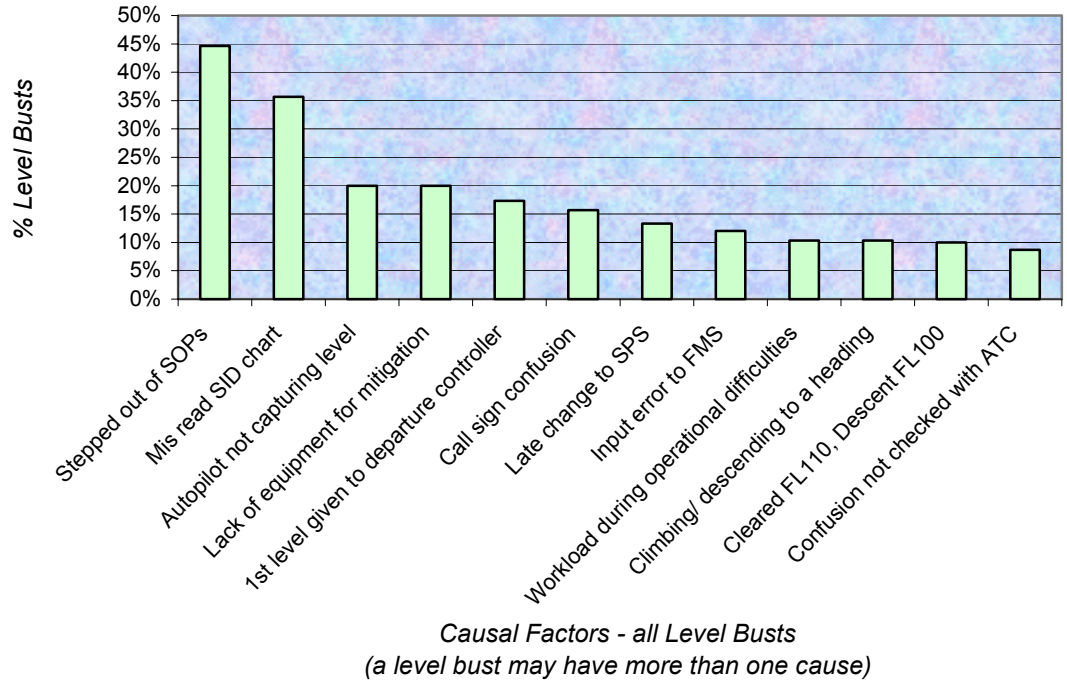
What is a level bust? A level bust occurs when an aircraft deviates from the correct level by more than 300ft. Normally vertical separation between aircraft is 1000ft. This project did not address level busts caused by TCAS events, nor instances of 'late re-clearance'.

Modern ATC equipment, including Short Term Conflict Alert (STCA), high quality radar, well-trained and experienced controllers, and up-to-date aircraft fitted with Traffic Alert & Collision Avoidance System **(**TCAS) flown by competent crews, should afford better protection. Despite this, a mid-air collision (not, it seems, the result of a level bust) occurred near Ueberlingen, earlier this year. This proves that **reliance upon present collision avoidance techniques is not sufficient**; accepting level busts and trusting that a collision will be avoided is not enough; new ways of eliminating level busts must be found.

Recognising the nature and potential severity of the hazard, UK National Air Traffic Services set up an ACE (Action for Continuous Excellence) project in September 2001. The Level Bust ACE team, chaired by a Terminal Control Watch Manager, included ATC managers and safety investigators, representatives of Safety Regulation Group, a human factors scientist, and pilots from British Airways and easyJet. The project is sponsored at NATS board level, and has an unrestricted brief. An 'ACE agent' oversees and facilitiates the group's work, providing guidance and administrative support, and ensuring the group retains its focus and that effective progress is made.

ACE projects address difficult problems that need to be solved. The process, developed from an analysis of industry best practice in problem solving, uses multi-disciplined teams and a structured approach, focusing on taking action and implementing solutions.

Over a series of one-day workshops, the team carried out a practical analysis of the root causes of level busts, and prioritised these causes, before discussing and identifying forty possible solutions. These solutions were themselves prioritised and matched against causes, in a matrix, before further work to specify solutions for action took place.



Solutions identified for action ranged widely in their simplicity of development and implementation, cost, and potential benefits in addressing issues other than level busts.

Education and Awareness

The most important solution identified is the need for an education and awareness programme for ATCOs and pilots. It became clear that **many, if not all, level busts would be avoided if crews and controllers complied with current regulations and 'best practice'**. A new working group, incorporating members of the ACE project team, together with ATC training experts, is developing this campaign. The campaign will be rolled out through summer and autumn this year. It is hoped that a concerted effort to improve SOP adherence, RTF discipline, and the use of 'best practice', may bring about a significant improvement in the level bust statistics.

Alphanumeric Callsigns

Data from ATC safety investigations identified that callsign confusion, a significant cause of level busts, is much reduced by the use of alphanumeric callsigns. This solution is being further examined, in order to establish that there are no unknown risks associated with alphanumeric callsigns. Once this is complete, consideration may be given to seeking **regulatory action to mandate the use of alphanumeric callsigns**.

RTF Phraseology

Much discussion took place regarding some of the RTF phraseology in current use. Whilst it was felt that **most communication difficulties arose from poor technique or assumption**, rather than from questionable phraseology, some opportunities for improvement were identified. The words 'Flight Level Wun Hundred' have been used in place of 'wun zero zero' on a trial basis for some time, and with success. This phraseology has been extended to other levels (200, 300, and 400). Other phraseology changes, such as the use of the word 'degrees' after headings, in order to differentiate from flight levels, are still under consideration.

The UK air traffic controller's 'bible', the Manual of Air Traffic Services Part One, gives a full account of standard RTF phraseology as used in the UK. Other states use slightly different phraseology. The Manual is available online at http://www.caa.co.uk/docs/33/CAP493__Part1.pdf, and Appendix E is the appropriate section. The UK AIP also gives relevant information at http://www.ais.org.uk/uk_aip/pdf/enr/2010103.pdf. CAP413 gives an overview of RTF techniques at http://www.caa.co.uk/docs/33/CAP413.pdf.

Chart Deficiencies

Many pilots reported level busts as a consequence of **mis-reading SID charts**. In particular, one chart manufacturer's depiction of step climb SIDs was felt to be unclear. Representations have been made to the manufacturer concerned, and work is ongoing to achieve changes.

FMC Software Modification

Modern aircraft such as the Boeing 737-NG and Airbus family have an alerting feature, which warns crews of climbing or descending through transition altitude without re-setting the altimeters. Investigations have been carried out to ascertain whether the FMC on older aircraft (such as the Boeing 737 EFIS, 757, and 767) could be modified to provide a similar alert. Initial indications are that this is feasible, and presentations will be made to FMC manufacturers in due course. One major operator has found that their Boeing 737 EFIS fleet experiences ten times more level busts with altimeter setting errors as their cause, than their A320 family fleet. (**Industry support for this proposal is sought** – interested parties should contact the author tim.atkinson@easyJet.com).

Distraction-Free Flight Deck

The project group identified that **distraction, causing breakdown of SOPs**, was a common factor in level busts, and concluded that a distraction-free flight deck is an environment in which level busts are less likely. Of course this is a matter of discipline, and some companies already operate a 'sterile' flight deck. Most operators are believed to be aware of the issue, and when the security implications of 'locked door' policies were considered, it was decided not to pursue this solution further for the moment.

Risk Analysis

It was decided that further formal risk assessment should be carried out. NATS Safety Analysis experts have studied substantial amounts of radar data, evaluating the possible consequences of level busts involving aircraft passing through or levelling at incorrect levels, this evaluation being carried out for various bands of flight levels. Whilst this work is ongoing, early indications are that the conclusions will enable **better prioritisation of mitigating techniques**. The work undertaken so far has already identified that some classes of level bust are far riskier than others – some of the riskiest being those involving altimeter mis-setting or mis-read SID charts. This knowledge allows greater priority to be given to eliminating these errors.

Mode S Implementation, and sub-scale setting

Consideration of the manner in which Mode S might help to reduce the level bust risk led to the project group's identifying that Mode S should be implemented without delay. Moreover, it was decided that Mode S selected altitude data could be of considerably more value, if **altimeter sub-scale setting** were also a down-linked parameter. Although the present Mode S plans do not incorporate sub-scale setting, NATS has expressed a desire that it should.

London TMA Design

The design of the London TMA was often cited as being critical to the number and nature of level busts. In particular, the fact that most SIDs climb under the holding stacks, makes certain types of level bust particularly hazardous. Whilst it is clearly a long-term objective, the project group felt that a recommendation to re-design the TMA should be made, and that any such re-design should have, as its basis, the need to avoid the types of **interaction between arrival and departure routes** that presently exist. Such a re-design might not reduce the number of level busts, but would certainly reduce the likelihood of a level bust causing a collision.

Datalink Communications

Datalink communications (CPDLC) provide an opportunity to **eliminate many human errors in the communication chain**. However, other forms of human inter-action with data received by electronic means will take place, and careful assessment of other areas of risk will need to be carried out. CPDLC trials are ongoing in various locations worldwide, and it is hoped that a robust and reliable form of technology will be arrived at. The project team agreed that CPDLC had significant potential.

Transition Altitude

The transition altitude in the UK varies between 3000ft and 6000ft, depending upon location. These different values, and the fact that our transition altitude is relatively low, not only add to the risk of level busts occurring, but make those which do occur, more likely to result in an encounter with another aircraft. For these reasons, the project group recommended the implementation of a **24000ft Transition Altitude throughout the UK FIRs**, in compliance with the European Single Skies concept. A

further working group will study this issue in due course, and its work will be monitored.

Conclusions

Level Busts represent a significant hazard. Much of the mitigation relies upon human endeavour – there is no technological remedy. The education and awareness programme mentioned above will aim to ensure that everyone exposed to the level bust hazard has a clear understanding of the problem, and knows how reduce to their risk. This programme, together with the other solutions raised by the ACE team, may go some way to improving the statistics, though greater awareness will also lead to more widespread reporting of non-safety-significant events. The only true measure of success available relates to level busts involving losses of separation, which are almost invariably detected. This statistic will be closely monitored, and will prove a measure of success of the ACE project's work, and other work presently being undertaken elsewhere.