Business Aviation and Level Busts

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Business aviation, which accounts for about seven percent of flights in the United Kingdom, was responsible for almost 20 percent of the level busts recorded in that airspace, and five of the eight most serious losses of separation following a level bust.

By Peter Riley, NATS, UK

Between January and September 2008 in the airspace in which NATS, the U.K. air navigation service provider, provides the air traffic control (ATC) service, there were 356 incidents involving business jet aircraft. Fourteen of these incidents were within the higher risk category and involved a loss of separation, mainly due to level busts.

Responding to this trend, NATS has looked more closely at the specific issues posed by business aviation with regard to level busts.

As part of its efforts to reduce the number and severity of level bust events, the NATS Level Bust Workstream, a working group of representatives from across the company, has become increasingly concerned about the prominence of business aviation aircraft, in particular non-U.K. registered, non-commercial operators, in the statistics. Of concern are not only the numbers but the severity of the busts; business jets caused 5 of the 8 most serious losses of separation resulting from level busts in the 6-month period that ended in June 2008 (see Table 1 on next page).

The NATS Level Bust Workstream determined that the evidence of a problem is compelling. Going back to January 2007, the business aviation community accounted for 10 out of the 19 most serious level busts recorded, 52% of the number of serious bust events. Eight of those ten events involved non-U.K.-registered aircraft. Given this disproportionate involvement in the higher severity events, it is clear there was a need to focus effort on working in partnership with the business aviation community.

NATS believes that there are many reasons for the unwelcome prominence of corporate jets in the level bust event data. The nature of business flying is

Table 1: Serious Level Busts in NATS Airspace

Date and Airspace	Summary	Primary Causal Factors
Jan. 14, 2008 Facon 10/100	The airplane descended below its cleared level and came into conflict with a Boeing 737-800, which was under the control of a different sector. Slow TCAS response was to "maintain passenger confort".	Incorrect TCAS response Rate of turn/climb/descent
March 7, 2008 Falcon 2000	The airplane was instructed to climb to FL 140 but climbed to FL 144 and into conflict with other traffic. The airplane had a very rate of climb and may have misinterpreted a TCAS RA.	Incorrect TCAS response Rate of turn/climb/descent
March 10, 2008 Falcon 50	The airplane was instruced to climb to FL 120. Approaching FL 110, it was given traffic information on an aircraft 1,000 ft above. The FA50 climbed to FL 127.	Incomplete readback by correct airplane Not heard
March 11, 2008 Falcon 50	On departure the airplane was instrucuted to climb to FL 80. The airplane was later observed at FL 87. The pilot was climbing on the QNH local pressure altimeter setting.	Altimeter setting error Not seen
April 1, 2008 Cessna 560	An inbound airplane was descended to FL 120. An outbound Cessna was climbed to FL 110. Both airplanes approached BPK at the same time. The Cessna was observed climbing to FL 117 before descending again. The inbound airplane received a TCAS RA.	Incorrect TCAS response Poor manual handling
April 11, 2008 Learjet 45	A learjet was instructed to climb to FL 80 against traffic descending to FL 90. The descending traffic reported a TCAS climb. The Learjet reported that it had also received a TCAS climb. It had climbed at 2,500 fpm with less than 1,000 ft to go.	Incorrect TCAS response Responded to TCAS/GPWS
May 26, 2008 Boeing 737-300	On climbout, the student pilot exceeded the cleared level by 600 ft before the training captain could intervene.	Correct readback, incorrect action Pilot under training
June 3, 2008 Boeing 737-800	Traffic in a holding pattern was cleared to descend to FL 70. The pilot's readback was garbled by another airplane's transmission. The clearance was not clarified by the controller and an incorrect airplane descended to FL 70, causing a loss of separation.	Pilot readback by incorrect airplane Not heard

such that crews often find themselves flying into airports and associated airspace for the first time. As infrequent visitors, a lack of familiarity with some of the more challenging procedures in U.K. airspace is probably a major factor. Among these challenging procedures are step-climb standard instrument departures (SID), a feature at many of the London region's outer airports, where business aircraft are frequent visitors.

There have been many instances recorded, and not only among the business aviation community, of crews "falling up the stairs" on a stepped profile. For business aviation, if the aircraft is flown by a single pilot, or if the crew is distracted from briefing the profile correctly - perhaps by having to perform functions carried out by other staff such as cabin crew on the airlines - the possibility of an incorrect or incomplete brief is increased. Throw into the mix the fact that many of the business aviation crews may not have the level of flight operations support available to airline crews, and the very high performance of the aircraft that are being flown, especially in the climb, and the reasons behind the prominence of corporate jet aircraft in the data become more obvious.

NATS has made great efforts to reduce the level bust threat, having introduced Mode S radars that display each aircraft's selected flight level (SFL) on the radar workstations within the Manchester Area Control Centre and in the London Terminal Control Operations Room at Swanwick Centre. Although this has had a very positive effect on reducing level busts, with controllers now able to see the flight level dialled into the mode control panel / flight control unit (MCP/FCU) by pilots following an instruction to climb or descend, it has not been the complete solution.

For example, the displayed SFL will not take into account any altimeter setting error made by the pilot. This is a common causal factor of level busts in the U.K., where the applicable transition altitude to change altimeter settings from local pressure readings (QNH) to 1013.2mb (29.92 inches) varies be-

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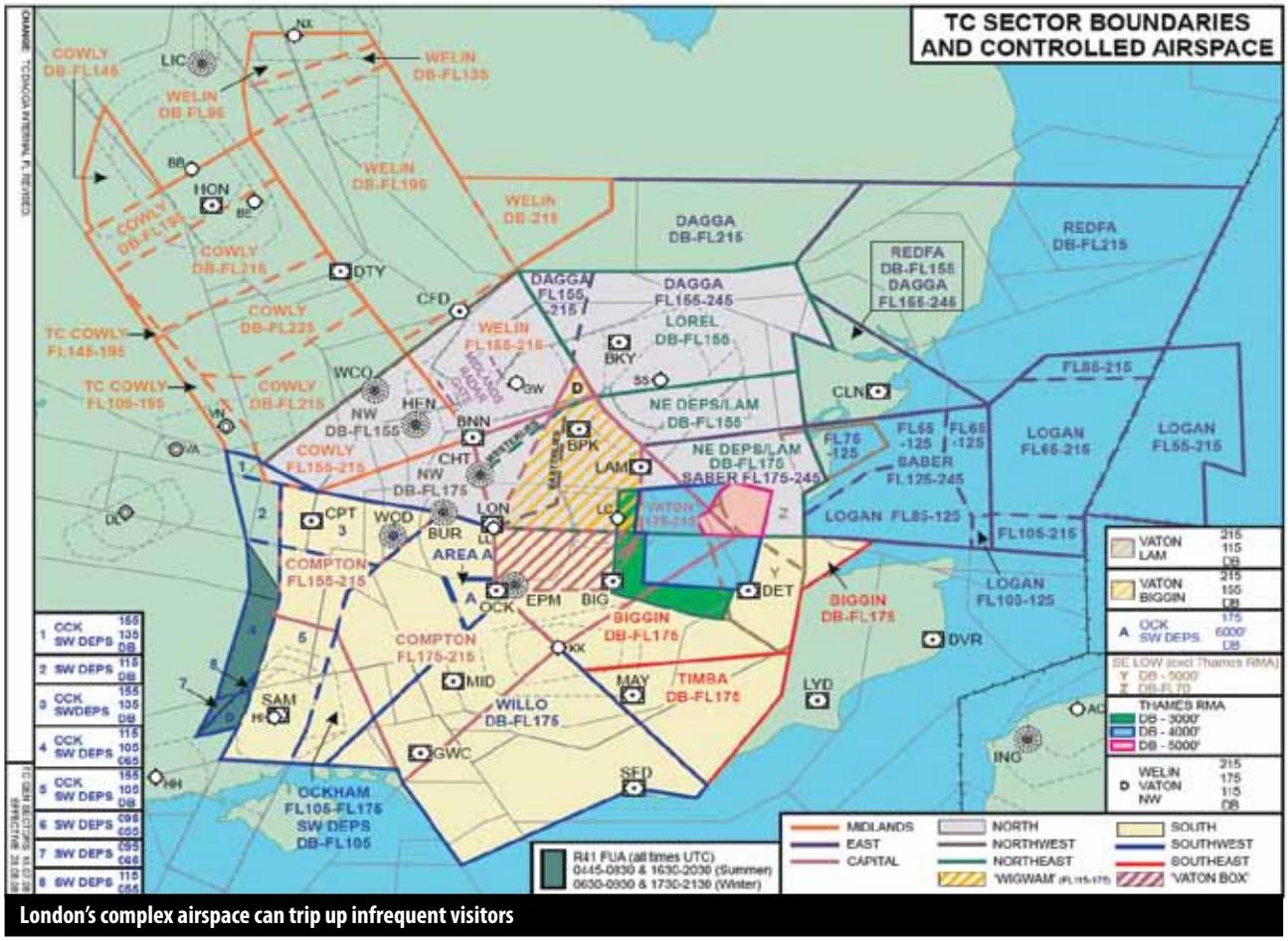
tween 3,000 ft and 6,000 ft according to the location.

It is appreciated that particular standard operating procedures (SOP) are chosen to enhance operational effectiveness according to the nature of the operation. However, where a pilot has programmed a step-climb profile into the flight management system (FMS), unless there is an additional SOP to set the profile restrictions in the MCP, there can be a disparity between the aircraft's SFL and the programmed SID, which can cause increased controller workload as they try to ascertain whether or not there is a level bust developing.

While there is little possibility that step-climb SIDs will be eliminated in the short term, avoidance of this procedure now is enshrined as a basic design principle for all future NATS airspace changes. In the interim, a number of successful mitigation measures have been applied at some NATS units; for example, providing with the departure clearance an explicit warning of the existence of a step-climb SID.

While helpful, Mode S SFL capabilities may create new hazards. Data is beginning to indicate a new issue. When the SFL displays the correct level to which an aircraft is cleared, controllers have a level of confidence in the crew's correct handling of the climb or descent that may turn out to be misplaced if the pilots do not adhere to sound airmanship principles of reducing the rate of climb or descent approaching the assigned level.

Further, a high rate of climb or descent can trigger a traffic alert and collision avoidance system (TCAS) warning on one or more aircraft under these circumstances, and the resolution advisory (RA) often is to continue the ongoing climb or descent. When this occurs, the SFL indication quickly becomes meaningless, and a situation the controller had every reason to believe was under



London's complex airspace can trip up infrequent visitors

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control can quickly become a level bust. This is one of the reasons an "incorrect response to TCAS" might be attributed to a level bust, even though the actual response to the RA may have been correct.

In fact, an incorrect response to TCAS is recorded in half the level bust events.

Analyses of TCAS-related events by the NATS TCAS Working Group have found three major contributory factors. The most numerous by far were aircraft with high rates of climb or descent approaching the cleared level; around 75 percent of recorded TCAS events involve aircraft cleared to vertically separated levels generating 'nuisance' TCAS RA manoeuvres. Incorrect responses to TCAS RAs were less frequent, but often had far more serious consequences.

The causes behind an incorrect TCAS response varied. In some, crews reported choosing not to follow the RA to maintain passenger comfort or because they had visually acquired the other aircraft in the encounter. A more common cause was misinterpreting an RA, in particular misunderstanding an "adjust vertical speed" RA, an instruction to reduce the rate of climb or descent.

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A normal TCAS response also can cause pilots to fail to maintain their ATC-cleared level when correctly following an RA; for example, an aircraft is climbed to a level with 1000 ft standard separation below another aircraft and receives an "adjust vertical speed" RA. While staying within the green arc of the TCAS climb/descent guidance, the aircraft can level at 600' beneath the traffic, preventing a collision but eroding standard ATC separation.

The increased risk of non-response, late response or incorrect response to TCAS — as well as possible pilot slow reporting of a deviation in response to a TCAS RA — are some of the many issues that have been identified as being more common in single-pilot operations. The introduction of very light jets (VLJs), particularly when operating with one pilot, complicates this picture. Although low performance VLJs are likely to be treated from a controlling perspective much the same way as current turboprops, mid-performance VLJs will have higher cruising levels combined with slower speeds than other aircraft at those levels. This is likely to add to controller workload, and, given the evidence of incorrect response to TCAS already identified, NATS will need to monitor closely the level bust performance of single pilot aircraft.

For NATS, having identified the level bust trend in the business aviation sector, the greatest challenge is to reach the correct audience with its mitigations. NATS has a very successful safety partnership agreement with many commercial operators in which it exchanges data and discusses issues in an open and frank forum. It also provides on a quarterly basis specific data on level bust performance to nearly 50 operators, including some business jet fleet operators such as Netjets.

However, for the business aviation community beyond the U.K. Air Operator's Certificate-holder sector, it has proven very difficult to reach the crews in an effective way. Small operators are too numerous, transitory, dispersed and infrequent U.K. airspace visitors to develop the longer-term relationship necessary to bring down level bust numbers. NATS has worked to develop ties with trade associations and simulator service providers, and has taken advantage of relationships with local handling agents to provide publicity and awareness initiatives. Ultimately, however, these strategies do not address the fundamental issue of directly engaging the target audience.

In an attempt to go further in addressing this issue, NATS has created a new workstream whose focus is on business

aviation, as well as cooperating with the Business Aviation Safety Partnership. The work of these groups will consider the following areas:

Training

- Joint training initiatives such as sending controllers to simulator training establishments and participating in multi crew resource management, which includes business aviation pilots and controllers discussing situations from both perspectives.

Regulation

- Promoting carriage of specific avionic equipment, such as Mode S and, in some airspace, airborne collision avoidance systems;
- Adequate licensing, training and competency arrangements to expand knowledge of TCAS responses and airspace, airports and poor weather operations.

Briefing

- Facilitate access to adequate briefing material through handling agents, etc. NATS has recently produced, in conjunction with Flight Safety International and EUROCONTROL, a DVD for TCAS interpretation to supplement TCAS training;
- Encourage correct briefing by the operators.

The focus of these groups is supported by the recent publication of the Business Jet Safety Research Report, a Statistical Review and Questionnaire Study of Safety Issues connected with Business Jets in the UK. This, in turn, has resulted in the formulation of a U.K. Civil Aviation Authority-led Safety Action Plan for Business Aviation. Although the work is not yet finalised in this area, it is clear that the need for specific attention to be given to this sector of the aviation industry is greater than ever. ■

BEST PRACTICE/GOOD CONTROLLING [1]

1- The best practices/good controlling practices are not necessarily ICAO compliant

1.	**Phraseology**
1.1	Add the word 'degrees' to all heading instructions (except during surveillance or precision radar approaches).
1.2	Expect clearances; There have been level busts caused by crews confusing the expect level with their cleared level. If possible don't use expect clearances, if they are required then put the expect level first then the clearance, I.E. BAW123 expect FL150 level BNN, descend now FL210.
1.3	The word 'hectopascals' should be used in all cases when the QNH or QFE are passed, irrespective of the value of the pressure setting i.e. above or below 1000mb.
1.4	Take particular care when issuing a clearance to FL One Hundred or FL110.
1.5	Use clear and unambiguous phraseology at all times; **challenge poor RTF.**
1.6	The Prevented Level Bust Trial indicated particular problems with the misinterpretation of the digits '2' and '3'. Consequently controllers should be meticulous in using ICAO pronunciation for these digits (TOO) and (TREE) when issuing level clearances.
1.7	Only give two instructions which require a read back in a single transmission.
1.8	When passing traffic information, do not mention the actual level of the other traffic but pass this in terms of "XXXX feet below your cleared level" or "XXXX feet above you" etc.
1.9	Keep frequency change instructions separate from other instructions where possible.
1.10	Do not restate a cleared level if the pilot has already correctly read it back because the act of restating can introduce the opportunity for error. You do not need to repeat Flight Level information already passed correctly by pilots.
1.11	Use standard phraseology in face-to-face and telephone coordination.
1.12	Aim to keep RTF delivery measured, clear and concise, especially when the frequency is congested. But, if it's urgent, **sound urgent!**
2.	**Read backs**
2.1	Minimise the risk of wrong read backs by using simple and correct phraseology. Listen to the whole read back - check that it is completely accurate. Always insist on complete and accurate read backs from pilots. Listen and respond to any uncertainty or questioning in a read back. Refrain from other tasks whilst listening to a read back. If in any doubt - get a repeat. If you hear a double transmission - sort it out. Keep a quiet working environment to aid concentration. Minimise distractions – especially the telephone.
2.2	Use the Write **A**s **Y**ou **S**peak **R**ead **A**s **Y**ou **L**isten technique to help ensure that you actively monitor the read back from the pilot.
3.	**Detection of a level bust**
3.1	RT tapes on level busts record that the first action of the controller is often to confirm the level of the 'offending' aircraft. This invariably confirms that the aircraft has bust its level and that the Mode C that we are receiving is correct. In cases where the aircraft is thereby brought into conflict with another, this can lose valuable time which can be used to resolve the confliction. It is recommended that the first transmission should be to ensure separation, any debate about the cause of the level bust can wait until after the resolution of any conflict.
4.	**Procedures**
4.1	GMC methodology ~ as part of runway safety and of level bust amelioration measures, adopt a 'No ATC clearance received, then no taxi clearance given' policy.
4.2	Whenever possible allow pilots to fly the procedure that they have briefed. For example, ■ reduce or remove the number of changes to ATC departure clearances prior to departure. If such changes are unavoidable then the earlier the changes are passed the better ■ Allow pilots to fly a standard missed approach unless a change is required to achieve separation
4.3	If there is any doubt expressed, implied or suspected during the readback of a departure clearance or if the pilot advises that the departure clearance passed if different to the planned departure-confirm the SID or departure level.
4.4	Whenever possible, if a pilot reports receiving an ATIS broadcast which is no longer current, highlight any significant changes to avoid one member of the crew going off air to listen to the current ATIS.
5.	**Sector Manning**
5.1	Create r/t time - split sectors.