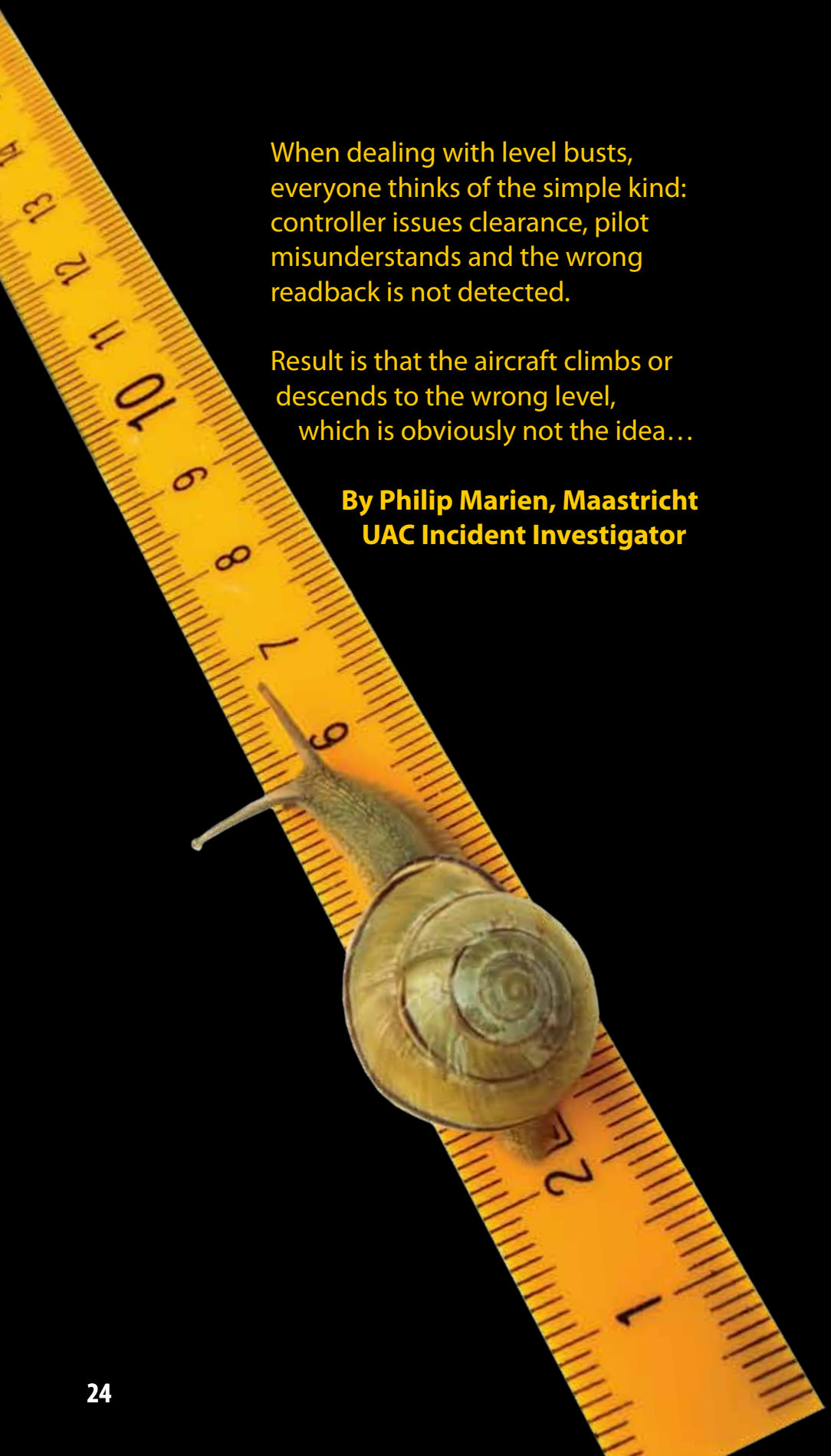
The 'OTHER' Level Busts



When dealing with level busts, everyone thinks of the simple kind: controller issues clearance, pilot misunderstands and the wrong readback is not detected.

Result is that the aircraft climbs or descends to the wrong level, which is obviously not the idea…

By Philip Marien, Maastricht UAC Incident Investigator

This type of event has been looked at from a lot of angles with some very clever solutions, including the latest one: to downlink the altitude selected in the onboard systems so the controller can compare it to his plan/clearance.

There are however more subtle cases of level busts. Perhaps these are not as dangerous as the classic level bust scenario, but they cause considerable stress and aggravation for a controller behind his radar. Not in the least because it usually involves having to fill in a form or two. In this article, I'd like to focus on those events.

Climb? YES WE CAN!

As airspace gets busier, controllers in some areas have become increasingly reliant on issuing vertical rate restrictions. Direct routes mean that it's not easy to give a geographical reference of where to be level. And the traffic density often means that a time or abeam restriction isn't precise enough to ensure separation.

Controllers will therefore often ask before the clearance whether an aircraft can climb with xxxx feet per minute. More often than not, the reply will be affirmative. Over the past years however, we've seen quite a number of infringements where the aircraft eventually wasn't able to comply with the agreed restriction. In the best cases, the pilot tells the controller in time to find some alternative solution (turns) but often, they'll simply not say anything until it's too late to avoid an infringement (see illustration 1).

In a lot of cases, the pilots seem at least as surprised as the controllers to see the aircraft reduce it's rate. It seems that

predicting or knowing what the aircraft (i.e. the computers) will decide what is possible and what is not has become more difficult over the years.

Controllers are generally taught to use caution (read: build in extra margins) when issuing such instructions, but there's a limit to that. Understandably, the larger the vertical distance that needs to be covered, the more difficult it becomes to foresee the limitations on aircraft performance, both for pilots and controllers. Therefore, if there's any doubt whether the restriction can be met, controllers would prefer being told when the clearance is issued. And a reply like 'We'll try' in response to such a clearance is less than useless…

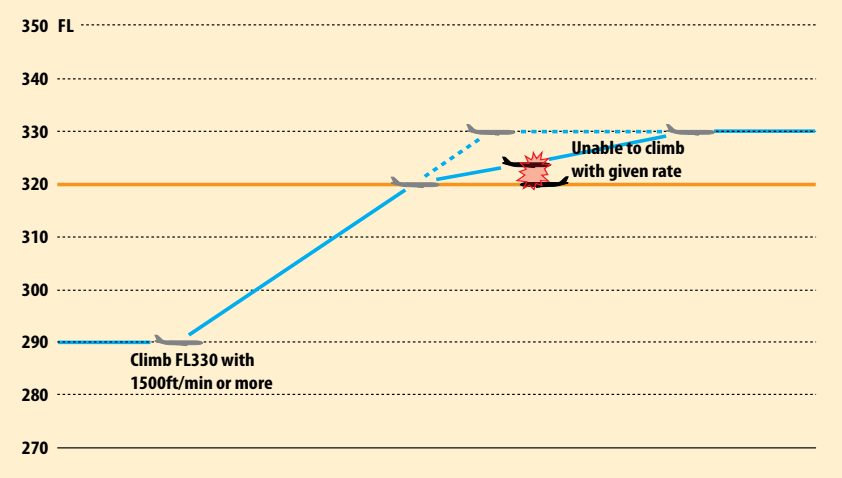


Illustration 1: instead of continuing at the agreed rate, the climbing aircraft reduces its rate. In the best cases, the pilot notifies the controller while an infringement can still be avoided.

Descent – Average or Absolute

Similar problem, except descent rates are usually less of a problem to maintain. The problem here comes from some airlines interpreting the requested descent rate as an average: they'll start descending slowly and cover the last few thousand feet with a very high rate. This may be problematic: quite often, the rate is needed for more than one reason. For example: an aircraft needs to be level somewhere to hand it off to the next unit, while there's also another aircraft between him and the exit level (see illustration 2).

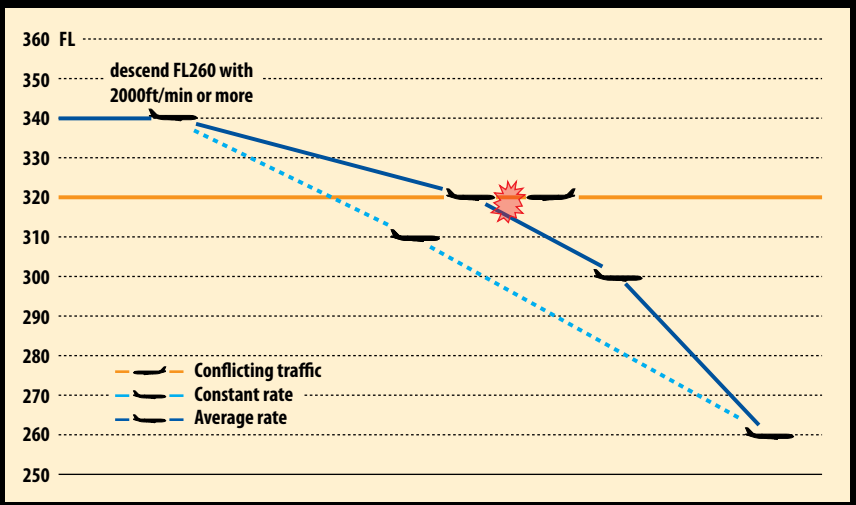


Illustration 2: the average vertical rate ensures that the aircraft is level at the intended point, but it meets traffic on the way.

While the absolute and average rates will both ensure the restriction will be met, only the absolute rate will ensure that vertical separation from the affected traffic (see illustration 2) will be enough to meet the restriction, it will not ensure vertical separation from the traffic in the middle…

Unfortunately, it's usually in busy and complex traffic situations that controllers have to rely mostly on the correct execution of the clearances they give.

It may be possible in both these cases to issue traffic information to make the crew aware of what the problem is. Unfortunately, it's usually in busy and complex traffic situations that controllers have to rely mostly on the correct execution of ▸

The 'other' Level Busts (cont'd)

the clearances they give. Quite often, there is simply no time to point out the full traffic picture to all pilots.

An additional problem with this type of profile is that the high rate at the end can easily cause TCAS Resolution Advisories – generally to adjust vertical speed. And those cause the next problem…

TCAS Bust

The last subtle form of level bust occurs when the crew 'forgets' their cleared level when following a TCAS resolution advisory. Typically, one or both crews get an RA that tells them to reduce their vertical rate when approaching their respective cleared levels. TCAS tells them to reduce the rate to 1000 or 500 ft/min a few hundred feet from their cleared level. The crews are trained to fly the RA accurately, and they ensure the Vertical Speed Indicator is in the 'green zone' calculated by the RA. However, the RA continues beyond the cleared level, as TCAS is completely unaware of the cleared level – otherwise it wouldn't need to trigger the RA. From a controller's point of view, the aircraft should level off correctly at the level they were cleared to (see illustration 3).

One can argue that the pilots should follow the RA, but from the controller's point of view, a perfectly controlled situation becomes quite stressful, as the aircraft end up with less than the required separation from each other. Agreed, if the RA is flown correctly they shouldn't hit, but why fix something that wasn't broken in the first place?

The upcoming (2011?) update of TCAS to version 7.1 will address this issue indirectly, by replacing the 'adjust v/s' RA with a simpler 'level off' instruction.

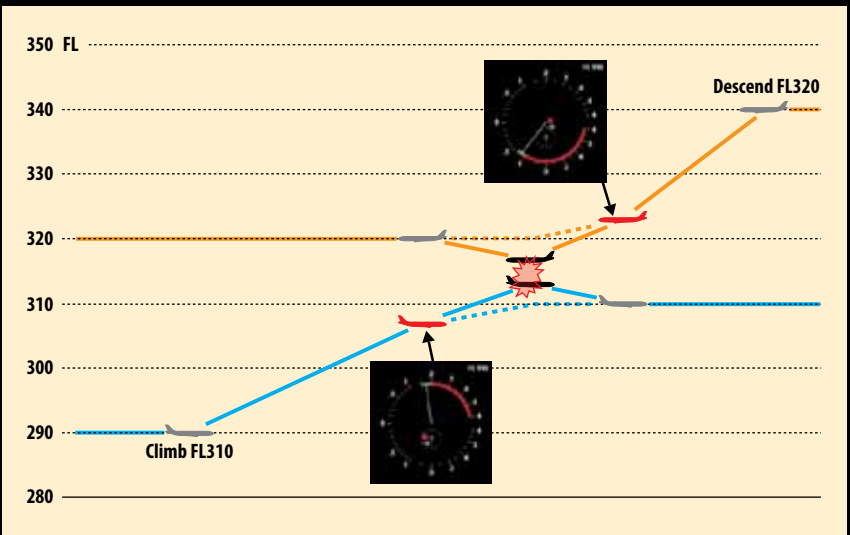


Illustration 3: approaching their cleared level, both aircraft get an 'adjust V/S' RA. Both put the VSI needlein the green zone, going beyond their cleared level.

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Distracting

While the risk to the aircraft involved in the cases outlined above is certainly less than in a traditional level bust, they can certainly cause problems indirectly as they increase the controller's workload significantly. They also regularly lead to animated discussions on the frequency and it wouldn't be the first time that another situation develops as a direct consequence of the controller being distracted by events like these.

Conclusion

Eliminating all and every type of level bust is unrealistic. While controllers need to realise that aircraft have performance limits, pilots need to be aware that they are not alone in the sky. Sometimes it's possible to give the reason for certain clearances and restrictions, but more often it is simply too time consuming. ■