Vertical Speed Control

General

Vertical speed is a useful method of maintaining separation between aircraft that are climbing or descending. Aircraft may be instructed to maintain a specific climb or descent rate. This is most useful when aircraft are climbing or descending through the level of other aircraft or are descending in a holding pattern.

Application of vertical speed control

Vertical speed control may be applied:

- To accommodate climb requests (by requesting an aircraft to expedite passing a level)
- For separation of arriving and departing traffic in opposite directions
- To descend arriving aircraft below enroute traffic
- For vertical sequencing between climbing or descending aircraft
- For corrective action (when unrestricted vertical speed is insufficient)

Benefits

Efficiency

Effectively used vertical speed control allows for continuous climbs and descents and therefore better efficiency. In addition, it permits descents to start close to top of descent and allows timely accommodation of climb and descent requests.

Reduced controller workload

This method also ensures vertical separation is maintained, resulting in reduced workload because of a reduced need for vectoring and/or horizontal speed control.

Risks

Reduced separation

The margin for error is reduced as this method relies on maintaining minimum vertical separation, which is much lower than minimum horizontal separation, therefore any non-compliance may result in a loss of separation between aircraft.

Non-compliance or misunderstanding

A misunderstanding of the instruction may result in the desired separation not being achieved. A correct readback does not guarantee compliance.

Aircraft may be unable to maintain the assigned rate of climb or descent beyond a certain level. If this occurs, there is a possibility the flight crew may not inform the controller.

Considerations

Aircraft performance

Certain aircraft types such as the Airbus A321 and Airbus A340 are unable to maintain high rates of climb.

In addition, climb rates can be expected to decrease when aircraft are approaching their cruise level, and will therefore generally be unable to maintain rates of climb in excess of 1000 ft/min. High temperatures will further reduce this value.

High rates of descent are generally incompatible with low airspeeds. Instructions to maintain both a high descent rate and low speed should be avoided.

Aircraft autopilots generally take a few seconds to respond. The transition time to achieve a vertical rate should be taken into account when issuing vertical speed control.

Level busts

When aircraft are within 2000 to 3000 ft of their assigned level, they should not be instructed to maintain vertical speeds in excess of 1500 ft/min in order to avoid a level bust and to prevent possible TCAS RA activation.

Safety buffer

In order to mitigate the risk of traffic on reciprocal tracks losing separation a safety buffer of one or two minutes needs to be applied by issuing the clearance earlier or assigning a higher vertical speed to maintain.

Expedited climbs or descents

The phrases “EXPEDITE CLIMB” and “EXPEDITE DESCENT” do not specify vertical speeds and should be used with caution. Climbing aircraft will climb at the maximum rate possible, which may sometimes be insufficient to achieve the desired result. The use of safety margins and alternative clearances should therefore be considered.

Aircraft descending will generally increase their vertical speed to 2000 ft/min or greater when instructed to expedite. For this reason, it is advisable that this instruction is given early on in the descent.

Alternative clearance

Controllers must always have an alternative plan available to accommodate a climb or descent request if aircraft are unable to comply with a vertical speed instruction.

Rules of thumb

- A vertical speed of 2000 ft/min results in a change of 10 flight levels in 5 minutes
- A vertical speed of 2500 ft/min results in a change of 10 flight levels in 4 minutes
- A combined vertical speed of 4000 ft/min (such as when one aircraft is climbing and the other is descending), results in a change of 20 flight levels in 5 minutes

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