Transition troubles

Understanding transition altitude and transition level

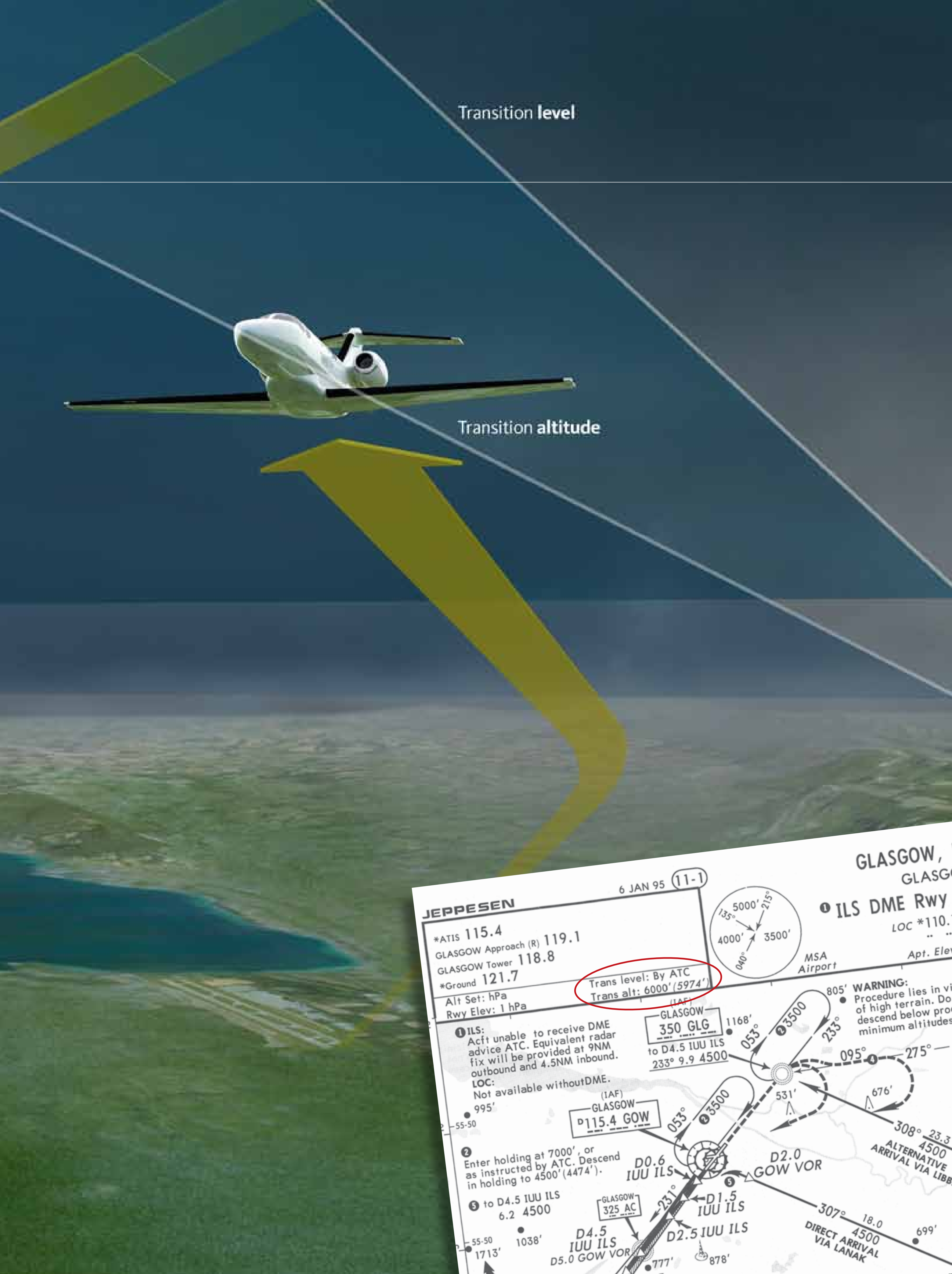
BY NEIL SINGER

International flying poses challenges to the pilot only accustomed to domestic flight. Differences in IFR procedure design, ATC, and flight planning all require adjustment from normal routine. One issue that has proven especially troubling is that of varying transition altitudes and levels found outside North America.

ILLUSTRATION BY CHARLES FLOYD

Transition levels

In foreign airspace, transition altitudes indicate when aircraft climbing out of lower altitudes must switch from a local altimeter setting to standard pressure. Conversely, at altitude, aircraft descending for an approach must switch from standard pressure to local station pressure when passing through the transition level. This level is either issued by ATC or published on charts. The briefing box at the top of the approach chart for the ILS DME Runway 5 to the Glasgow, United Kingdom, airport (opposite page) shows that pilots must switch their altimeter settings to 1013.2 millibars/hectopascals (29.92 inches of mercury) upon climbing through 6,000 feet; those on descent will be issued a transition level by ATC. Transition altitudes and levels can vary from region to region. Confusing? Yes, but Eurocontrol has been considering a common transition altitude. In North America we already have a common transition altitude—and it's a transition level as well: 18,000 feet msl.



Transition level
Transition altitude
JEPPESEN
6 JAN 95 (11-1)
GLASGOW,
ILS DME Rwy
*ATIS 115.4
GLASGOW Approach (R) 119.1
GLASGOW Tower 118.8
*Ground 121.7
Alt Set: hPa
Rwy Elev: 1 hPa
Trans level: By ATC
Trans alt: 6000′(5974′)
MSA Airport
ILS:
Acft unable to receive DME advice ATC. Equivalent radar fix will be provided at 9NM outbound and 4.5NM inbound.
LOC:
Not available without DME.
Enter holding at 7000′, or as instructed by ATC. Descend in holding to 4500′(4474′).
to D4.5 IUU ILS 6.2 4500
GLASGOW 350 GLG
to D4.5 IUU ILS 233° 9.9 4500
GLASGOW D115.4 GOW
D0.6 IUU ILS
D2.0 GOW VOR
D1.5 IUU ILS
D2.5 IUU ILS
D4.5 IUU ILS
D5.0 GOW VOR
GLASGOW 325 AC
WARNING:
ALTERNATIVE ARRIVAL VIA LIBB
DIRECT ARRIVAL VIA LANAK

The terms are often taken by U.S. pilots to be interchangeable, but there is a subtle difference between transition altitude and transition level—a difference that can have important safety implications. Transition altitude is the altitude above sea level at which a climbing aircraft should switch an altimeter setting from the local setting (called QNH) to the standard setting of 29.92 inches of mercury or 1013 hPa (called QNE). Transition level is the lowest flight level available for use above the transition altitude. Looking at most international charts, transitional altitude is a fixed number for an airport, while transition level is often given as "by ATC."

So why isn't transition level also a fixed number? On a day with lower than standard pressure, QNH is less than QNE. If transition altitude is 5,000 feet, FL050 will actually be below 5,000 feet, and thus not a usable flight level. If QNH is equal to or higher than 5,000 feet, FL050 is available for use, and will be the transition level. As the note section of the approach plate states, this calculation will be performed by ATC, and the transition level is transmitted to pilots over ATIS—and again with the first clearance to an altitude below transition level.

To complicate the issue, not only will pilots flying internationally experience different transition altitudes from country to country, they will often experience different transition altitudes within a country. Le Bourget Airport in Paris, France, has a transition altitude of 4,000 feet, while high terrain makes the transition altitude at Chambéry Airport, in the Rhône-Alpes region of the French Alps, 6,500 feet. In countries without terrain considerations, the transition altitude can be as low as 3,000 feet, a particular challenge as this altitude often corresponds to a high-workload segment of flight.

Consider departing a busy European airport with a transition altitude of 3,000 feet. The pilot will be assigned a SID, which in Europe tends to be complex. The SID will likely involve a combination of headings, triggering altitudes, and navigation legs that may or may not be coded properly in the GPS or FMS database. While properly managing vertical and lateral navigation, the pilot must also remember to switch from QNH to QNE as quickly as a minute or two after takeoff.

With this workload, it's not surprising that in countries with a low transition altitude, altitude busts because of altimeter mis-set are twice as likely to occur during climbout as during descent. It's easy to see how an aircraft cleared to level at FL060 on a SID could actually level at 6,000 feet if, because of workload, QNE was never set. Depending on ambient pressure, this could put the aircraft dangerously close to traffic above or below properly flying referenced to QNE.

To help prevent these altitude busts, many operators make it a standard practice to set QNE immediately when first cleared to a flight level, not when passing through transition altitude. Likewise, when cleared out of a flight level to an altitude, the altimeter will be set to QNE immediately, not when passing transition level.

If, as standard practice, the altimeter is reset with clearance above/below transition altitude/level, it precludes forgetting later if workload is high. Also, when flying out of the normal environment, the habits that serve well at home aren't of help. An experienced U.S. turbine pilot may notice 18,000 feet displayed on the altimeter and instinctively check that the altimeter setting has been appropriately set. That same pilot in Europe won't have the mental cue to recheck at 4,000 feet, flying into Paris, for example.

Even for pilots who never fly outside North America, consideration of the difference between transition altitude and level can be worthwhile.

Garmin G1000-based systems have a useful feature in that an alert can be enabled to flash the altimeter setting window when passing through a pilot-defined altitude. While it may take a few seconds to reprogram the alert altitude for each airport of departure and landing, it's time well spent in areas of low transitional altitudes.

Pilots should also consider the implication of a low transition altitude if needing to execute either an unexpected return to landing or a missed approach. Both are very unusual events, meaning that if they occur, workload and stress are likely to be high. It's not difficult to imagine an aircraft on missed approach forgetting to set QNE, or one returning for an emergency landing forgetting to re-set QNH. The implication of the former is a potential altitude violation or loss of separation between aircraft. The latter is more serious, representing a risk of flight into terrain if the pilot is inadvertently flying flight levels, rather than altitudes, during the approach back into the departure airport.

Even for pilots who never fly outside North America, consideration of the difference between transition altitude and level can be worthwhile. Imagine an aircraft in cruise flight at FL280, cleared to descend to 17,000 feet. The pressure that day is extremely low, 29.06. As the aircraft descends through FL180, the pilot resets the altimeter from QNE to QNH. Doing so, the indicated altitude drops from 18,000 feet to 17,140 feet. Descending at 2,500 fpm the autopilot is not given enough time to initiate a level-off, and the aircraft descends to 16,500 feet before climbing back to 17,000 feet.

This situation happened to a Canadair Regional Jet earlier this year. To compound bad fortune, a turboprop transport was almost directly below the CRJ, level at 16,000 feet, and the high rate of closure caused the turboprop's traffic system to command an immediate descent to avoid collision.

Had the pilots been applying the international concept of transition altitude and level, they may have considered that the lowest available flight level with QNH of 29.06 is not FL180, but rather FL190. Passing through this "effective transition level" of FL190 and setting the altimeter to QNH would have given the autopilot an additional 1,000 feet to capture 17,000 feet.

If all these problems of different transition altitudes and levels seem troubling, there's some consolation that European authorities are aware of the associated dangers, and there is a move to institute a single transition altitude throughout all of Europe. The International Civil Aviation Organization (ICAO) advocates a common transition altitude within a region; for Europe 10,000 feet and 18,000 feet have been discussed as possibilities. Until this occurs, the issue will continue to be one requiring careful attention from pilots, especially those unaccustomed. AOPA

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