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Current use of Selected Altitude Parameters in Air Transport Aircraft

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Summary
This Working Paper identifies the use of Selected Altitude parameters in current air transport category aircraft and the impacts to the encoding of Selected Altitude in the Target State & Status message, register 62H.

The parameter "Selected Altitude" is actually multiple values selected and used by separate systems in modern air transport aircraft. Attention must be paid as to which aircraft vertical guidance mode is active in order to understand how the aircraft will actually respond in the vertical profile in order to ensure correct encoding of the single Selected Altitude field in the TSS message with minimum confusion.

Since they have requested this data and mandated its transmission, the ANSP's must also pay careful attention to the TSS mode bits in order to correctly understand their received data and minimize confusion on the aircraft's vertical intent.

Table 1 summarizes the vertical logic for Selected Altitude and the aircraft's vertical profile response for each mode. Figures 1 and 2 demonstrate the results for Climb and Descent when VNAV is engaged and for when it is not active.

If the Autopilot's Approach Mode and Glide Slope Engaged is active then the aircraft will respond to ILS or GLS vertical guidance and will not fly to either of the Selected Altitude parameters.

If Approach Mode and VNAV Mode are not Engaged then the aircraft will fly to the Mode Control Panel's (MCP) Selected Altitude parameter (MCP Label 102) for level flight, climb and descent flight modes.

If VNAV Mode is Engaged then FMS Target Altitude (label TBD) which is generated by the flight plan is also a factor. The aircraft's next altitude level is a function of which value it encounters first during a climb or descent profile. Note that both parameters meet the definition of "valid data" as defined by Appendix A Section A.1.3.2.4 of DO-260B. During a climb the aircraft will level off at the smaller value of MCP Selected Altitude or FMS Target Altitude. During a descent the aircraft will level off at the larger value of MCP Selected Altitude or FMS Target Altitude. Note that FMS vertical waypoints can be designated as either "At or Below" or as "At or Above" types as shown in Figures 1 and 2.

It is proposed that the transponder must examine the vertical mode bits and select the correct value of MCP Selected Altitude or FMS Target Altitude to be encoded into Register BDS 6,2 H in order to avoid broadcasting misleading information about the aircraft's vertical intent.

If the Autopilot Approach Mode and Glide Slope Engaged are active then the Selected Altitude field should be encoded with all zeros [TBV].

Table 1 Selected Altitude Mode Logic

Parameter > Mode	MCP Selected Altitude	FMS Target Altitude	Airplane Flies To	Notes
AP Approach Mode ON & Glide Slope Engaged	N / A	N / A	ILS OR GLS GUIDANCE	Prior to G/S Capture will fly to MCP or FMS value.
VNAV OFF – Climb	Label 102 (from MCP)	N / A	MCP Selected Altitude	Approach Mode OFF
VNAV OFF – Descent	Label 102 (from MCP)	N / A	MCP Selected Altitude	Approach Mode OFF
VNAV ON – Climb	Label 102 (from MCP)	Label TBD (from FMS)	Smaller of two parameters	First value encountered
VNAV ON – Descent	Label 102 (from MCP)	Label TBD (from FMS)	Larger of two parameters	First value encountered

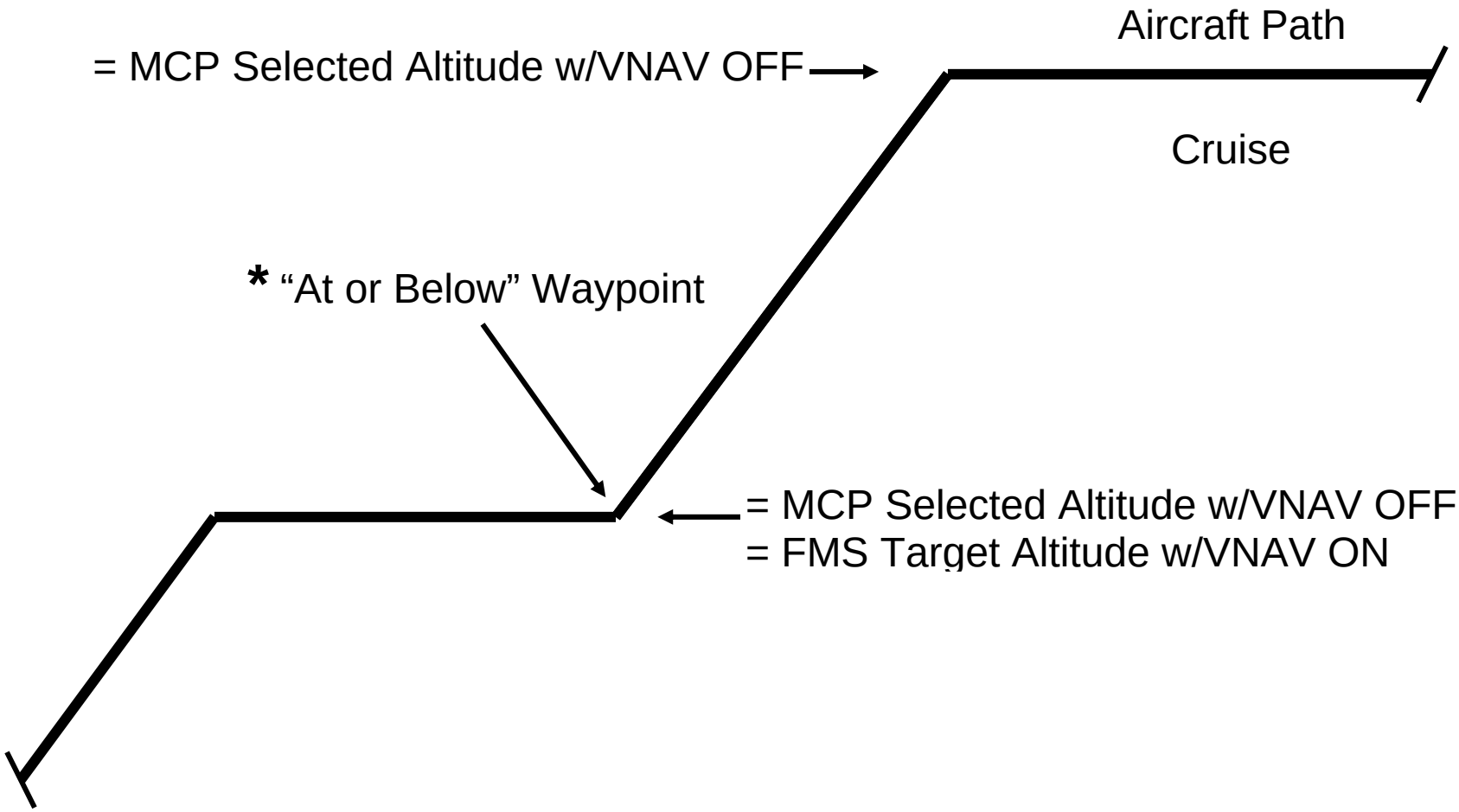

Figure 1 Selected Altitude Parameters in Climb Mode

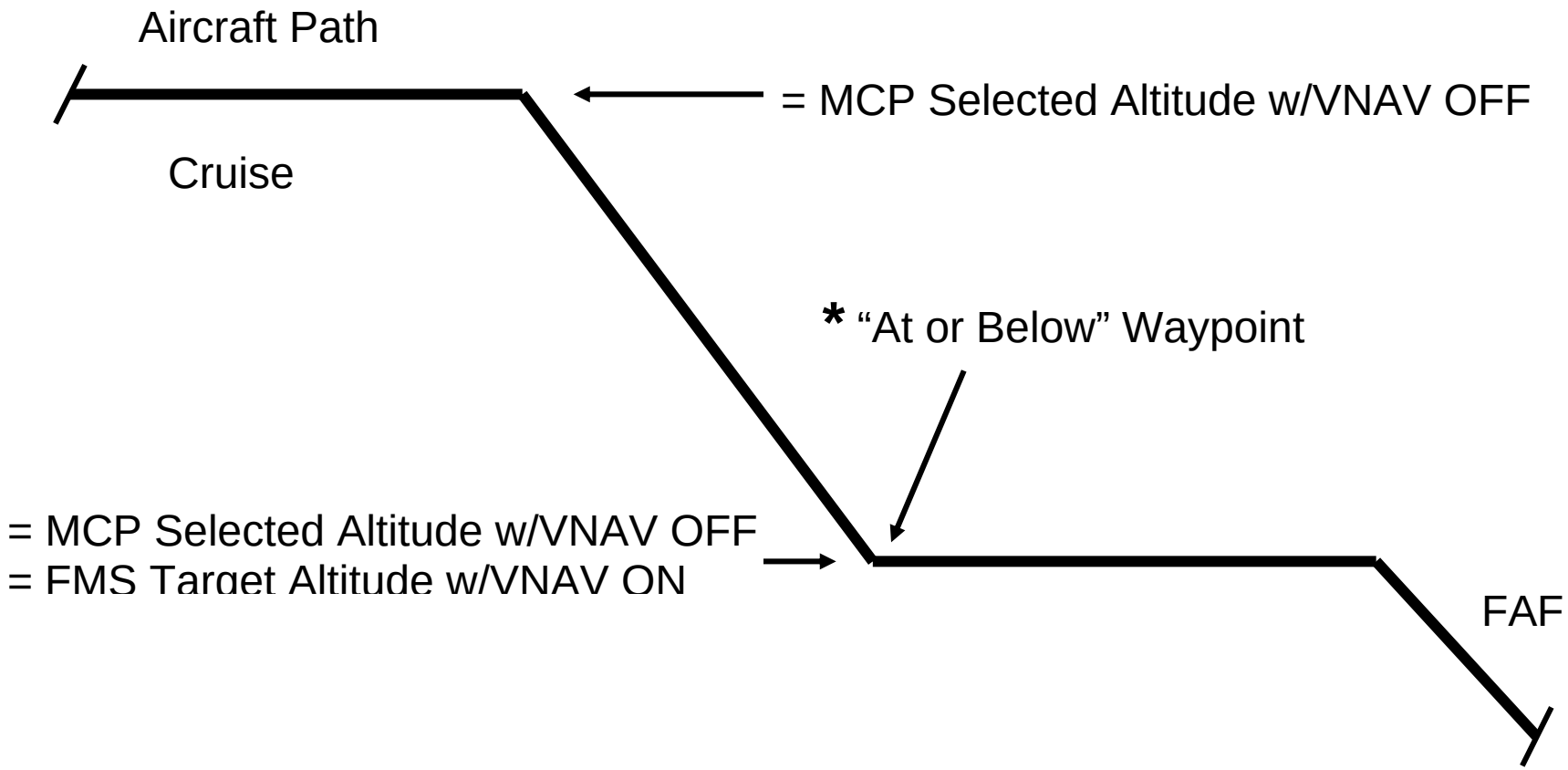

Figure 2 Selected Altitude Parameters in Descent Mode