Proposed Revisions to Intent Information Broadcast
242A-WP-7-01

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1. Introduction

Intent information describes the intended future trajectory of an aircraft. The ADS-B MASPS (DO-242)[1] discusses current intent (2.1.2.3.2) and trajectory change intent (2.1.2.3.3.1). Current intent refers to an aircraft's next target state, including the target altitude and desired track. These intent parameters (also referred to as "short-term intent") are not currently recognized in an ADS-B report. Trajectory change intent is provided in the form of a Trajectory Change Point (TCP). DO-242 defines a TCP as "the point in three dimensional space where the current operational trajectory is planned to change, and estimated remaining flight time to that point." (p. 39) Four dimensional TCP and TCP+1 points are defined in the mode-status and on-condition reports, respectively. DO-242 provides several notes to clarify this definition (pp. 39-41). The transmitting aircraft is assumed to fly a great circle trajectory from its current position to the TCP. Turn points and speed change points are not included in the TCP definition.

As new operational concepts have emerged requiring the use of aircraft intent, committee members have expressed concern that the intent sections of DO-242 may lack sufficient guidance for avionics manufacturers. In August, 2000, a subgroup of RTCA Special Committee 186 Working Group 4 was formed to address several key issues. Certain operational concepts may require the transmission of TCP's excluded by DO-242. Work done by the European DAP program and the WG4 Intent Subgroup has suggested that current intent parameters be included in ADS-B reports. Providing the TCP information identified in DO-242 often requires the transmitting aircraft to combine targets from multiple aircraft systems. Some aircraft may not be able to provide all of these information elements. This issue has led to a review of the equipage class requirements related to intent information broadcast. Issues have also been raised concerning ways to verify conformance with broadcast intent.

The Intent Subgroup, in cooperation with members from SC186 Working Groups 1, 4, and 6 has developed a proposed set of revisions for inclusion in DO-242A. This proposal provides a target state report to address current intent information. A trajectory change report represents an expansion of the previously defined TCP elements. Changes to the TCP definition and equipage class requirements are also addressed.

2. Short and Long-term Intent

Intent information can describe the trajectory of an aircraft when it reaches a change in its trajectory (TCP) or its next target state. Aircraft may not always fly a great-circle route from the present position to the TCP, as assumed by DO-242. For example, after sequencing a fly-over waypoint, the aircraft executes a turn toward the inbound track to the next waypoint. The great circle route to that waypoint doesn't begin until the aircraft is established on the inbound track. Aircraft may also turn to an assigned heading. For some operating modes, a TCP may not exist. For example, an aircraft may be level at FL350 and engaged in an Altitude Hold mode. In this situation, the aircraft does not have a programmed trajectory change. The target state report, discussed further in Section 4, provides information on these short-term intent parameters. Long-term intent refers to one or more TCP's on the aircraft's intended trajectory. Section 6 describes the Trajectory Change Report that provides TCP information.

The amount of intent information available about an aircraft's active ("command") trajectory depends in large part on that aircraft's current operating mode and equipment. The three primary operating modes, referred to here as manual, target state, and flight plan are diagrammed in Figure 1. With each additional outer loop the pilot communicates more intentions about future states to his or her own aircraft, thus enabling them to be exchanged with other aircraft, assuming a capable datalink system. In most cases, intent information in a more outer loop than the aircraft's current operating mode does not affect that aircraft's active trajectory. Target state information is still available when the aircraft operates in a flight plan mode. The aircraft can be operated in different lateral and vertical modes concurrently.

Figure 1 also shows typical equipment available on transport category aircraft that is capable of providing the associated information. Other flight hardware may be able to generate this information, although each successive outer loop generally requires more sophisticated automatic flight and navigation systems. Inner loop information may also be difficult to transmit for older analog aircraft. A Mode Control Panel (MCP) or Flight Control Unit (FCU) is the primary interface between the pilot and autopilot. Boeing aircraft use the former and Airbus aircraft the latter. It allows the pilot to select target states such as altitude, heading, vertical speed, and airspeed. Since only the next target state is allowed in each axis, pilots often use the MCP/FCU for short-term tactical flying. Conversely, the Flight Management System (FMS) allows the pilot to select a series of target states through a keypad-based Control Display Unit (CDU). A pilot may program an entire route, complete with multiple waypoints, speed, altitude, and time restrictions at a waypoint, and desired speeds along different flight segments. Because the FMS allows multiple states, it is frequently used for long-term strategic flying. Complex paths often develop when an aircraft's trajectory is generated with both MCP/FCU and FMS information. Such a situation may develop when the lateral and vertical modes are controlled separately by the MCP/FCU and FMS or when an MCP/FCU target value affects the FMS trajectory. The latter case is most common when the MCP/FCU selected altitude lies between the aircraft's current altitude and the commanded FMS altitude. In this scenario, the aircraft levels out at the MCP/FCU selected altitude.

Both short and long-term intent information offer a potential benefit to airborne conflict management, separation assurance, surveillance, and conformance monitoring applications. Short-term intent is available in almost all operating modes, while 4D

TCP's are only available when equipped aircraft are using sophisticated FMS and area navigation (RNAV) systems. Short term intent provides information on the aircraft's next target state (altitude and heading or track), even if it does not have an associated TCP. The DO-242A proposal includes provisions for short and long-term intent.

3. Command and Planned Trajectories

Two path definitions may prove useful when describing an aircraft's intended trajectory. The *command* trajectory refers to the path the aircraft will fly if it remains in the same automation state. A change in automation state occurs when the pilot engages a new mode, changes the targets for the current mode, or the aircraft reverts to a new mode automatically. The latter can occur due to envelope protection limits. The *planned* trajectory includes MCP/FCU and FMS intent information that is not part of the command trajectory. These targets would be an extension of the command trajectory if the automation state changes in a way that makes them active targets. If the automation state remains the same, the aircraft will only fly toward the command trajectory targets. Figure 7 illustrates the difference between the command and planned trajectories for a simple descent scenario. In this case, the aircraft is flying a lateral and vertical FMS path that includes a waypoint altitude restriction at the End of Descent (E/D). The MCP/FCU selected altitude lies between the aircraft's current altitude and the bottom of descent. Assuming the pilot doesn't change the aircraft's automation state, the aircraft will fly on the FMS descent path until reaching the MCP selected altitude and then level off. This path is the command trajectory. If the pilot resets the MCP prior to reaching the selected altitude, the aircraft will continue to fly along the FMS descent path and will level out at the bottom of descent. The programmed FMS path beyond the MCP selected altitude represents a longer range objective and can be considered a planned trajectory. The pilot may plan to fly this trajectory as soon as the intermediate altitude constraint is removed.

These trajectory definitions are also expandable to aircraft sending intent information from non-FMS flight planning tools. For example, a LORAN or GPS unit on a general aviation airplane can be programmed to contain multiple waypoints. This path represents a planned trajectory. It does not guarantee that the aircraft will fly that path, but it may offer insight into the pilot's long term strategic plan.

Both the command and planned trajectories may provide useful information for separation assurance and flow management applications. In order to use this information effectively, the receiving system must be able to clearly delineate between the command and planned trajectories. Providing clear and unambiguous information is a primary objective when developing datalink requirements for aircraft intent.

4. Target State Report

Short-term intent parameters are assembled in the Target State Report, shown in Table 1. The principal elements of this report are the target altitude and target heading or track. These parameters represent the transmitting aircraft's target state and will also be included in the Trajectory Change Report (Section 6) if they are part of a TCP. The target altitude is the aircraft's next intended level-off altitude if in a climb or descent or the aircraft's current altitude if it is being commanded to hold altitude. This definition is consistent with that provided by the European Downlink of Airborne Parameters (DAP) program.[2] Target heading is provided if the aircraft is actively being controlled to a heading (such as a Heading Select or Heading Hold mode). Target track is used if the aircraft is controlled to a track, such as when flying between waypoints on a flight plan. A single bit (Element 3) specifies whether the aircraft is controlled to heading or track.

Horizontal and vertical target source indicators describe the aircraft system providing the corresponding target state. Options include the FMS, MCP or FCU, or holding the aircraft's current state. In cases where the aircraft is acquiring a target altitude common to the MCP/FCU and FMS, the target source indicator should declare the target to be the former. The MCP/FCU altitude has limiting authority over the FMS altitude.

Horizontal and vertical mode indicators state whether the aircraft is acquiring (transitioning toward) the target state or is capturing or maintaining the target. These parameters are expected to benefit conformance monitors.

Future space is reserved for horizontal and vertical validity bits. These bits are conformance monitoring elements under consideration by the Intent Subgroup. Guidance and navigation validity bits have been discussed so far, but require further investigation. The former would determine whether the aircraft is being controlled in the direction of its flight director command, while the latter would compare an aircraft's position with its intended flight path when controlled by the FMS.

5. TCP Definition

Further investigation into the many types of TCP's that can occur along an operational trajectory has led to a proposed TCP definition change. The current definition (DO-242 p. 39) states that a TCP occurs at a known 3D position in space. Although a 3D location is known for FMS waypoints, many TCP types do not occur at a known point. For example, an aircraft may be climbing in a constant vertical speed mode towards a target altitude. In this case, the aircraft may not take actual wind conditions into account when predicting the level-off location. Level-off prediction in a climb may also depend on changing aircraft performance. These uncertainties make it difficult to predict an accurate 3D point. An analogous lateral situation may occur when an aircraft flies at constant heading to intercept a flight plan route. The intercept point is also dependent on wind and is difficult to determine precisely. To account for these uncertainties, the following TCP definition is proposed: "A Trajectory Change Point may be described as a 3D location or interception of a 2D plane where the current aircraft trajectory is intended to change."

Given this definition, there are many possible points along the trajectory that could be considered to be TCP's. It is important to convey a consistent meaning of a TCP to ensure that all parties know which points should be broadcast as TCP's and included in the Trajectory Change Report described in Section 6. Likewise, the receiving aircraft should expect that points not included as ADS-B TCP's could occur along the trajectory. TCP's should be broadcast when the aircraft reaches a target altitude, leaves the current altitude for another target altitude, changes course at a waypoint or other course interception point, or begins or ends a constant radius turn. These definitions are mostly consistent with the points included as TCP's in DO-242. Speed change and vertical speed change points (except those beginning or ending in level flight) are not included. The start and end of turn points for a constant radius turn negate the note in DO-242 (p. 39) that prohibits the use of turn points as TCP's. Note that some aircraft may be able to provide start and end of turn points for fly-by turns. The DO-242 statement that TCP's "are not necessarily flight plan waypoints" is consistent with the proposed definition.

In addition to TCP's, points involving an altitude constraint are included in the Trajectory Change Report (see Section 6), even if they do not involve a trajectory change. These points are considered to provide value to conformance monitoring applications. Only altitude constraints are included for DO-242A. Other constraint points may be considered for future revisions.

Consider an FMS descent with three altitude constraints as an example of which trajectory points should be included in the Trajectory Change Report (TCR). The profile view is shown in Figure 8. The aircraft flying in cruise decelerates prior to reaching the top of descent point. The top of descent point, defined here as the location where the aircraft begins the descent, is included in the TCR. Note that some aircraft manuals call the preceding deceleration point the "Top of Descent". When the Mach number reaches the desired descent speed, the aircraft switches to airspeed control (not included in TCR). Because the aircraft changes its lateral trajectory at point ABC, it should be broadcast. Speed change points associated with the 250 knot 10,000 ft restriction are not considered in the TCR (consistent with the DO-242 definition). The next 3 waypoints (DEF, GHI, JKL) are provided since they have altitude constraints.

6. Trajectory Change Report

The trajectory change report (TCR) provides information about TCP's and altitude constraints. TCR fields are filled based on information availability aboard the transmitting aircraft and the TCP type. Many additional elements have been added to the DO-242 TCP report to facilitate path re-generation, data confidence assessment, and conformance monitoring. Some of the new parameters have been added to be consistent with the Eurocontrol ADS Requirements.[3]

The availability of TCR Elements 1-4 depends on the transmitting aircraft's operating mode and equipment capability. These elements are provided if they are associated with a known waypoint or can be estimated by the FMS. The operating mode greatly affects the accuracy of a predicted trajectory change point, if one exists at all. When flying between flight plan waypoints, the aircraft is programmed to arrive at specific 2D points in space. With an altitude constraint, the waypoint is controlled to a 3D location. The time of arrival at each waypoint is usually estimated, but can be controlled if the point has an associated required time of arrival (RTA). When using FMS lateral and vertical navigation modes, TCP's associated with waypoints can be estimated with high confidence.

For TCP's which do not involve closed-loop control, such as top of climb or top of descent, the latitude, longitude and time elements have higher uncertainty. Other cases that increase TCP position and time uncertainty include mixed mode operations, where the FMS controls either the lateral or vertical path, while an MCP state mode is used for the other dimension. Examples include a heading hold mode to intercept a lateral flight plan (Figure 6) or an MCP altitude intervention along an FMS descent (Figure 7). These scenarios are discussed further in Section 7. When the TCP location or time is uncertain, Elements 1-4 should be filled with FMS estimates, if available. Note that some FMS systems may not be able to provide these estimates. The TCP type described below can be used by the receiving aircraft to assess the uncertainty in Elements 1-4. Noisy predictions such as the "green arc" on Boeing aircraft that predicts altitude level-offs for MCP modes should not be included in the TCR. These predictions can vary greatly if they do not compensate for varying wind and aircraft performance.

Elements 5 and 6 are used if the TCR is filled with an altitude constraint. Altitude constraints may or may not be associated with a trajectory change point, since the aircraft may be able to comply with the constraint without changing its trajectory. For altitude constraint points (including those associated with TCP's), the Altitude field (Element 3) should be filled with the constraint altitude. Element 5 clarifies whether the altitude constraint is an "at", "at or above", or "at or below". The transmitting aircraft's determination of whether it can or cannot meet the altitude constraint is provided in Element 6.

Figure 2 shows the information needed for fixed radius, fly-by, and fly-over turns (Elements 7-9). Fixed radius turns include turn radius and start and end of turn points. Fly-by turns can also be described in this manner, however the alternate representation in Figure 2b is acceptable if the aircraft cannot provide start and end of turn points. In this case, the fly-by turn waypoint is provided, along with the track to and track from that point and the turn radius. Fly-over turns include the fly-over waypoint and the track to and track from the waypoint. For other TCP's, only the track to the TCP (Element 8) is provided.

Horizontal and vertical TCP types (Elements 10-11) describe the TCP's attributes. They can be used to anticipate an aircraft's behavior when arriving at the TCP, identify the type specific elements of the TCR report that should be included, and suggest the confidence level in Elements 1-4 that can be assumed by the receiving aircraft. For example, a flight plan waypoint would be presumed to have a more well defined lateral position than a top of climb point. Example TCP types are fly-by waypoint, fly-over waypoint, and RF leg (lateral cases) and top of climb, top of descent, and level-off (vertical cases). Collaboration should occur with the Eurocontrol ADS Requirements[3], although additional types may need to be added. TCP types to be included in DO-242A have not yet been determined.

Space is reserved for horizontal and vertical validity bits (Elements 12-13). Elements 14-15 state whether the TCP is part of the command or planned trajectory (see description in Section 3).

TCR elements (TCP's or altitude constraint points) that are part of the command trajectory should be ordered as they are expected to occur. The nearest points should appear first. In cases where time to go cannot be determined, points having an altitude closest to the aircraft's current altitude should be placed first. If there is space available for additional points, planned TCP's can be included, but they should be placed at the end of the list.

7. Target State and Trajectory Change Reports for Example Scenarios

Figures 3-8 and Tables 3-8 are intended to provide guidance on filling the target state and trajectory change reports for a variety of operational scenarios. Tables 3a-8a and 3b-8b show the values of the target state and trajectory change reports, respectively, for Figures 3-8. An "X" in the "Contents" column indicates that the value is not provided. All turns are assumed to be fly-by turns using the representation shown in Figure 2b. TCP's not associated with FMS waypoints have Elements 1-4 filled with FMS estimates, if available (see Section 6). TCP types are yet to be determined and are labeled as TBD.

In Figure 3, the aircraft is climbing at constant vertical speed and heading to a target altitude of 8,000 ft, programmed in the MCP/FCU. It is presumed that the FMS cannot provide an estimate of the level-off point. The "green arc" prediction is not used, due to significant uncertainty. After reaching 8,000 ft (Figure 4), the aircraft levels out and flies an open loop trajectory segment. If the current automation state is maintained, no trajectory change will occur. Therefore, a TCR is not available for this segment.

Figure 5 shows an aircraft turning to join a 040 course to waypoint ABC. The roll-out point is not considered to be a TCP. After rolling out, it will join the FMS flight plan and fly to waypoints DEF and GHI. This example is flown at a constant altitude of 15,000 ft. All latitude and longitude fields are filled since all TCP's in this example are FMS waypoints. The aircraft is holding its present 15,000 ft altitude, causing each altitude field to be filled with 15,000 ft (command trajectory). If any of the waypoints ABC, DEF, or GHI had associated crossing altitude restrictions or other FMS vertical path altitude predictions, additional planned TCP's could be added after the command TCP's, if space were available. In this case, only the vertical component would be "planned", since the aircraft will fly to waypoints ABC, DEF, and GHI as part of the command trajectory.

Figure 6 is an example of a mixed mode operation. The aircraft is flying in a Heading Hold mode with the FMS lateral navigation mode armed. After intercepting the lateral flight plan, the aircraft will fly the lateral FMS trajectory. At the same time, the aircraft is climbing at constant vertical speed (an MCP/FCU mode) to FL210. The target altitude is FL210 and the target heading is 030 deg. The first TCP is the interception with the lateral flight plan. The aircraft has predicted that it will reach ABC prior to leveling off at FL210, so it orders TCP's 2 and 3 accordingly. The level-off point (TCP #3) location and time may be predicted by some FMS systems. If so, TCR elements 1-2 and 4 may be filled. As in Figure 5, altitude constraints or FMS path predictions at ABC and DEF may be added as additional planned vertical TCP's if space is available.

Figure 7 shows a simple FMS descent having both command and planned trajectories. The aircraft is flying in cruise at FL350, approaching the top of descent. The FMS cruise altitude is limiting and functions as the vertical target source. It has a single FMS altitude constraint (cross ABC at 3,000 ft). The MCP/FCU altitude is set to an intermediate value of 15,000 ft. Since the aircraft always respects the MCP/FCU altitude, it will level-off at 15,000 ft, given the current automation state. This path is the command trajectory. If the pilot resets the MCP/FCU altitude prior to reaching 15,000 ft, the aircraft will continue toward the FMS altitude constraint at ABC. ABC is included as a planned trajectory point. It has a known 3D location and the FMS time estimate may be provided.

Figure 8 represents a more complicated FMS descent path. The target source report is the same as that described for Figure 7. The vertical target source indicator states that the FMS is providing the altitude target. In this case the FMS cruise altitude is limiting and can be considered to be the target source (even if the MCP/FCU is set to the cruise altitude). Both the FMS cruise altitude and MCP/FCU altitude must be changed for the aircraft to change altitudes in an FMS mode prior to reaching the top of descent. The scenario assumes that the MCP/FCU altitude is set at or below the lowest FMS altitude constraint. Section 5 described the rationale for determining the points along the trajectory that are included in the TCR (recognized TCP's and altitude constraints). The top of descent point is estimated by the FMS and is the first TCP. A lateral trajectory change occurs at ABC and this point serves as the second TCP. DEF, GHI, and JKL are included as altitude constraints. The transmitting aircraft must determine whether it can meet the constraints (Element 6). All points in this example are part of the command trajectory.

8. Further Discussion Areas for DO-242A

Further discussion is needed to determine intent information requirements for each aircraft equipage class. Many aircraft will not be able to support all of the TCR elements. Some aircraft have lateral navigators and may capable of providing only latitude and longitude information for flight plan waypoints. It is expected that less sophisticated equipment is needed to provide target state reports.

DO-242 requires that one TCP be provided for A2 aircraft, whereas A3 aircraft are required to support 2 TCP's. New on-condition reports are proposed for the target state and trajectory change reports. These reports will likely replace the DO-242 "TCP" (Mode Status) and "TCP+1" (On Condition) reports.

TCP types to be included in DO-242A should also be determined.

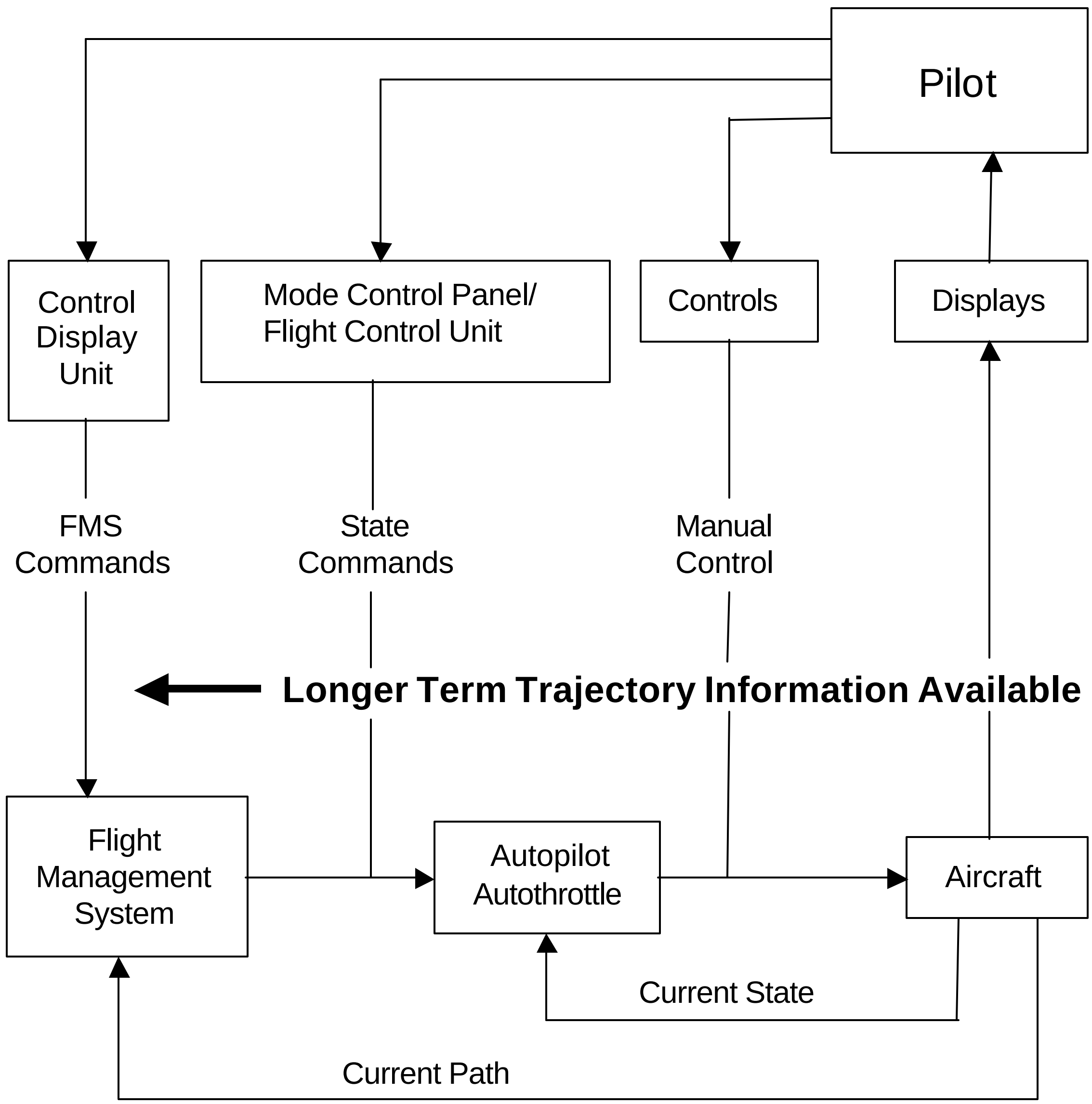

Figure 1 Aircraft Flight Modes

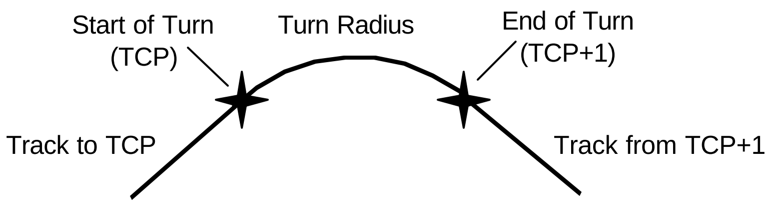

Figure 2a Fixed Radius or Fly-by Turn

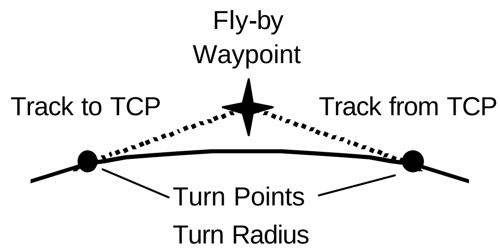

Figure 2b Fly-by Turn

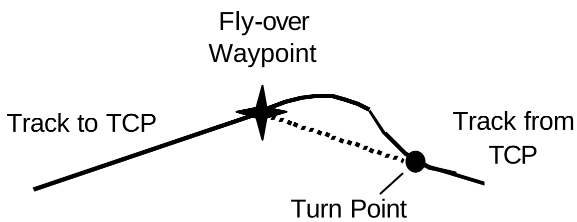

Figure 2c Fly-over Turn

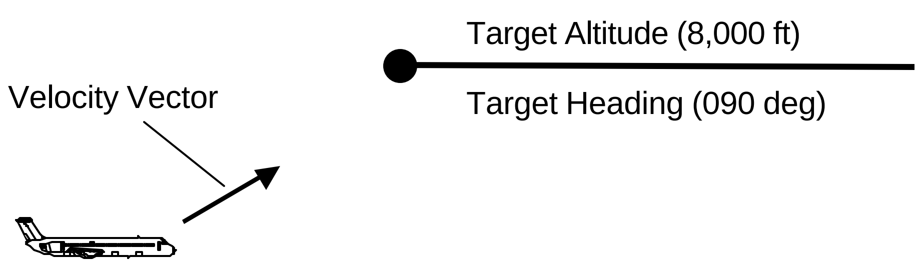

Figure 3 Constant Vertical Speed Climb at Constant Heading to MCP/FCU Selected Altitude

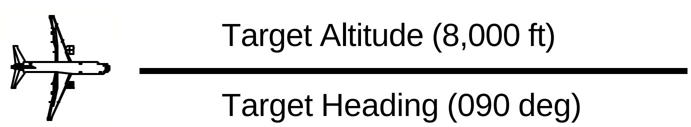

Figure 4 Constant Heading and Altitude

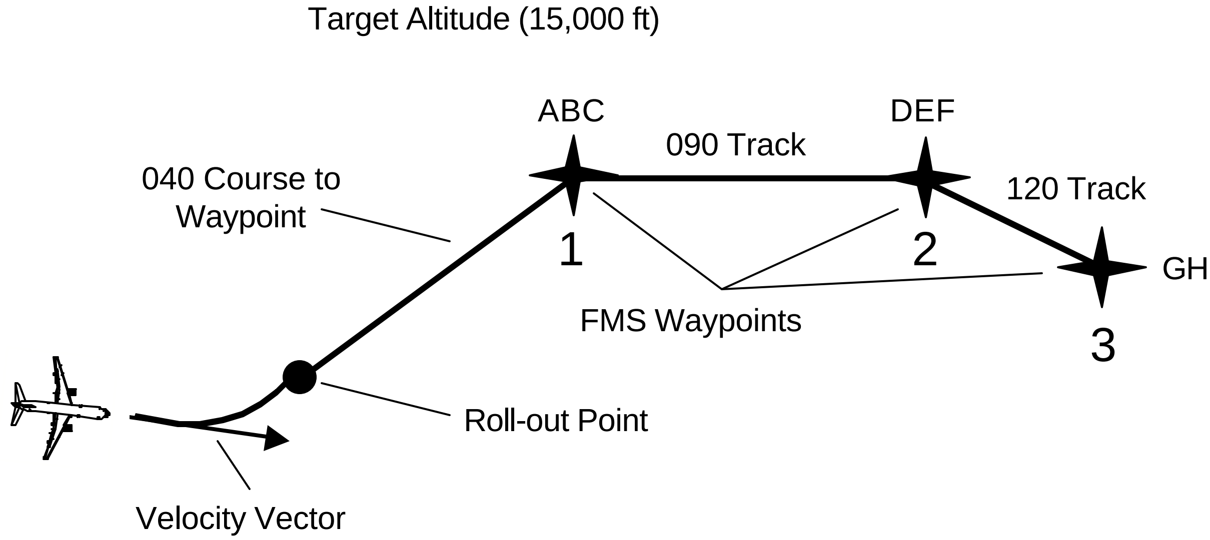

Figure 5 Intercept Course to FMS Flight Plan at Constant Altitude

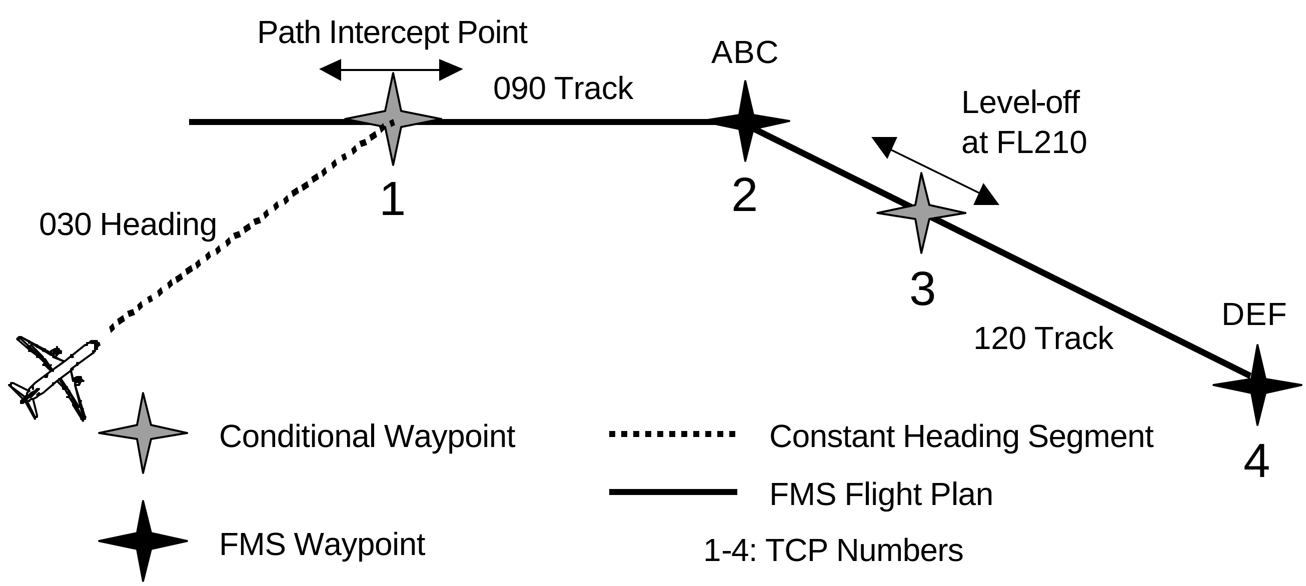

Figure 6 Constant Vertical Speed Climb and Constant Heading to Intercept FMS Flight Plan

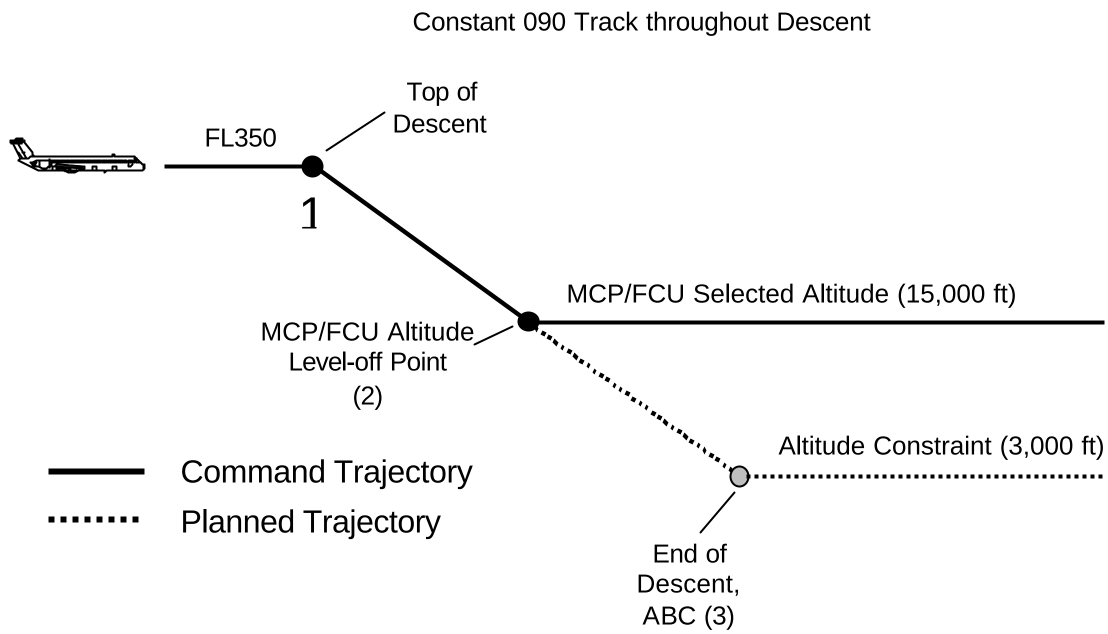

Figure 7 Simple FMS Descent Showing Command and Planned Trajectories

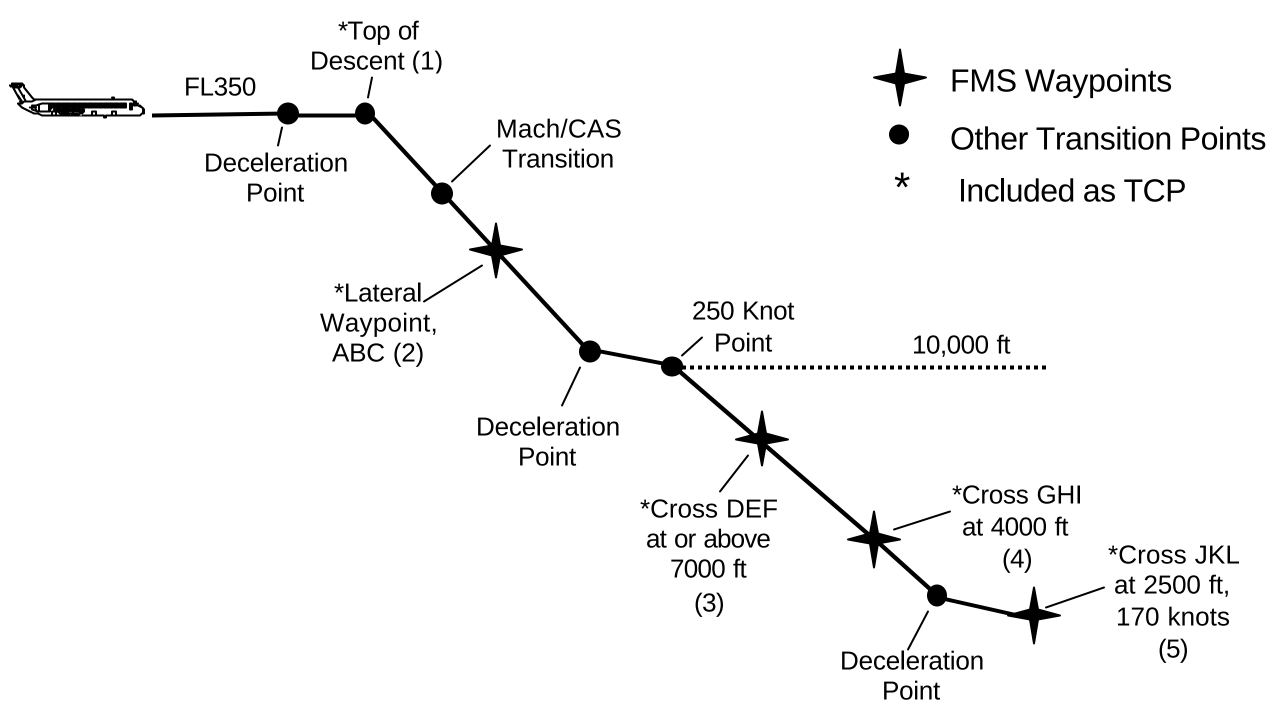

Figure 8 FMS Descent

Table 1: Target State Report

Element #	Contents
1	Target Altitude
2	Target Heading/Track
3	Heading/Track Data Reference Frame
4	Target Source Indicator (Horizontal)
5	Target Source Indicator (Vertical)
6	Mode Indicator (Horizontal)
7	Mode Indicator (Vertical)
8	*Validity Bit (Horizontal)
9	*Validity Bit (Vertical)

*Space reserved for future MASPS versions

Table 2: Trajectory Change Report

Element #	Contents
1	Latitude
2	Longitude
3	Altitude
4	Time to Go (TTG)
5	Altitude Constraint Type
6	Altitude Constraint Validity
7	Turn Radius
8	Track to TCP
9	Track from TCP
10	TCP Type (Horizontal)
11	TCP Type (Vertical)
12	*TCP Validity (Horizontal)
13	*TCP Validity (Vertical)
14	Command/Planned (Horizontal)
15	Command/Planned (Vertical)

*Space reserved for future MASPS versions

Table 3a: Target State Report for Figure 3

Element #	Contents
1	8,000 ft
2	090 deg
3	Heading
4	MCP/FCU
5	MCP/FCU
6	Maintaining
7	Acquiring
8	*
9	*

*Space reserved for future MASPS versions

Table 3b: Trajectory Change Report for Figure 3

Element #	Contents (1)
1	X
2	X
3	8,000 ft
4	X
5	X
6	X
7	X
8	X
9	X
10	X
11	TBD
12	*
13	*
14	X
15	Command

*Space reserved for future MASPS versions
“X”: Element contents not filled.
“Est”: Element contents filled with FMS estimate, if available.
“TBD”: TCP types used for DO-242A require further discussion.

Table 4a: Target State Report for Figure 4

Element #	Contents
1	8,000 ft
2	090 deg
3	Heading
4	MCP/FCU
5	Current Altitude
6	Maintaining
7	Capture/Maintaining
8	*
9	*

*Space reserved for future MASPS versions

Table 4b: Trajectory Change Report for Figure 4

Not available (open ended segment with no TCP).

Table 5a: Target State Report for Figure 5

Element #	Contents
1	15,000 ft
2	040 deg
3	Track
4	FMS
5	Current Altitude
6	Acquiring
7	Capture/Maintaining
8	*
9	*

*Space reserved for future MASPS versions

Table 5b: Trajectory Change Report for Figure 5

Element #	Contents (1)	Contents (2)	Contents (3)
1	Latitude_{ABC}	Latitude_{DEF}	Latitude_{GHI}
2	Longitude_{ABC}	Longitude_{DEF}	Longitude_{GHI}
3	15,000 ft	15,000 ft	15,000 ft
4	Est	Est	Est
5	X	X	X
6	X	X	X
7	Radius_{ABC}	Radius_{DEF}	Radius_{GHI}
8	040 deg	090 deg	120 deg
9	090 deg	120 deg	Track from GHI
10	TBD	TBD	TBD
11	TBD	TBD	TBD
12	*	*	*
13	*	*	*
14	Command	Command	Command
15	Command	Command	Command

*Space reserved for future MASPS versions
"X": Element contents not filled.
"Est": Element contents filled with FMS estimate, if available.
"TBD": TCP types used for DO-242A require further discussion.

Table 6a: Target State Report for Figure 6

Element #	Contents
1	FL210
2	030 deg
3	Heading
4	MCP/FCU
5	MCP/FCU
6	Maintaining
7	Acquiring
8	*
9	*

*Space reserved for future MASPS versions

Table 6b: Trajectory Change Report for Figure 6

Element #	Contents (1)	Contents (2)	Contents (3)	Contents (4)
1	Est	Latitude_{ABC}	Est	Latitude_{DEF}
2	Est	Longitude_{ABC}	Est	Longitude_{DEF}
3	Est	Est	FL210	Est
4	Est	Est	Est	Est
5	X	X	X	X
6	X	X	X	X
7	X	Radius_{ABC}	X	Radius_{DEF}
8	X	090 deg	X	090 deg
9	X	120 deg	X	Track from DEF
10	TBD	TBD	TBD	TBD
11	TBD	TBD	TBD	TBD
12	*	*	*	*
13	*	*	*	*
14	Command	Command	Command	Command
15	Command	Command	Command	Command

*Space reserved for future MASPS versions
“X”: Element contents not filled.
“Est”: Element contents filled with FMS estimate, if available.

Table 7a: Target State Report for Figure 7

Element #	Contents
1	FL350
2	FMS track
3	Track
4	FMS
5	FMS
6	Maintaining
7	Capture/Maintaining
8	*
9	*

*Space reserved for future MASPS versions

Table 7b: Trajectory Change Report for Figure 7

Element #	Contents (1)	Contents (2)	Contents (3)
1	Est	Est	Latitude_{ABC}
2	Est	Est	Longitude_{ABC}
3	FL350	15,000 ft	3,000 ft
4	Est	Est	Est
5	X	X	At
6	X	X	X
7	X	X	Radius_{ABC}
8	Track to T/D	Track to TCP	Track to ABC
9	X	X	X
10	TBD	TBD	TBD
11	TBD	TBD	TBD
12	*	*	*
13	*	*	*
14	Command	Command	Planned
15	Command	Command	Planned

*Space reserved for future MASPS versions
"X": Element contents not filled.
"Est": Element contents filled with FMS estimate, if available.

Table 8a: Target State Report for Figure 8

Element #	Contents
1	FL350
2	FMS Track
3	Track
4	FMS
5	FMS
6	Maintaining
7	Capture/Maintaining
8	*
9	*

*Space reserved for future MASPS versions

Table 8b: Trajectory Change Report for Figure 8

Element #	Contents (1)	Contents (2)	Contents (3)	Contents (4)	Contents (5)
1	Est	$Latitude_{ABC}$	$Latitude_{DEF}$	$Latitude_{GHI}$	$Latitude_{JKL}$
2	Est	$Longitude_{ABC}$	$Longitude_{DEF}$	$Longitude_{GHI}$	$Longitude_{JKL}$
3	FL350	Est	7,000 ft	4,000 ft	2,500 ft
4	Est	Est	Est	Est	Est
5	X	X	At or Above	At	At
6	X	X	Valid (y/n)	Valid (y/n)	Valid (y/n)
7	X	$Radius_{ABC}$	$Radius_{DEF}$	$Radius_{GHI}$	$Radius_{JKL}$
8	Track to T/D	Track to ABC	Track to DEF	Track to GHI	Track to JKL
9	X	Track from ABC	Track from DEF	Track from GHI	Track from JKL
10	TBD	TBD	TBD	TBD	TBD
11	TBD	TBD	TBD	TBD	TBD
12	*	*	*	*	*
13	*	*	*	*	*
14	Command	Command	Command	Command	Command
15	Command	Command	Command	Command	Command

*Space reserved for future MASPS versions.
“X”: Element contents not filled.
“Est”: Element contents filled with FMS estimate, if available.

References

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