

NAS-MD-312
Computer Program Functional Specification
Route Conversion and Posting
Model — A5f1.5

PAGE CONTROL CHART

The following pages contain technical and/or editorial changes for the A5f1.5 update dated 4 October 2004. Pages that have not changed for this update will maintain their previous levels and dates.

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NATIONAL AIRSPACE SYSTEM
En Route
CONFIGURATION MANAGEMENT DOCUMENT
COMPUTER PROGRAM FUNCTIONAL SPECIFICATIONS
ROUTE CONVERSION AND POSTING

Model A5f1.5

NAS-MD-312

4 October 2004

Operational Support
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1.0 INTRODUCTION

This document defines the airspace which comprises an ARTCC, specifies the format and logic checks to which field 06 and field 10 are subjected, and establishes the rules by which various types of routes and combinations of types of routes are processed.

NOTE

Unless otherwise indicated, it is understood that the term FDEP applies to FDEP equipment controlled by a CCU or a DCCU and the term FSP applies to FSPs that are controlled by a PCU.

NOTE

Unless otherwise indicated, it is understood that the terms teletypewriter, TY, or TTY now refer to the NADIN communications.

NOTE

Unless otherwise indicated, it is understood that any term or terms that reference an adjacent NAS Center, such as Adjacent NAS, Adjacent ARTCC, Adjacent Center, Adjacent Facility, Center and Intercenter, that these terms also reference an Adjacent Non-U.S. Automated Facility, when applicable.

2.0 AIRSPACE DEFINITION

The 3-dimensional volumes of airspace that comprise an ARTCC are described by points and lines with a specified altitude range for each. These volumes of airspace are fix posting areas (FPAs). Geographic points are described in source information in terms of latitude and longitude in units of degrees, minutes, and seconds and are converted to conventional X and Y coordinates (see Appendix D), in units of one-eighth mile, and stored in that form. A boundary line is described by its geographic end points. Since each line segment has a specified altitude range adapted to it, a series of connected lines is used to describe a 3-dimensional volume of airspace.

An FPA is the fundamental unit of airspace within the ARTCC. Other volumes of airspace within a center, such as sector or approach control areas, are described in terms of FPAs that comprise them.

A fix posting area (FPA) is a volume of airspace identified by a series of connected line segments that form a polygon when viewed in the horizontal and vertical plane, with each boundary line having a specified altitude range. The polygon may be convex or concave, permitting a variety of geometric shapes.

Each FPA boundary line contains, as a part of the adaptation data, the identification of the FPA, center or Non-U.S. Automated Facility that lies adjacent to that line.

Any adapted fix can be designated as a focal point fix for a fix posting area. A focal point fix is the point to which positions calculated during direct route conversion of flights are related, except as specified in section 7.3. A fix posting area may have none or one focal point fix. All domestic FPAs will have a focal point fix adapted.

A fix designated as a focal point fix for an FPA has the following characteristics:

- a. Its identifier must be from 2–5 alphanumeric, one of which must be a letter.
- b. It may lie geographically outside the FPA which it serves.
- c. It may serve more than one FPA.

3.0 FIELD 10 ELEMENT DESCRIPTION

This section describes the various formats that are acceptable for field 10.

3.1 FIX

A fix must be filed in one of the following ways and as specified in table 4-1 or 4-2. Substitute identities may be adapted for a fix and may be used in place of the fix wherever such use is specified.

3.1.1 Latitude/Longitude

Latitude and longitude identify a geographic point by coordinates (lat/long), which are entered in degrees and minutes in a sequence of 9-12 characters.

Example: 7522/16345; 2430/8915; 2430N/8915E

3.1.2 Fix Name

A fix name is a sequence of 2-5 alphanumeric characters. The sequence of alphanumeric characters, if adapted, identifies a geographic point. A four character fix name must include at least one letter.

Example: PHX; TH; F4DOV

3.1.3 Fix-Radial-Distance

A fix radial distance (FRD) identifies a geographic point in terms of a fix name, a radial from that fix name, and a distance from that fix name. The fix name must include at least one letter. The radial must be three digits in units of degrees. The distance must be the last three digits in units of nautical miles.

Example: LAX250020

3.1.4 Implied Fix

An implied fix is the geographic point where two adapted routes (excluding PARs, PDARs, and PDRs) intersect.

Example: V1..V2

3.1.5 Adapted Fix

An adapted fix identifies a geographic point and is a sequence of 2-12 characters in the format of a lat/long, a fix name, or an FRD.

Example: 3500N/14000W; FIX; H3Y180100

3.2 ADAPTED ROUTES

An adapted route consists of a series of adapted fixes. Each fix on an adapted route that forms a junction with another adapted route may be identified as a junction fix in adaptation. Adaptation for

an adapted route that crosses a center boundary may identify the fix to be used for coordination with the adjacent center.

3.2.1 Airways

An airway is a type of adapted route, which is filed by name as a route element of field 10. A route element filed as an airway is subject to alteration in the vicinity of an airport by application of a preferential route such as a PDR, PAR, or PDAR.

3.2.2 Coded Routes

A coded route is entered in field 10 as a coded route name. A coded route, with the exception of a Type 2 coded route with a re-entry option, may be entered or exited at any fix adapted on the route.

Coded routes are not subject to internal modifications by the application of PDRs, PARs and PDARs. Adaptation for coded route names may contain from 0 to 60 characters to be printed in the route field following the coded route name on flight strips. If adaptation indicates that the characters are in field 10 format, they are substituted for the coded route name on the flight progress strip and in the intercenter message (ICM).

The program provides for the following types of coded routes:

- a. A Type 0 is the basic type of coded route and has no special options.
- b. A Type 1 coded route may have airspeed adapted with each fix.
- c. A Type 2 coded route may have an altitude, airspeed, and/or re-entry option adapted with each fix and may have a transition option adapted. The re-entry option may indicate one or two loops. A type 2 coded route will have an altitude adapted on the loop entry fix.
- d. A Type 3 coded route may have a time delay adapted with each fix.
- e. A Type 4 coded route may have an altitude, airspeed, and/or time-delay option adapted with each fix and may have a transition option adapted.
- f. A Type 1, 2, or 4 coded route is direction sensitive. If both directions are required it is necessary to adapt each individually with a unique name.

3.2.3 Preferential Departure Route

Preferential departure routes (PDRs) are adapted for the purpose of providing rigidly controlled flight paths from specified airports. PDRs are not filed routes but are program applied, as specified in section 8.2.

3.2.4 Preferential Arrival Route

Preferential Arrival Routes (PARs) are adapted for the purpose of providing rigidly controlled flight paths to specified airports. PARs are not filed routes but are program applied, as specified in section 8.3.

3.2.5 Preferential Departure Arrival Route

A Preferential Departure Arrival Route (PDAR) functions as a combined PDR and PAR to provide airport-to-airport processing via a single adapted preferential route. Adaptation for a PDAR contains all the options associated with PDRs and PARs as specified in section 8.6.

3.2.6 Standard Instrument Departure

A Standard Instrument Departure (SID) route is similar in purpose to a PDR. SIDs differ from PDRs in that SIDs must be filed by name in the second element of field 10. SID processing is described in section 8.2.

3.2.7 Standard Terminal Arrival Route

Standard Terminal Arrival Route (STAR) is similar in purpose to a PAR. STARs differ from PARs in that STARs must be filed by STAR name in the next-to-last element in field 10. STAR processing is described in section 8.3.

3.3 NON-ADAPTED ROUTE SEGMENTS

A non-adapted route is a direct route or Great Circle route for which no direct route segment has been adapted. A straight-line route or great-circle route is implied (see section 7.3). Since no adaptation data exists for intermediate fixes, postings are determined by a calculation of the fix posting areas intercepted on the route in accordance with posting rules for FPAs as specified in section 7.0. Non-adapted routes are subject to alteration by substitution of an adapted preferential route (PAR, PDR, or PDAR). If two fix elements are filed as Direct, the route is subject to modification by substitution to an Adapted Direct Route (see section 3.5).

3.4 STEREO ROUTE

A Stereo Route is adapted as a series of any combination of adapted or non-adapted routes previously described, except PDRs, PARs, and PDARs. Each segment of a stereo route is subject to the processing appropriate for that kind of route. Processing of a stereo route may result from the entry of an SP or FP message (see NAS-MD-311). An FP message may be entered with a stereo tag in field 10, which causes the field 10 data adapted for the stereo tag to be substituted and processed for the filed field 10.

Field 06 is stored as part of stereo adaptation. If field 06 of the FP message differs from the stored field 06 associated with the stereo route, an error message is returned.

3.5 ADAPTED DIRECT ROUTES

Adapted Direct Routes are adapted for controlling fix postings on often-used flight routes between consecutive filed fix names. Each adapted direct route record specifies an applicable altitude range, the applicable segment (i.e., departure, arrival, en route, or any) and the appropriate adapted route elements to be used for the conversion and posting of one or two airways or Type 0 coded routes or of one PDR or PAR. When the adapted direct route consists of a PDR or PAR the preferential route must be active to be applicable. In addition, if the PDR or PAR has Equipment Restricted Route (ERR) indicator(s) adapted, the referent flight must have at least one Advanced Navigation Capability (ANC) indicator adapted (for the airborne equipment qualifier in field 03) that matches one of the ERR indicators, for the preferential route to be applicable.

When the adapted direct route consists of a PDR or PAR that has Route ICAO Equipment Eligibility (RIEE) indicators adapted, the referent flight plan must have data present in both elements of field 910 (element a. (EQP) and element b. (SRV)) and parameter ICAO Route Equipment Eligibility (IREE) must be "ON", for the PDR or PAR to be considered for application using the RIEE indicators. When RIEE indicators are adapted for the PDR or PAR to be considered and parameter IREE is "ON", the specifications described above in the first paragraph for ERR/ANC indicators will not be considered.

Flight strips show the route as originally filed.

An adapted direct route is direction sensitive. If route substitution (section 7.4) is required in both directions, a separate adapted direct route must be adapted for each direction.

4.0 ROUTE FORMAT CHECKS

This section of the specification contains the rules used in format checking Field 10 of a flight plan and indicates the error response when the format is incorrect.

4.1 FIELD 10 DEFINITION

Field 10 is a fixed-sequence field. The first element must be a fix, and the last element may be a fix or one of the route elements VFR, DVFR, or XXX (see table 4-2). The remaining elements of field 10 alternate route, fix, route, fix, etc. An element is separated from another element by a period character. When consecutive fix elements or route elements are filed, the fixed sequence format is maintained by inserting two period characters between the filed field 10 elements, e.g., fix..fix or awy..awy. When a stereo tag is used, it must be the only element.

The slash character (/) is used to file a lat/long fix element or as specified in table 4-1 in the description of ETE, ETA, and Delay Data. When the slash character is the second field 10 element, the slash character is interpreted as a tailoring indicator and is processed as specified in section 6.1.

4.2 FIELD 10 SIZE

The maximum allowable number of elements in field 10 of a flight plan is 48. The slash character, when used as a tailoring indicator, is considered a route element. Each delay suffix (/D(d)+dd) also is counted as a filed element. The double period (..), when used to indicate a fix or route element is omitted, is not considered to be an element and is not counted against the field size. This element limitation is applied to both the filed route and the expanded route which results from program insertion of transition route elements. When the number of elements exceeds 48, the following rejection message is returned:

REJECT - 10 RTE TOO MANY ELEMENTS

4.3 FIELD 10 ELEMENTS

Each element of field 10 is checked for proper element formats. If an element does not conform with one of the formats specified in tables 4-1 and 4-2, the following error message is returned:

10 RTE coele FORMAT

NOTE

coele includes delimiters output.

TABLE 4-1. FIELD 10 FIX ELEMENT DEFINITION

Field Elements	Format	Requirements
Latitude Longitude	dddd(L ₁)/ (d)dddd(L ₂)	<ol style="list-style-type: none"> 1. Degrees of latitude must not exceed 90 and degrees of longitude must not exceed 180. The leading digit of longitude is optional. Minutes of latitude or longitude must not exceed 59. L₁ may be N or S. L₂ may be E or W. If the degrees of latitude are 90, the minutes must be 0; if the degrees of longitude are 180, the minutes must be 0. 2. N latitude and W longitude, when omitted, are implied. S latitude and E longitude must be entered if applicable. If the optional L₁ or L₂ is used, both must be used
Fix Name	aa(a)(a)(a)	<ol style="list-style-type: none"> 1. The optional asterisk (*) character may be suffixed to the departure or destination fix. If suffixed to the departure fix, it inhibits the assignment of a PDR or PDAR applied by transition fix or D-line. If suffixed to the destination fix, it inhibits the assignment of a PAR or PDAR applied by transition fix or A-line. 2. When parameter EDEP is 'ON', the optional overcast symbol (⊕) may be suffixed to the departure fix. When parameter EDES is 'ON', the optional overcast symbol may be suffixed to the destination fix. If suffixed to the departure fix, it inhibits the consideration for application by transition fix or D-line of a PDR or PDAR that is adapted as an Equipment Restricted Route (ERR) and/or adapted as a Route ICAO Equipment Eligibility (RIEE) route. If suffixed to the destination fix, it suppresses the consideration for application by transition fix or A-line of a PAR or PDAR that is adapted as an Equipment Restricted Route (ERR) and/or adapted as a Route ICAO Equipment Eligibility (RIEE) route. 3. An asterisk character and an overcast symbol cannot be suffixed to the same departure and/or destination fix at the same time. 4. A four character fix name must include at least one letter.
Fix Radial Distance	aa(a)(a)(a) ddd ₁ ddd ₂	<ol style="list-style-type: none"> 1. The fix name aa(a)(a)(a) must include at least one letter. 2. The radial ddd₁ (in degrees) must be within the range of 001-360. 3. The distance ddd₂ (in miles) must be within the range of 001-999.

TABLE 4-1. FIELD 10 FIX ELEMENT DEFINITION

Field Elements	Format	Requirements
Adapted Fix 2-12 Characters		1. In the format of a lat/long, a fix name or an FRD.
Stereo Tag	La(a)(a)(a) (a)(a)(a)	1. If used, a stereo tag must be the only filed element of Field 10. 2. The letters OTP are not a legal stereo tag.
Estimated Time En Route	/dddd	1. If used, the ETE must be suffixed to the last filed element when that element is a fix. 2. The first two digits are hours, and the last two digits (minutes) must not exceed 59. 3. An ETE is filed with a proposed flight plan only.
Estimated Time of Arrival	/dddd	1. If used, the ETA must be suffixed to the last filed element when that element is a fix. 2. The first two digits (hours) must not exceed 23; the last two digits (minutes) must not exceed 59. 3. An ETA is filed with an active flight plan only.
Delay Data	/D(d)d+dd	1. If used delay data must be suffixed only to a fix name, FRD, or lat/long. 2. The first two digits (hours) must not exceed 21; the last two digits (minutes) must not exceed 59. 3. Delay data must not be suffixed to the last filed element.
Plus Sign (For printing with highlighting)	+	1. A maximum of two plus signs may be filed. 2. If used, a plus sign must prefix the field 10 element. 3. The plus sign may not prefix the first element (departure point) of field 10. 4. Additional requirements are as specified in NAS-MD-314.
Period Element Delimiter	.	1. Used to separate elements of field 10.

TABLE 4-2. FIELD 10 ROUTE ELEMENT DEFINITION

Field Elements	Format	Requirements
Airway	aa(a)(a)(a) (a)(a)(a)	1. Must be a unique name.
Coded Route	aa(a)(a)(a) (a)(a)(a)	1. Must be a unique name.
Standard Instrument Departure	aa(a)(a)(a)d	1. Must be a unique name. 2. If used, SID name must be filed as the second element in field 10.
Standard Arrival Route	aa(a)(a)(a)d	1. Must be a unique name. 2. If used, the STAR name must be filed as the next-to-last element in field 10.
Tailoring Indicator	/	1. If used, the tailoring indicator must be filed as the second element. 2. The third element must be a fix.
Incomplete Route Indicator	XXX	1. Unique name.
Visual Flight Rules Indicator	VFR	1. Unique name. 2. When filed as the second element in field 10, the third element must be a fix.
Defense Visual Flight Rules Indicator	DVFR	1. Unique name. 2. When filed as the second element in field 10, the third element must be a fix.
Reentry Operator	+Rd(d) +Sd(d) +Rd(d)+Sd(d)	1. The reentry operator may be suffixed to an internal adapted coded route or to any external route element. 2. d(d) must be between 0 and 15, inclusive. 3. Either or both operators may be suffixed.

TABLE 4-2. FIELD 10 ROUTE ELEMENT DEFINITION (Continued)

Field Elements	Format	Requirements
Plus sign signs (For printing with highlighting)	+	<ol style="list-style-type: none"> 1. A maximum of two plus signs may be be filed. 2. If used, a plus sign must prefix the field 10 element. 3. The plus sign may not prefix the first element (departure point) of field 10. 4. Additional requirements are as specified in NAS-MD-314.
Element Delimiter	•	<ol style="list-style-type: none"> 1. Used to separate elements of field 10.

5.0 FIX DESCRIPTION

This section describes the different conditional uses for certain fixes. A fix qualifies for different functions because of either adaptation or different processing rules.

5.1 INTERCENTER COORDINATION FIX

An intercenter coordination fix is a fix used as a common reference point for traffic between centers. If referenced by fix name, the intercenter coordination fix name must be contained in the adaptation for both centers. Different fixes, each applicable to different altitude ranges, may be adapted as coordination fixes for the same adapted route. Intercenter coordination fixes are referred to as outbound coordination fixes for the center being exited and inbound coordination fixes for the center being entered.

The fix to be used as the coordination fix for flights entering into an adjacent center on an adapted route may be specified in adaptation. The search for an adapted adjacent center coordination fix will begin with the first fix in the adjacent center and go backward along the converted route of flight. Each converted fix is examined as an applicable adapted coordination fix until one of the following occurs:

- a. An adapted coordination fix, applicable at the processing altitude, in the direction of flight, for the specific adjacent center is encountered, or
- b. The route (going backward) junctions with another adapted route or a direct route in the center being exited, or
- c. There are no more converted fixes left to examine.

If the center boundary is crossed by a non-adapted route or by an adapted route whose converted portion has no coordination fix adapted, the intercenter coordination fix is the last fix posted in the center being exited, or the last filed or implied fix in the center being exited, whichever is closer, measured along the route, to the boundary crossing point.

If the last fix posted for an overflight on a non-adapted route, as determined by the preceding rules, is the only postable fix in the center and the flight is entering from and exiting to the same adjacent center, the outbound boundary crossing point will be used as the intercenter coordination fix.

When the intercenter coordination fix used is a Fix Radial Distance (FRD), and parameter Interfacility Coordination Fix Data Transfer (ICDT) is set to ON for the adjacent NAS center, the converted fix location and the outbound boundary crossing point will be sent in lat/long coordinates precise to a second of a degree in flight plan and amendment messages sent to the adjacent NAS center. If the outbound boundary crossing point is used as the intercenter coordination fix, only the boundary crossing fix location will be sent.

Intercenter messages are sent, based on the time at the last converted fix within the center being exited, for all adapted route segments. For non-adapted route segments, intercenter messages are sent based on the time at the boundary crossing point. Intercenter message for all routes which exit a center on a vertical altitude transition are based on the time at the altitude transition point.

5.2 BOUNDARY CROSSING POINT

A boundary crossing point is a point where a boundary crossing between two centers occurs at a flight's processing altitude. When this point is needed for processing, it is calculated.

5.3 DEPARTURE COORDINATION FIX

A departure coordination fix is a fix used for printing departure coordination strips for proposed flights in designated FPAs adapted for coded routes, PDRs, PDARs, and SIDs. If the processing altitude is within the altitude range associated with the FPAs, the coordination strip will be posted. Departure coordination strips are not produced for flights for which no adapted departure routes are applicable.

If a coded route is filed as a second element in field 10, each fix adapted as a departure coordination fix subsequent to the departure point will be posted if the processing altitude at the fix is within the altitude range associated with the designated FPA adapted for the coded route.

When a proposed flight plan is departed or when a flight plan is entered as an active departure, the departure coordination adaptation (if applicable at flight altitude) is used in addition to en route adaptation to convert the fix. However, if an FPA appears in both departure coordination adaptation and in the en route adaptation, the FPA will appear in the converted route for that fix only as indicated in the en route adaptation, but the fix will be force posted in that FPA. If the departure coordination strips were not printed before the flight was activated, en route strips will be printed for the fix for those FPAs which would have received departure coordination strips at proposed time.

5.4 APPROACH CONTROL COORDINATION FIX

An approach control coordination fix is a converted fix used for coordination with an approach control facility. An approach control facility may be made up of more than one FPA. When a route of flight penetrates an approach control facility one coordination fix is required for each FPA that contains a postable fix.

The coordination fix for a duplicate FDEP strip at active time is determined as follows:

- a. If the FDEP strip is a duplicate of another approach control posting, the duplicate FDEP strip will show the same coordination fix and time as the primary strip;
- b. If the FDEP strip is a duplicate of a center posting, the duplicate FDEP strip coordination fix and coordination time will show the center fix it is a duplicate of, and the time at that fix. At proposed time, the duplicate FDEP strip will show the departure fix and departure time.

5.4.1 Adapted Coordination Fix

The fix to be used as the coordination fix for flights traversing or arriving in an approach control's area on an adapted route may be specified in adaptation. The search for an adapted coordination fix will begin in the last contiguous approach control FPA along the route of flight beginning with the last converted fix in that FPA and going backward along the converted route of flight. Each converted fix is examined as applicable adapted coordination fix until one of the following occurs:

- a. An adapted coordination fix, applicable at the processing altitude in the direction of flight for the specific approach control FPA is encountered or;
- b. The route (going backward) junctions with another adapted route or a direct route outside of the specific approach control area being searched or;
- c. There are no more converted fixes left to examine.

Each approach control FPA, in the approach control area(s), containing a posted fix will be processed in this manner.

In the case of Approach Control facilities made up of more than one FPA or adjacent approach control(s), it is possible for the adapted coordination fix for one of the FPAs within the facility to reside in another FPA (see figure 5-1).

CENTER ZAA	APPROACH CONTROL ABC			APPROACH CONTROL XYZ		ADJACENT CENTER ZBB
FPA 1201	FPA 0101	FPA 0102	FPA 0103	FPA 0201	FPA 0202	
AA	BB	CC	DD	EE	FF	GG

FIGURE 5-1. APPROACH CONTROL COORDINATION FIXES

EXPLANATION OF FIGURE 5-1

FPA 1201 is a center FPA; FPAs 0101, 0102 and 0103 belong to ABC Approach Control. FPAs 0201 and 0202 belong to XYZ Approach Control. Any of these fixes may be designated as the coordination fix for one or more of the approach control FPAs.

In the case of an inbound flight from an adjacent center into an approach control area, the inbound coordination fix is the coordination fix for that approach control FPA.

5.4.1.1 Non-Adapted Coordination Fix. If the converted route of flight does not contain an adapted approach control coordination fix, then the last posted fix prior to the FPA or — in the case of no posted fix — the last converted fix prior to the FPA will be used as the coordination fix. This fix must lie in the center/approach control area preceding the approach control FPA that is penetrated by the route of flight.

5.4.2 Non-Adapted Routes

The fix to be used as the coordination fix for flights arriving in or traversing an approach control's area on a non-adapted route will be the entry point to the approach control FPA that is to be posted, and is posted relative to the FPF for this FPA.

5.5 ARTS COORDINATION FIX

The ARTS coordination fix is used as the coordination fix for flights departing from, arriving in or traversing ARTS airspace on adapted or non-adapted route segments. The ARTS coordination fix may be specified in the adaptation or may be derived from calculated bearings from an adapted point in ARTS airspace. The exception is when a flight is totally within a single ARTS facility, then the coordination fixes will be the first converted fix and the last converted fix. (NAS-MD-312, section 6.1 and 6.3).

The ARTS airspace will be divided into radial segments described by adapting starting and ending bearings from the adapted point in the ARTS airspace. Each of these segments will have a fix adapted to be used as an ARTS coordination fix for flights entering or exiting the ARTS airspace on routes without adapted coordination fixes.

5.5.1 Adapted Coordination Fix

The fix to be used as the coordination fix for flights departing from, arriving in or traversing ARTS airspace on an adapted route may be specified in adaptation.

5.5.1.1 Arrivals and Overflights. For flights arriving in or traversing ARTS airspace the search for an adapted coordination fix will begin with the last converted fix prior to the ARTS area on the route of flight and go backward along the converted route until one of the following occurs:

- a. An adapted coordination fix, applicable at the processing altitude, in the direction of the flight for the specific ARTS area is encountered, or
- b. The route (going backward) junctions with another adapted route or a direct route preceding the ARTS area, or
- c. There are no more converted fixes to examine.

5.5.1.2 Departures. For flights departing from an ARTS area the search begins at the first converted fix in the first FPA outside of the ARTS area and goes forward along the route of flight. Each converted fix is examined as an applicable adapted coordination fix until one of the following occurs:

- a. An adapted coordination fix applicable at the processing altitude, in the direction of flight for the specific ARTS area is encountered, or
- b. The route junctions with another adapted route or a direct route following the ARTS area, or
- c. There are no more converted fixes left to examine.

5.5.2 Non-Adapted Coordination Fix

For flights entering an ARTS area without adapted coordination fixes, the coordination fix will be determined by computing the radial from a point, adapted in ARTS airspace, to the last converted fix within the adjacent (Center/ARTS/Approach Control) FPA. The fix adapted to the ARTS segment containing the radial will then be used as the coordination fix.

If the selected converted fix within the adjacent facility FPA and the arrival point in ARTS airspace are identical (same X, Y coordinates; e.g., vertical transition into the ARTS at the arrival point), the last converted fix without the same X, Y coordinates will be used.

For flights exiting the ARTS area without adapted coordination fixes, the coordination fix will be determined in the same manner as arrivals, but using the first converted fix in the adjacent (Center/ARTS/Approach Control) FPA. If the selected converted fix within the adjacent facility FPA and the departure point in ARTS airspace are identical (same X, Y coordinates; e.g., vertical transition out of the ARTS at the departure point), the first converted fix without the same X, Y coordinates will be used.

5.6 TRANSITION FIX

Each PDR and PAR must have at least one adapted fix specified as a transition fix. In the case of PDRs the transition fix designates the point at which the PDR route ends and the flight is considered

en route. In the case of PARs the transition fix designates the point at which the en route inbound flight will begin the arrival route. The transition fix is used to determine the eligibility of a flight plan for PDR and PAR application if the filed route (as amended by route substitution) is via adapted airways or direct.

A transition fix, when applicable to a PDR or PAR, is an adapted fix related to an adapted airport, used to determine PDR or PAR application and used as a junction fix between the filed route and the applied adapted route.

A STAR, SID, and types 2 and 4 coded routes may have one or more adapted fixes specified as a transition fix. In the case of STARs the transition fix is an adapted fix used to determine the route to be used between the transition fix and the entry fix of the STAR. In the case of SIDs the transition fix is an adapted fix used to determine the route to be used between the exit fix of the SID and the transition fix. An entry fix on a STAR and the exit fix on a SID can also be adapted as a transition fix. In the case of type 2 and 4 coded routes the transition fix is an adapted fix used to determine the route between a fix on the coded route and the transition fix.

5.7 CONNECT FIX

A connect fix is an adapted fix used to connect an airport or an airport's adapted satellite airport with a coded route or an airway that does not pass directly over that airport or satellite airport. A connect fix may also be used to connect two airways or coded routes that do not junction. Two connect fixes may be adapted on an airway or coded routes to connect an airport or fix off the airway or coded route.

6.0 ROUTE LOGIC CHECKS AND ADAPTATION CHECKS

Route logic checks and adaptation checks are performed to ensure that the data filed in Field 10 are compatible with adaptation and other existing data of the flight plan. Route logic checks and error responses are contained in this section.

When the route logic checks and adaptation checks specified in this section are performed on a field 06 and/or field 10 that were constructed from an ICAO flight plan message (see NAS-MD-311, section 13.1.1.4), all of the applicable error responses contained herein will be reject messages. When the error response applies to an ICAO flight plan message, the appropriate reject message(s) will be shown under each error response, enclosed in parentheses. When more than one ICAO field element is present in a reject message they will be separated by a minus sign (-) character, i.e., DEP/ROU (where ROU is an airway element) would be ARPT-V13. Only those reject messages that apply to the appropriate ICAO field element(s) in error will be output, i.e., when a fix element is not in fix adaptation as in section 6.5.1 and it is the fix from field 914, element a., when it is inserted into field 10, the element abbreviation of BPT will appear in the reject message or when the departure airport and airway element as in section 6.7.1.3 are in error the ICAO element abbreviations of DEP/ROU will both appear in the reject message.

When the ICAO three letter abbreviation DEP is output in a REJECT message and the ICAO field 918, indicator DEP/ data was inserted as the first element of field 10 (see NAS-MD-311, section 13.1.1.4.11.1), the DEP/ data will be output as the coele.

When the ICAO three letter abbreviation DST is output in a REJECT message and the ICAO field 918, indicator DEST/ data was inserted as the last element of field 10 (see NAS-MD-311, section 13.1.1.4.11.5), the DEST/ data will be output as the coele.

ICAO route (ROU) delimiters are space characters and will be part of the reject message text where present in the referent field 915, element c., Route Data. ICAO route delimiters are not indicated in this section for each ICAO reject message, but where the referent NAS error message indicates "with delimiters" or "including delimiters" the ICAO reject text will also include ICAO delimiters. The ICAO route indicator "DCT" is not considered an ICAO delimiter and it will be output as an element of the route data (ROU) in the reject message text when applicable.

When ICAO flight plan messages are being processed, the incomplete route indicator, XXX, when referenced in this section was either filed or converted from the ICAO route truncation indicator, T, when field 10 was constructed (see NAS-MD-311, section 13.1.1.4.11.4, item b.).

6.1 FIRST CONVERTED FIX DETERMINATION

The following rules, in order of priority, are used to determine the first converted fix of a flight plan:

- a. If the second element is a tailoring symbol (/), processing is done from the coordination fix to the fourth element, and the coordination fix (field 06) becomes the first converted fix.
- b. If the second element is VFR or DVFR, the third element must be a fix. The first converted fix is the fix following VFR or DVFR.
- c. If the coordination fix (field 06) is the same as the first element (departure point), processing is done from the coordination fix to the second element in field 10 and the coordination fix becomes the first converted fix. If the departure point is an adapted airport and the entered time is P- or D-time, the X-Y coordinates of the airport are used for the first converted fix.
- d. If the first element is followed by two consecutive element delimiters, processing is done from the coordination fix (field 06) direct to the second fix in field 10 and the coordination fix becomes the first converted fix. If the coordination fix (field 06) and the second fix in field 10 are the same, the second fix in field 10 is the first converted fix.
- e. If the second element in field 10 is an adapted route, processing is done from the coordination fix (field 06) to the second element and the coordination fix (field 06) becomes the first converted fix.

After the first converted fix has been determined, at least one route segment, beginning with the first converted fix, must exist. Otherwise, the following message is returned:

```
10 RTE cofie SHORT ROUTE
(REJECT — DEP/BPT/ROU/DST coeles SHORT ROUTE)
(REJECT — DEP/ROU/DST coeles SHORT ROUTE)
(REJECT — DEP/ROU/DST/ETE coeles SHORT ROUTE)
```

6.2 (DELETED)

6.3 LAST CONVERTED FIX DETERMINATION

The last converted fix consists of one of the following:

- a. The destination airport, or fix, for flights which do not cross a center boundary outbound.
- b. The first adapted fix which is physically external to the center at the altitude being processed for flights which exit the center via an adapted route.
- c. The second endpoint of the direct route segment which exits the center for flights which exit via direct route.

One exception applies to (a), (b), and (c) above, i.e., if XXX, VFR, or DVFR appears in the route prior to center exit, other than the second element, the last converted fix is the last filed or adapted fix preceding XXX, VFR or DVFR.

Last converted fix refers to the last fix for which route records are generated. The number of route records for any flight plan may not exceed 255. The determination of last converted fix does not preclude the examination of filed elements, beyond the filed element containing the fix, for purposes of logic checking preferential route application, or external arrival processing.

If the destination fix identification matches that of an adapted airport, the X–Y coordinates of the airport are used as fix coordinates for the last converted fix.

6.4 INTERNAL FLIGHT PLANS

For a flight plan, with P or D time, if the departure fix is internal to the center area at the ground, and VFR, DVFR, or tailoring symbol is not the second element of field 10, the departure fix and the coordination fix must be identical, or either or both fixes may be an adapted substitute fix for the other. Otherwise, the following error message is returned:

06/10 FIX/RTE cofie and the first element of field 10, including delimiters, FIXES MUST MATCH

If the second element is VFR or DVFR, processing begins with the third element in field 10 and the time in field 07 represents the time over the third element.

6.5 ADAPTATION CHECK

This section specifies the error responses for elements not adapted.

6.5.1 Fix Elements

An adapted fix may be a fix name, a lat/long, or a fix-radial-distance. The first and last fix element to be converted and all filed fix elements in between must be an adapted fix, an unadapted lat/long or a fix-radial-distance. If a fix element is not in fix adaptation and does not qualify as a lat/long or fix-radial-distance; or if the fix name portion of a fix-radial-distance is not adapted, the following error message is returned:

10 RTE coele NOT STORED
(REJECT — BPT coele NOT STORED)
(REJECT — DST coele NOT STORED)
(REJECT — ROU/DST coeles NOT STORED)
(REJECT — DST/ETE (coele and coele) NOT STORED)
(REJECT — ROU/DST/ETE coeles NOT STORED)
(REJECT — ROU coele NOT STORED)

If a fix element is a lat/long and is determined to be greater than 4096 nautical miles from the origin of the center's geographic plane, the following error message is returned:

REJECT — LAT/LONG CONV. EXCEEDS PROGRAM LIMIT

NOTE

This reject message also applies to ICAO flight plan messages.

When the coordination fix (field 06) is not adapted and does not qualify as a lat/long or a fix-radial-distance, or if the fix name portion of a fix-radial-distance is not adapted; the following error message is returned:

06 FIX cofie NOT STORED
(REJECT — BPT coele NOT STORED)

6.5.2 Route Elements

The route elements between the first and last fix elements to be converted, except XXX, VFR, and DVFR, must be adapted route elements. Otherwise, the following error message is returned:

10 RTE coele NOT STORED
(REJECT — ROU coele NOT STORED)

6.6 DISTANCE CHECK

When the entry fix and the exit fix of a filed airway are the same and the fix appears only once on the airway, the following error message is returned:

10 RTE route segment in error including delimiters DISTANCE ZERO
(REJECT — ROU route segment in error DISTANCE ZERO)

When the entry fix and the applied exit fix of a filed coded route are the same and the fix is adapted only once on the coded route the preceding error message is returned.

When the element preceding a filed, adapted route segment is the coordination fix (field 06) and when the exit fix of the filed, adapted route segment is this same fix, the following error message is returned:

06/10 FIX/RTE cofie and the route segment in error, including delimiters, DISTANCE ZERO
(REJECT — BPT/ROU coele and the route segment in error DISTANCE ZERO)
(REJECT — BPT/ROU/DST coeles and the route segment in error DISTANCE ZERO)
(REJECT — DEP/ROU coele and the route segment in error DISTANCE ZERO)
(REJECT — DEP/ROU/DST/ETE coeles and the route segment in error DISTANCE ZERO)

A zero distance on a direct route segment is acceptable. If the entire route has a distance of zero, the following error message is returned:

10 RTE cofie and the route in error, including delimiters, DISTANCE ZERO
(REJECT — DEP/ROU/DST coeles (the route in error) DISTANCE ZERO)
(REJECT — DEP/BPT/ROU/DST coeles (the route in error) DISTANCE ZERO)
(REJECT — DEP/ROU/DST/ETE coeles (the route in error) DISTANCE ZERO)
(REJECT — DEP/DST coeles DISTANCE ZERO)
(REJECT — DEP/ROU/DST/ETE coeles DISTANCE ZERO)

6.7 CONNECT CHECKS

Each adapted route (airways, coded routes, STARs, and SIDs) if filed, must connect with the element preceding and the element following it. If the filed route cannot be connected, the flight plan is not accepted.

Adaptation does not permit multiple junctions between two airways, two coded routes, or between an airway and a coded route.

A departure or an arrival airport cannot be used as the transition fix for a PAR, PDR, STAR, or SID. A departure airport cannot be used as the transition fix for a PDAR.

The following subsections specify connect requirements and indicate the appropriate error responses.

6.7.1 Adapted Route Connections

6.7.1.1 Fix to Adapted Route and Adapted Route to Fix Connection. When a filed route contains an adapted route, either preceded by and/or followed by a fix, the fix must either be adapted as on the adapted route or be adapted as a fix connected to the adapted route.

Exceptions are as follows:

- a. When a type 2 coded route is followed by a fix, the fix must be one of the following:
 1. Adapted as a fix connected to a fix on the coded route (not a loop only fix).
 2. Adapted as a transition fix to the coded route.
 3. Adapted as a fix connected to the coded route (not a loop only fix).
- b. When a type 4 coded route is followed by a fix, the fix must be one of the following:
 1. Adapted as a fix on the coded route.
 2. Adapted as a transition fix to the coded route.
 3. Adapted as a fix connected to a fix on the coded route.
- c. When a type 2 coded route is preceded by a fix, the fix must be one of the following:
 1. Adapted as a fix on the route (not a loop only fix).
 2. Adapted as a fix connected to a fix on the route (not a loop only fix).
- d. When an airway to fix combination is entered in the route of flight and the airway is a segmented airway, the fix following the airway must be the same segment or connected to a fix on the same segment, as the filed or implied fix preceding the airway.
- e. When a fix to adapted route combination is entered in the filed route of flight and the route is processed from the coordination fix to the second element and the second element is an adapted route, the fix prior to the adapted route (the departure point) does not have to be adapted as on the adapted route or be adapted as a fix connected to the adapted route.

Otherwise, the following error message is returned:

```
10 RTE the fix and adapted route element including delimiters FIX NOT ON ROUTE  
(REJECT — ROU the fix and adapted route element FIX NOT ON ROUTE)  
(REJECT — BPT/ROU the fix and adapted route element FIX NOT ON ROUTE)
```

When a type 2 coded route is preceded by and/or followed by a fix, the fix must be adapted as a fix on the route (not on the loop only). Otherwise, the preceding error message is returned.

When a fix to adapted route connect-error occurs and the fix is the coordination fix (field 06), the following error message is returned:

```
06/10 FIX/RTE (cofie and coele) FIX NOT ON ROUTE  
(REJECT — BPT/ROU (coele and coele) FIX NOT ON ROUTE)  
(REJECT — DEP/ROU (coele and coele) FIX NOT ON ROUTE)  
(REJECT — ROU coele FIX NOT ON ROUTE)
```

6.7.1.2 Adapted Route to Adapted Route Connection. When an adapted route to adapted route combination is filed in the route of flight the second adapted route must be intersected by the first adapted route. The existence of an intersection is determined as follows:

If the first adapted route is an airway name or a coded route name and the second adapted route is an airway name or coded route name, the second adapted route must be adapted as a junction on the first adapted route.

If the first adapted route is an airway name or a coded route name and the second adapted route is a STAR name, one of the fixes adapted on the first adapted route must match the entry fix or transition fix adapted for the STAR.

If the first adapted route is a SID name and the second adapted route is an airway name or a coded route name, the exit fix adapted for the SID must match one of the fixes adapted on the second adapted route.

If the first adapted route is a SID name and the second adapted route is a STAR name, the exit fix adapted for the SID must match the entry fix or transition fix adapted for the STAR.

Otherwise, the following error message is returned:

```
10 RTE the two adapted routes with delimiters NO DEFINED JUNCTION
(REJECT — ROU the two adapted routes NO DEFINED JUNCTION)
```

6.7.1.3 Airway to Airport and Airport to Airway Connection. When a filed route contains an airway, either preceded by and/or followed by an airport, the airport must either be an adapted airport connected to the airway or must be a fix adapted as on the airway or connected to the airway. Otherwise, the following error message is returned:

```
10 RTE the airport and airway element including delimiters FIX NOT ON ROUTE
(REJECT — DEP/ROU the airport and airway element FIX NOT ON ROUTE)
(REJECT — ROU/DST the airway element and airport FIX NOT ON ROUTE)
(REJECT — ROU/DST/ETE the airway element, airport and ETE FIX NOT ON ROUTE)
```

If the airport is an adapted satellite airport, the above connect check is performed using the adaptation of the associated airport.

6.7.1.4 Coded Route to Airport and Airport to Coded Route Connection. When a filed route contains a coded route preceded by an airport, the airport must be either an adapted airport connected to the coded route or a fix connected to the coded route. When a filed route contains a coded route followed by an airport, the airport must be an adapted airport connected to the coded route, a fix connected to the coded route, or a transition fix for the coded route. Otherwise, the following error message is returned:

```
10 RTE the airport and coded route element including delimiters FIX NOT ON ROUTE
(REJECT — DEP/ROU the airport and coded route element FIX NOT ON ROUTE)
(REJECT — ROU/DST the coded route element and airport FIX NOT ON ROUTE)
(REJECT — ROU/DST/ETE the coded route element, airport and ETE FIX NOT ON ROUTE)
```

If the airport is an adapted satellite airport, the above connect check is performed using the adaptation of the associated airport.

6.7.2 Connect Check for SIDs

When a SID name appears in other than the second element of field 10 or a SID name is the only filed route element, or a SID is filed in an airfile flight plan (E-time) the following error message is returned:

10 RTE coele INVALID SID USE
(REJECT — ROU coele INVALID SID USE)

The filed fix identifier preceding a SID name must match the identifier of an airport adapted to the SID. Otherwise, the following error message is returned:

10 RTE name of fix and SID with delimiters FIX NOT ON ROUTE
(REJECT — DEP/ROU name of departure aerodrome and SID FIX NOT ON ROUTE)

If the SID name filed is inactive or if the aircraft class(es), or ERR indicator(s), or altitude range adapted to the SID name filed do not match that of the flight plan, or when adapted RIEE indicators cause the flight plan to not qualify for the application of the filed SID name, the following error message is returned:

10 RTE coele SID NOT ACTIVE
(REJECT — ROU coele SID NOT ACTIVE)

If the element following the SID name is a fix and the fix is other than the adapted exit fix or transition fix from that SID, the following error message is returned:

10 RTE name of SID and fix with delimiters FIX NOT ON ROUTE
(REJECT — ROU name of SID and fix FIX NOT ON ROUTE)

6.7.3 Connect Check for STARs

When a STAR name is filed in other than the next to last element of field 10 or a STAR name is the only filed route element, the following error message is returned:

10 RTE coele INVALID STAR USE
(REJECT — ROU coele INVALID STAR USE)

The filed fix identifier following a STAR name must match the identifier of an airport adapted to the STAR. Otherwise, the following error message is returned:

10 RTE name of STAR and fix with delimiters FIX NOT ON STAR
(REJECT — ROU/DST name of STAR and destination aerodrome FIX NOT ON STAR)
(REJECT — ROU/DST/ETE name of STAR, destination aerodrome and ETE FIX NOT ON STAR)

When the STAR name in an internal filed proposed flight is inappropriate because it is inactive, or the aircraft class(es), or ERR indicator(s), or altitude range adapted to the STAR name filed do not match that of the flight plan, or the STAR is inappropriate for the reasons stated above for an active flight and the resultant flight does not have a processable route segment, or when adapted RIEE indicators cause the flight plan to not qualify for the application of the filed STAR name, the following error message is returned:

10 RTE coele STAR NOT ACTIVE
(REJECT — ROU coele STAR NOT ACTIVE)

The adaptation check (section 6.5) is applied to the STAR prior to the preceding check.

If the element preceding the STAR name is a fix and the fix is other than the adapted entry fix or transition fix into that STAR, the following error message is returned:

10 RTE the fix and the STAR name with delimiters INVALID STAR ENTRY
(REJECT — ROU the fix and the STAR name INVALID STAR ENTRY)
(REJECT — BPT/ROU the fix and the STAR name INVALID STAR ENTRY)

If a STAR name is part of the route of an accepted flight plan, except one that is still proposed and the STAR is inactive or inappropriate, then the flight plan is processed to the filed or implied fix element preceding the STAR name. If the fix element is implied the fix is program inserted into the route. In addition, the incomplete route indicator (XXX) is program inserted before the STAR name, and an Incomplete Route Alert message is outputted as specified in NAS-MD-314. A STAR may become inappropriate, in the sense of this paragraph, when:

- a. An entered altitude or altitude amendment causes the processing altitude to be outside the stratum adapted for the STAR.
- b. An entered aircraft characteristic or aircraft characteristic amendment makes the STAR invalid for the flight.
- c. An entered airborne equipment qualifier or a change to an airborne equipment qualifier makes the STAR invalid for the flight.
- d. When parameter IREE is "ON" an entered amendment to field 910 (element a. (EQP) and/or element b. (SRV)), when RIEE indicators are adapted for this STAR name, makes the STAR invalid for the flight.

A STAR may be inappropriate or inactive but is processed as specified in this paragraph in any of the following conditions:

- a. An airfile flight plan is entered.
- b. A flight plan is entered with a D-time.
- c. An intercenter message (ICM) is received.
- d. An altitude amendment to an active flight plan moves the processing outside the stratum in altitude stratification adaptation.
- e. An amendment message is entered that would activate the flight plan or a Departure message is entered.
- f. An aircraft characteristic amendment to an active flight plan is entered.
- g. A change is entered (AM or QB) to the airborne equipment qualifier of an active flight that causes the flight plan's route to be reprocessed and makes the STAR invalid for the flight.
- h. When parameter IREE is "ON" an amendment (AM) was entered to field 910 (element a. (EQP) and/or element b. (SRV)) of an active flight and the RIEE indicators, when adapted for this STAR name, causes the flight plan's route to be reprocessed and makes the STAR invalid for the flight.

6.8 SPECIAL ELEMENTS

The following special route elements are described and their logic checking specified in this section:

- a. Visual Flight Rules (VFR)
- b. Defense Visual Flight Rules (DVFR)
- c. Incomplete Route Indicator (XXX)

- d. Reentry Operator
- e. Stereo Tag

6.8.1 VFR and DVFR Logic Checking

When VFR or DVFR is the second element in field 10, the filed fix following VFR or DVFR must be internal to the center area at the filed altitude. Otherwise, the following error message is returned:

10 RTE coele NOT INTERNAL TO CENTER
(REJECT — ROU coele NOT INTERNAL TO CENTER)

When VFR or DVFR is other than the second element in field 10 the element preceding the VFR or DVFR element must be a filed fix. Otherwise, the following error message is returned:

10 RTE element preceding VFR or DVFR and the VFR or DVFR both with delimiters FIX MUST PRECEDE VFR/DVFR
(REJECT — ROU element preceding VFR and the VFR FIX MUST PRECEDE VFR)

6.8.2 Incomplete Route Indicator (XXX) Logic Checking

When XXX, the incomplete route indicator, appears in field 10, the element preceding the XXX element must be a filed or program-inserted fix. Otherwise, the following error message is returned:

10 RTE element preceding XXX and XXX both with delimiters FIX MUST PRECEDE XXX
(REJECT — ROU element preceding T and T FIX MUST PRECEDE T)

6.8.2.1 Incomplete Route Indicator (XXX) Insertion. On receipt of a flight plan from an adjacent NAS center, an adjacent Non-U.S. Automated Facility or ARTS facility that has one processable segment but contains a logic error in the flight plan, or when a STAR name is part of the route (see section 6.7.3), the program insert an Incomplete Route Indicator after the last processable fix element. If the error occurs on a segment following an adapted route element, the fix that makes up the junction of the adapted route is program inserted.

6.8.3 Reentry Operator

If one or more passes through the reentry loop of a coded route is specified in the route field (field 10), and that loop (first or second) is adapted on the coded route, the coded route may be entered at any fix up to but not including the loop entry fix for that loop and exited at or beyond the loop entry fix. Otherwise, the following error message is returned:

10 RTE the preceding element, the coded route name, and the following element with delimiters INVALID CODED ROUTE ENTRY

(REJECT — BPT/ROU the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — BPT/ROU/DST the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — DEP/ROU the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — DEP/ROU/DST the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — DEP/ROU/DST/ETE the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — ROU the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — ROU/DST the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

(REJECT — ROU/DST/ETE the preceding element, the coded route name, and the following element INVALID CODED ROUTE ENTRY)

In no case can a coded route be entered or exited at a loop fix (see section 6.7.1.1).

6.8.4 Stereo — Field 06

Field 06 is stored as an adapted fix in stereo adaptation (NAS-MD-316). If field 06 of the FP message containing a stereo tag as field 10 differs from the stored field 06 associated with the stereo route, the following error message is returned:

06 FIX cofie NO MATCH WITH STEREO TAG

6.8.5 Stereo — Adaptation Retrieval

Stereo adaptation is stored on disk. If stereo adaptation is required in order to process a message and the data cannot be retrieved from the disk, the following reject message will be returned:

REJECT — STEREO DATA NOT AVAILABLE

6.9 BOUNDARY CROSSING DETERMINATION

For each route segment to be converted the program determines whether or not the route segment enters and/or exits the center area at the processing altitude:

- a. The boundary crossing for a direct route is the intersection of the direct route with the center boundary.
- b. The inbound boundary crossing for an adapted route is the first converted fix within the center area.
- c. The outbound boundary crossing for an adapted route is the last converted fix within the center area.
- d. For a departure or arrival fix on a PDR, PDAR, PAR, SID, or STAR, boundary crossing determination is made based on the adaptation of the route.

6.9.1 Adapted Route Segments

When processing determines that a flight is out of the center area at the flight's altitude, on an adapted route, the flight is considered to have crossed the center boundary.

6.9.2 Direct Route Segments

All center boundary lines described in adaptation specify an altitude range. When a direct route segment intersects a center boundary applicable at the flight's altitude, the flight is considered to have crossed the center boundary.

6.9.3 Outbound Crossings

After an internal point has been processed, the program begins to check for an outbound boundary crossing. The flight is considered to have exited the center when the first center boundary crossed is determined.

7.0 ROUTE CONVERSION AND POSTING (EN ROUTE)

Route conversion is the process of expanding each route segment filed in field 10 into the component fixes making up the route. Component fixes that describe an adapted route are found in adaptation. Fixes along direct routes are calculated in accordance with direct route conversion rules.

When the route elements VFR or DVFR appear in field 10 as the second element, route conversion begins with the fix following the VFR or DVFR. The fix following the VFR or DVFR is given a priority code 14 by the program and is posted for the FPA appropriate at the processing altitude.

Route conversion begins with the coordination fix of a flight which originates as an airfile in the center area with other than VFR or DVFR as the second element. The coordination fix is given a priority code 14 by the program and is posted for the FPA appropriate at the processing altitude.

When the route elements VFR, DVFR, or XXX appear in field 10 in other than the 2nd element, route conversion ends with the fix preceding the VFR, DVFR, or XXX. Elements beyond are not converted. The fix preceding VFR, DVFR, or XXX is force posted for the FPA appropriate at flight altitude unless it is a postable fix for the FPA.

Airfile points are always posted.

7.1 ADAPTED ROUTE CONVERSION AND POSTING PRIORITIES

The adapted fixes on an adapted route between the entry and exit fixes, filed or implied, of a filed route segment are the fixes to be converted for an adapted route.

For airways, when the previous posted fix to be printed on the flight strip for a fix is to be other than the normal previous posted fix for that fix, an indicator may be adapted for each fix eligible as the previous posted fix. Those airway fixes having such indicators adapted for the direction of flight will use the previous fix so adapted (if any) for the direction of flight as long as all of the following conditions are met:

- a. Both fixes lie on the same airway.
- b. The airway is continuous between the two fixes.
- c. The route of flight follows that airway between the two fixes.

If the last fix on an airway segment has an adapted previous posted fix applied, it is applied for all postings for that one occurrence of the fix whether the postings are a result of converting the airway segment or of converting the segment following the airway segment.

Adaptation for each fix on airways and coded routes contains a posting priority code or special indicator for each direction along the airway or coded route for each altitude stratum over the fix. Adaptation for each fix on PDRs, PARs, PDARs, SIDs, and STARs contains one posting priority code or special indicator. Priority codes range from 01 through 14. Posting eligibility of a specific fix is determined based on its postability at flight altitude and priority. Eligibility at flight altitude is determined, first, from

route adaptation, or if not available, second, from fix adaptation. A special indicator of 00 indicates that fix is not posted for this adapted route, and a special indicator of 15 indicates that a fix is unconditionally posted for this adapted route except as discussed in section 7.5.4. Postings are based on priority for a Fix Posting Area (FPA) such that only the highest priority fix for an FPA is posted. The priority codes at the junction fix between adapted routes will be compared and posting will be via adapted posting priorities. When entering an FPA on an adapted route(s) which junction with a direct route, posting will be via adapted posting priorities. If all fixes on an adapted route within a given FPA have a special indicator of 00, no fixes are posted for that FPA. All fixes on an adapted route within a given FPA that have a special indicator of 15 are unconditionally posted (except as discussed in section 7.5.4) in addition to postings determined by priorities.

If more than one fix on an adapted route in an FPA has the highest priority for that FPA, the first fix encountered with that priority is posted. Subsequent fixes for the same FPA having the same or lower priority are not posted.

For the departure FPA, the departure point and any fixes in that FPA with a posting priority of 15 will be the only primary postings for that FPA.

Departure airports are always posted. Arrival airports have priorities adapted and are direction sensitive. Fixes off airways or off coded routes that serve to connect two airways or coded routes have priorities adapted and are altitude and direction sensitive. Direction sensitive means that connect fixes for airports and airways or coded routes are determined from flight direction.

7.1.1 Elimination of Duplicate Postings

For each fix on an adapted route, adaptation may contain a list of FPAs to be used when outputting strips for each fix on the adapted route. If this information is omitted from route adaptation, the information contained in fix adaptation is used to determine FPA postings.

If this list is adapted, the first FPA in the list is the primary FPA, i.e., the FPA which contains the fix. Subsequent FPAs in the list are duplicate or alternate FPAs that may receive fix postings.

For an adapted route, duplicate primary and alternate postings for FPAs based on direction priority at processing altitude within an FPA will be eliminated.

7.2 SPECIAL RULES FOR PROCESSING CODED ROUTES

Processing characteristics unique to coded routes are specified in this section.

7.2.1 Airspeed

An adapted airspeed represents the airspeed used in fix time calculation for all flights that traverse the coded route and are applied until reaching a subsequent fix that has a different adapted airspeed or until the coded route is exited. Filed true airspeed (TAS) will be used for fix time calculations until the first fix that has an adapted airspeed is encountered. The same adapted airspeed is used for strip printing as specified in NAS-MDs-314 and 315.

7.2.2 Posting Altitude

If the coded route does not have an altitude adapted, post according to coded route adaptation at the request or assigned altitude as specified in section 10.0.

7.2.2.1 Posting on the Coded Route. Processing altitude(s) for type 2 and type 4 coded routes is specified in section 10.6.1.

For the first fix with an adapted altitude, post according to adapted posting priorities in all FPAs from the processing altitude to the adapted altitude, except as follows:

- a. If this first fix is the entry fix of this coded route and the exit fix of a preceding coded route that had an adapted altitude applied, then post according to the coded route adaptation at the adapted altitude.
- b. If this first fix is the departure fix, post according to the coded route adaptation at the adapted altitude.
- c. If this first fix is the first converted fix and if it is external to the center area at the adapted altitude and if VFR or DVFR is not the second element, this fix is not posted by the center.
- d. If this fix is the Departure Route Distance Parameter (DRDP) point of a non-adapted departure, post according to coded route adaptation in all appropriate FPAs from Departure Route Altitude Parameter (DRAP) to the adapted altitude.
- e. If this first fix is the exit fix, post according to coded route adaptation at the requested or assigned altitude as specified in section 10.0.

If the entry fix of the coded route is the DRDP point of a non-adapted departure and does not have an altitude adapted, post according to coded route adaptation in all appropriate FPAs from DRAP altitude to the higher of the assigned or requested altitude until a fix with an adapted altitude is reached.

If the entry fix is the departure point and does not have an adapted altitude, post according to coded route adaptation at the requested or assigned altitude as specified in section 10.0.

Altitudes for strip printing are specified in NAS-MDs-314 and 315.

7.2.2.2 Posting When Exiting the Coded Route. Processing altitude when exiting a type 2 or type 4 coded route is specified in section 10.6.2.

For the exit fix of a coded route, post according to adapted posting priorities in all FPAs from the adapted altitude to the altitude to be used when the coded route is exited, except as follows:

- a. If the exit fix is the destination fix and has an altitude adapted, post according to the coded route adaptation at the adapted altitude.
- b. If the exit fix is the destination and has no adapted altitude, post according to coded route adaptation at the requested or assigned altitude as specified in section 10.0.
- c. If the exit fix is also the entry fix of a following coded route and if there is an adapted altitude on the entry fix of this second coded route, post according to adapted posting priorities in all FPAs from the adapted altitude on the first route to the adapted altitude on the second route.
- d. If the exit fix of a coded route is also the Arrival Route Distance Parameter (ARDP) point for a non-adapted arrival, post according to the coded route adaptation in all appropriate FPAs from the adapted altitude to ARAP.

Altitudes for strip printing are specified in NAS-MDs-314 and 315.

7.2.3 Reentry

A Type 2 coded route may contain one or two optional repetitive series of fixes as part of the route.

This series of fixes has a fix designated as the loop entry fix, which is the fix where the coded route is exited to enter the reentry loop. A coded route may have one or two loops, and each loop is identified as the first or second loop. The reentry loop fixes consist of the adapted fixes, in order, from the loop entry fix, back to the loop entry fix, and are adapted separately from the coded route fixes. Loop fixes will not be adapted as outbound coordination fixes. A loop entry fix may be adapted as an outbound coordination fix.

The number of times the reentry loop is to be processed must be filed with the coded route name in the route field (field 10) of the flight plan. If the R reentry operator is filed, the loop (if any) adapted as the first loop on this coded route is processed. If the S reentry operator is filed, the loop (if any) adapted as the second loop on this coded route is processed. If a reentry operator is filed and the coded route does not have the specified (first or second) loop adapted or if the coded route is not a type 2 coded route, the reentry operator is ignored.

7.2.4 Transition

Various transition fixes can be specified at which the coded route can be exited.

If the next element following a coded route is a transition fix, the program inserts the adapted transition route associated with the referent transition fix between the coded route and the transition fix in the filed route of flight.

7.2.5 Delay

An adapted delay represents the delay time to be used in the fix time calculation for each fix to which the delay is adapted. A filed delay at the entry and/or exit fix of a coded route takes precedence over an adapted delay. This delay is used only if a hold does not exist for the fix. In addition, for an amendment for which the route is reconverted, a delay is applied to the first converted fix only if there is a delay on the fix in the converted route before the amendment (the delay has not been overruled or completed). Delays are reapplied on other converted fixes if there is no hold stored for them when reversion takes place.

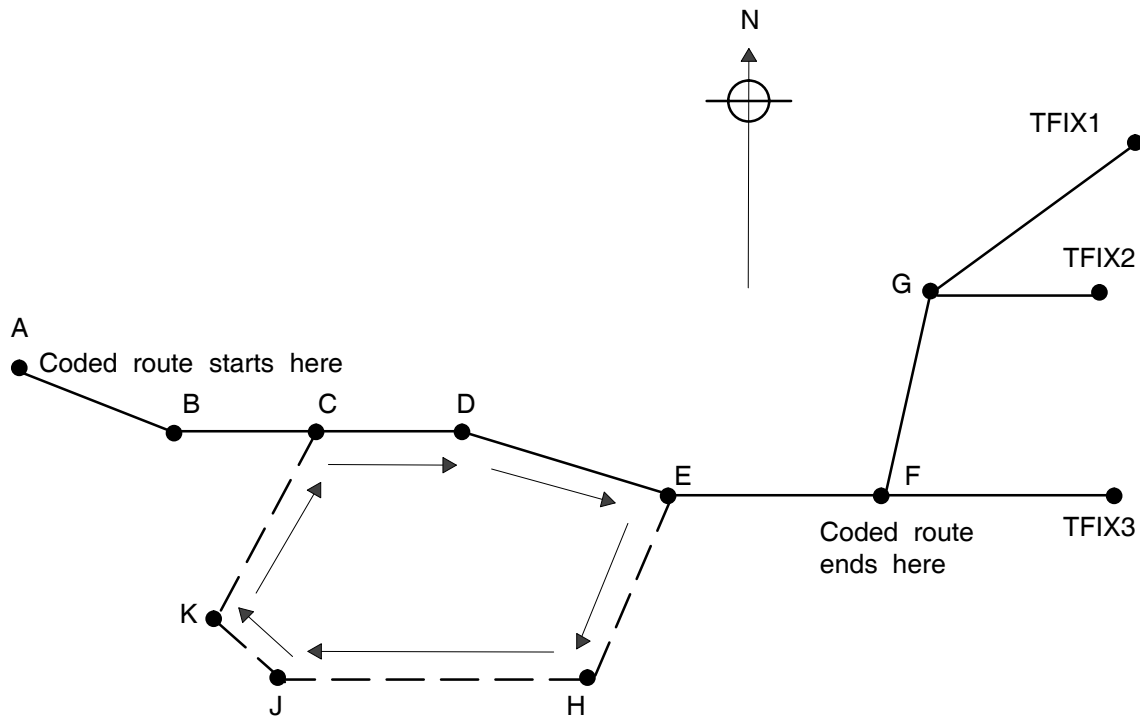
Figure 7-1 illustrates an example of a Type 2 coded route with an optional re-entry sequence and three transition fixes.

Field 10 of the flight plan that traverses the coded route in the example, makes two passes around the optional loop and exits at transition fix, TFIX2, would be filed as:

A.CR2+R2.TFIX2

The preceding filed route would be printed on a flight strip as follows:

A CR2+R2 F J1 G J2 TFIX2



Legend (Assuming a West to East Flight Path):
 CR2 = A-B-C-D-E-F
 RE-ENTRY LOOP = E-H-J-K-C-D-E
 CR2 ENTRY FIXES CAN BE = A-B-C-D
 CR2 EXIT FIXES CAN BE = E-F

FIGURE 7-1. EXAMPLE OF A TYPE 2 CODED ROUTE WITH AN OPTIONAL REENTRY SEQUENCE AND THREE TRANSITION FIXES

The sequence of fixes (converted route) traversed by a flight following this route is as follows:

A

B

C

D

E

H

J

K First Loop

C

D

E

H

J

K

C Second Loop

D

E

F

G

TFIX2

7.3 DIRECT ROUTE CONVERSION AND POSTING PRIORITIES

Direct route conversion is applied to each segment of a filed route in field 10 for which no adapted route applies. Converted fixes for a direct-route flight consist of filed fixes and implied fixes, and intersections which are calculated according to equations contained in Appendix B and Appendix C of this specification.

Two methods are used to process non-adapted direct route segments. The straight-line method is used if the Great Circle Processing Check (GCPC) parameter is off and the Great Circle Method is

used if the Great Circle Processing Check (GCPC) parameter is on. The equations used in straight-line calculations are in Appendix B and the equations used in great-circle calculations are in Appendix C.

When a flight plan or amendment message is received from an adjacent NAS center with an intercenter coordination fix (Field 06) as an FRD, it may contain high-precision coordination fix and boundary crossing data (Field 12/17 pair). When parameter Coordination Fix Data Processing Switch (CDPS) is set to COR or BOTH, this data received as a lat/long precise to the second, is used to determine the location of the coordination fix (x-y coordinates) and the boundary crossing point in the converted route. When CDPS is set to COR, only the coordination fix data is used. When CDPS is set to BOTH, the coordination fix and boundary crossing data is used. The coordination fix is processed as if it is in the airspace of the sending center.

The appropriate method of the two described is used to find the point of intersection between a filed route segment and:

- a. a center boundary
- b. an FPA boundary
- c. a major or minor airway
- d. a fix posting line (B-line)
- e. an arrival or departure transition line (A- or D-line)
- f. a line perpendicular to that segment which passes through a focal point fix.
- g. a special sector coordination line (S-line)

The program determines which FPAs have been penetrated in the case of a direct route segment being coincident with a boundary. When a direct route segment turn point falls on a boundary line, the turn point is considered to be in the same FPA that the route was in prior to the turn point. When a direct route segment passes through a boundary node, the FPA penetrated is the one which the route will enter immediately after crossing the node.

7.3.1 Posting Format

All points of intersection are stored as converted fixes in the form of x-y coordinates. All points to be posted are posted in the form of fix-radial-distance, relative to the FPF of the FPA being posted. The following exceptions apply:

- a. If the distance from the fix to which the FRD is referenced is less than or equal to Minimum Perpendicular Check Distance (MPCD) miles, the point is posted as fix only.
- b. If the FPA is an oceanic FPA and no focal point fix is adapted, the point is posted in the form of lat/long, except where paragraph "c" below applies.
- c. If filed point posting is selected, the filed point is posted as filed when the filed fix is an adapted fix, an FRD from the focal point fix assigned to the FPA, a latitude/longitude if the FPA containing the filed point has no FPF assigned, or an FRD the name of which is within the FPA. In all other cases, the filed point is posted as an FRD from the FPF of the FPA being posted. A star is printed in the first character position following the filed point whenever

the filed point is posted other than as filed. The star informs the user that the point posted is the same as the filed point with a different descriptive name. Exceptions are as follows:

1. If the departure point (P- or D-time) and/or the arrival point are printed other than as filed, a star is not printed in the first character position following the filed point. This is to prevent confusion between a no-name star and a PDR/PAR override indicator.
 2. If the coordination fix (field 06) and the first element in field 10 are different and if the coordination fix is going to be printed other than as filed, the star is printed in the first character position following the first filed element in field 10 for that strip.
- d. If an FPA has a NO POST indicator set ON, postings for that FPA are inhibited.

7.3.2 Direct Route Posting Priority

The selection of points to be posted is made according to the following priority list with the result being one posting per pass of the flight through each FPA, except as noted below.

The point of entry into an FPA and any fix that has a special indicator of 15 are the only points posted for the FPA when the entry point posting indicator (EPPI) is ON.

When entering an FPA on a direct route which junctions with an adapted route, when EPPI is off and Direct Route Priority Indicator (DRPI) parameter is adapted, a priority code will be assigned to the fix on the direct route segment that junctions with the adapted route. The priority codes at the junction fix between the direct route and the adapted route will be compared with any other applicable priority codes for the FPA. If the priority code assigned to the fix on the direct route segment that junctions with the adapted route is equal to or higher than any other applicable priority code for the FPA, posting is via direct route posting priorities. Otherwise, posting is via adapted posting priorities. When EPPI is OFF, the following priority list applies:

- a. Direct-route filed-points and A-line intersection points.
- b. Intersection of the route with a major airway
- c. Intersection of the route with a minor airway or fix posting line
- d. The intersection of the perpendicular from the FPF with the route segment within the FPA
- e. Point of entry into the FPA

When entering an FPA on direct route segment when EPPI is off and DRPI is not adapted, posting will be via direct route posting priorities on the direct route segment entering the FPA.

7.3.2.1 Direct-Route Filed-Points. The selection of filed points to be posted is determined by the Filed Point Posting Indicator (FPPI), which is set in adaptation. An A-line intersection point is considered to be a filed point for posted point selection purposes. The FPPI controls postings and may specify one of the following:

- 1 = Post only the first filed point within an FPA.
- 2 = If two or more direct route filed points occur within an FPA, post only the first and last of these points. If only one filed point occurs within an FPA, it is posted.
- 3 = Do not post any filed points.

7.3.2.2 Major Airway or Minor Airway or Fix Posting Line or S-Line Intersections with a Route Segment. Segments of airways or fix posting lines that lie within an FPA may be specified in adaptation for posting of the intersections of direct routes with these segments. The priority of posting major airways, minor airways, or fix posting line intersection is in the following order:

- a. major airway intersection
- b. minor airway intersection or fix posting line (B-line) intersection

The intersection of a direct route with an airway or fix posting line segment is posted only if no filed postable point is found within the FPA or if FPPI is set to 3.

If the direct route intersects more than one major airway in an FPA, only the intersection closest to the FPF is posted. If no FPF is assigned to the FPA, only the first intersection encountered along the route of flight should be posted. If a direct route does not intersect a major airway and intersects more than one minor airway or fix posting line in an FPA, only the intersection closest to the FPF is posted. If no FPF is assigned to the FPA, only the first intersection encountered along the route of flight should be posted.

Whenever a direct route intersects an S-line and the route segment heading is within the range of headings adapted for the S-line, a supplemental fix posting is developed for the FPA specified in adaptation. If the lat/long option is adapted for this S-line, the S-line intersection will be posted in lat/long format. If the FRD option is indicated, the S-line intersection will be posted as an FRD off the focal point fix if the intersection occurs in an FPA with an adapted FPF. Otherwise, the lat/long format will be used.

7.3.2.3 Closest Point to Focal Point Fix. If the conditions a, b, and c specified in section 7.3.2 are not applicable, the point of intersection of the perpendicular from the focal point fix with the route segment, is computed by the equations described in Appendices A and B. If any of these intersections are within the FPA, the closest one to the focal point fix that is also within the FPA, is posted. If all of the above intersections are outside the FPA or if no focal point fix is assigned to the FPA, the FPA entry point is calculated and posted.

7.4 ADAPTED DIRECT ROUTE PROCESSING

When two consecutive fix names (2–5 alphanumeric) are filed in field 10 of a flight plan, the program determines whether an adapted direct route applies as specified in section 3.5. If an adapted direct route applies, the converted fixes as specified by adaptation are used for the direct route segment. The fixes are posted according to the processing rules for the adapted routes that replace the direct segments.

7.5 SPECIAL POSTING REQUIREMENTS

This section specifies the rules that modify or override the usual en route posting determination rules.

7.5.1 A-Line

If in an FPA there is no postable fix at or before the point of crossing an applicable A-line, the A-line crossing point is force posted.

7.5.2 S-Line

On a direct route, an S-line crossing point is force posted to the FPA adapted for that S-line.

7.5.3 XXX, VFR, DVFR

If the fix preceding XXX, VFR, or DVFR is not already postable in the last center or Approach Control FPA at the flight's last processing altitude, it is force posted at that altitude.

7.5.4 Special Indicator of 15

A route record with a special indicator of 15 is force posted. This rule overrides direct route rules and adapted route rules. This rule is overridden only by sections 7.5.6 and 7.5.7 below.

7.5.5 Multiple Primary Route Records at One Fix

If a combination of one or more altitude transitions or concave FPAs or unusual adaptation at a route junction causes a primary route record sequence to exit and then reenter an FPA without progressing to another fix, en route posting rules will be applied as if the FPA had not been exited. The route records at that fix in the other FPA(s) will also be referred normally as appropriate.

7.5.6 Posting Convention

When by the application of all other en route posting rules more than one postable primary route record is generated for one fix at one time in one FPA, the last postable coded route record, or the last postable adapted route record (if there are no route records), or the last postable route record (if there are no coded route or adapted route records) will be the only posting for that fix at that time in that FPA.

If a duplicate FPA is adapted for a primary fix that is converted more than once in the primary FPA at one time, only the last of the identical duplicate route records will be posted if more than one of them are postable.

7.5.7 Precedence of En route Posting Determination Rules

Postings determined by en route rules may be overridden by the suppression of postings specified for non-adapted departures. See section 8.2.3.

7.5.8 Special Arrival Fix Posting

Postings determined by non-adapted arrival processing rules may be overridden in order to provide the posting of a fix that is the arrival fix and is adapted within a center sector, when the flight is on a non-adapted arrival. This special arrival fix processing will only apply when normal processing does not post the arrival fix and parameter Force Post Arrival Airports (FPAA) is ON.

8.0 ROUTE CONVERSION AND POSTING (ARRIVAL AND DEPARTURE)

This section specifies requirements for the application of preferential routing to a filed route of flight. Preferential routings apply to departures and arrivals at airports and consist of SIDs, STARs, PARs, PDRs, and PDARs. Non-adapted departure and arrival processing is also specified. If a departure or arrival airport is adapted as a satellite airport, the satellite airport will be processed using all the adaptation from its associated adapted airport except for name; location (X–Y coordinates); FDEP, if applicable; and overlying strata. Overlying strata, as adapted in fix adaptation, is used.

8.1 TRANSITION LINES (A-LINES AND D-LINES)

Transition lines are adapted in terms of their end-point coordinates. Each line is adapted to one or more airports and may be adapted to PARs and PDRs for direct routes. Two types of transition lines can be adapted: Arrival Transition line (A-line) and Departure Transition line (D-line). A-lines can be used to initiate PAR application, and D-lines to initiate PDR application.

A-lines and/or D-lines can be adapted with no corresponding PARs and/or PDRs specified. The function of the transition lines in this case is to modify the posting requirements for non-adapted arrivals and departures (see sections 8.4 and 8.5). Each transition line has a specified altitude range and applicable aircraft class or classes adapted with it. If more than one D-line or A-line is within A-line/D-line Distance Parameter (ADDP) miles of the airport, the farthest line from the airport that is applicable to the altitude and class is to be used. Each A-line can specify the fix on the PAR to which the flight is to proceed directly after crossing the A-line. The specified fix may be any transition fix on the PAR. At the point at which the route of flight intercepts an A-line, a converted fix is generated. If a PAR is applied, the converted fix is printed on a flight strip in the format specified in section 7.3.1. Each D-line can specify the fix at which the flight must exit the PDR. The specified fix may be any transition fix on the PDR. The PDR is applied from the point of departure to the fix adapted to the D-line and then processed direct to the filed point beyond the D-line. The fix may be any fix on the PAR or PDR.

8.2 DEPARTURE ROUTES

Airport departure routes include SIDs, PDRs, PDARs, and non-adapted departures.

8.2.1 Standard Instrument Departure Application

Standard instrument departure routes are applied only when filed by SID name appearing as the second element in field 10. Each SID may specify the aircraft class(es), the ERR indicator(s), the Route ICAO Equipment Eligibility (RIEE) indicator(s), and the altitude range to which the SID applies. Each SID may contain an active/inactive indicator, which can be changed dynamically by the Switch Activity (SA) input message, as specified in NAS–MD–311. A SID serves one or more airports and may have multiple transition fixes adapted. The SID adaptation may contain a route for each transition fix adapted for the SID. This adapted route is the route from the last fix on the SID (exit fix) to the transition fix. Each fix along a SID has an altitude range(s), FPAs, and a priority code adapted for posting purposes.

When a SID has adapted RIEE indicators it can only be considered for application using the RIEE indicators when parameter ICAO Route Equipment Eligibility (IREE) is “ON” and the referent flight plan has filed data in both elements of field 910 that match those adapted RIEE indicator letters.

In addition to all other eligibility checks the logic in table 8–1 is used for considering the application of a filed adapted SID name when RIEE and/or ERR indicators, adapted or not adapted, are/are not considered.

TABLE 8–1. SID RIEE/ERR ELIGIBILITY

Field 910 Elements a. and b. Contents	Parameter IREE Setting	SID With Only RIEE Indicators Adapted	SID With RIEE and ERR Indicators Adapted	SID With Only ERR Indicators Adapted	SID With No RIEE and No ERR Indicators Adapted
Data in Both Elements	ON	Consider for RIEE Indicators Only	Consider for RIEE Indicators Only	Reject Flight Plan	Consider
	OFF	Reject Flight Plan	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider
Data in Only one Element or No Data	ON or OFF	Reject Flight Plan	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider

Key:

- RIEE = Adapted Route ICAO Equipment Eligibility indicators, optionally adapted for preferential routes, SIDs and STARS.
- IREE = Adapted dynamic parameter ICAO Route Equipment Eligibility.
- ERR = Adapted Equipment Restricted Route indicators, optionally adapted for preferential routes, SIDs and STARS.

When the fix following the SID name is a transition fix, the exit fix of the SID followed by the applicable adapted transition route will be inserted in field 10 by the program between the SID name and the transition fix.

Figure 8–1 shows a SID that serves three airports with three different transition fixes.

Fixes AAA, BBB, CCC, and DDD make up the common SID route. The route from DDD to the filed transition fix is stored in the SID adaptation data and is different for each transition fix. Fix DDD can also serve as a transition fix.

The following filed routes are equivalent:

- a. TERM1.SIDNAME.TFIX2
- b. TERM1.SIDNAME.DDD.J1.TFIX2

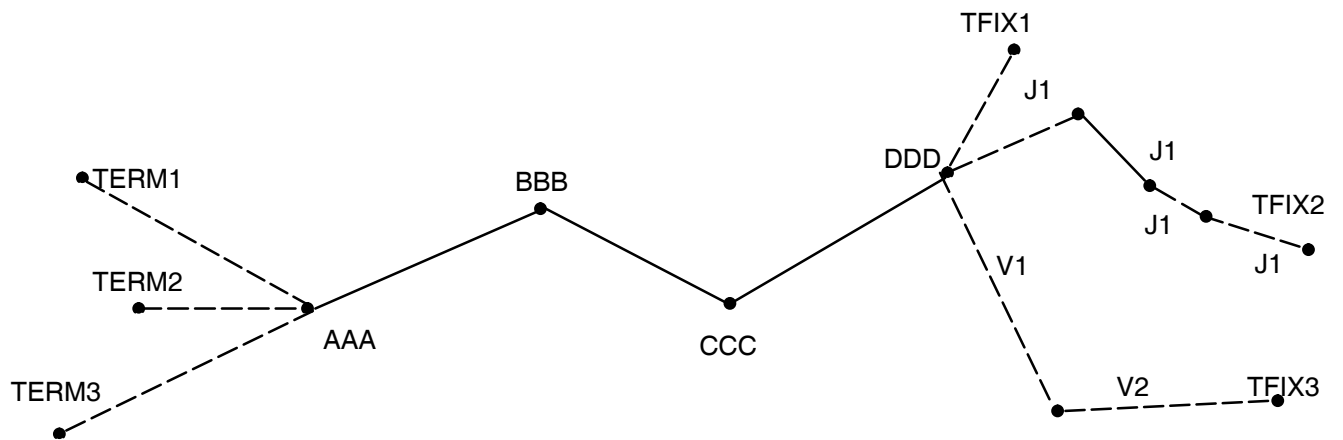


FIGURE 8-1. A SID SERVING THREE AIRPORTS WITH THREE DIFFERENT TRANSITION FIXES

8.2.2 Preferential Departure Route Application

Preferential Departure Routes are conditionally inserted by the program based on the criteria described in following subsections. The procedures for determining the eligibility of a flight plan for PDR application vary, depending upon whether the flight is via an adapted route or direct. A flight is ineligible for PDR application if:

- a. The flight is not a departure as defined in section 10.2.
- b. An asterisk (*) is suffixed to the point of departure.
- c. The departure fix is on a coded route.
- d. The departure airport has no currently active PDR applicable to the specified aircraft class, the ERR indicator(s) (if applicable) the Route ICAO Equipment Eligibility (RIEE) indicator(s) (if applicable) and filed requested altitude.
- e. A PDAR is applicable.
- f. VFR or VFR/(d)dd appear in field 8/9.
- g. The first segment of the filed route is an adapted direct route consisting of a preferential route.
- h. The flight plan has a SID filed.

If none of the preceding conditions apply, the flight plan is tentatively qualified for PDR application. Methods of determining the final eligibility of the filed route for PDR application differ with each filed route segment, depending upon whether a segment is via adapted route or direct.

A flight is ineligible for PDR RIEE and ERR eligibility considerations (Table 8-2) when an overcast symbol (\oplus) is suffixed to the departure fix. Only those PDR routes without adapted RIEE and ERR indicators, if any are adapted, will be considered for application.

If the referent flight plan contains data in both elements of field 910 (element a. (EQP) and element b. (SRV)) and parameter IREE is "ON", the following eligibility checks are made for each PDR under consideration, prior to any further checks:

- a. If the PDR has one or more RIEE indicators adapted and if
- b. the equipment (EQP) and surveillance (SRV) letters in field 910 of the flight plan are adapted in one or more RIEE indicators for the PDR, then the flight plan is eligible to have this PDR applied. Otherwise, this flight is not eligible to have this PDR applied.

If more than one PDR is eligible to be applied for the referent flight plan, the PDR that has the highest priority adapted RIEE indicator that contains the referent field 910 letters, is considered for application. If the highest priority adapted RIEE indicator is the same for two or more PDRs, the PDR that has its transition point most distant from the departure point along the route is the one considered for application.

If the flight is not eligible for the application of any PDR routes that have adapted RIEE indicators or there are no PDRs adapted with RIEE indicators, then those PDR routes without adapted RIEE and ERR indicators, if any are adapted, are considered for application.

In addition to all other eligibility checks the logic in table 8-2 is used for considering the application of a PDR when RIEE and/or ERR indicators, adapted or not adapted, are/are not considered.

TABLE 8-2. PDR RIEE/ERR ELIGIBILITY

Field 910 Elements a. and b. Contents	Parameter IREE Setting	PDR With Only RIEE Indicators Adapted	PDR With RIEE and ERR Indicators Adapted	PDR With Only ERR Indicators Adapted	PDR With No RIEE and No ERR Indicators Adapted
Data in Both Elements	ON	Consider for RIEE Indicators Only	Consider for RIEE Indicators Only	Do not consider	Consider
	OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider
Data in Only one Element or No Data	ON or OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider

Key:

- RIEE = Adapted Route ICAO Equipment Eligibility indicators, optionally adapted for preferential routes, SIDs and STARS.
- IREE = Adapted dynamic parameter ICAO Route Equipment Eligibility.
- ERR = Adapted Equipment Restricted Route indicators, optionally adapted for preferential routes, SIDs and STARS.

If the referent flight plan does not have data in one or both elements of field 910 (element a. (EQP) and/or element b. (SRV)) or if parameter IREE is "OFF" and the referent flight's airborne equipment qualifier in field 03 has one or more ANC indicators adapted, the following eligibility checks are made prior to any further checks:

- a. If one of the adapted ANC indicators matches one of the adapted ERR indicators, if present, for the referent PDR route, this flight is eligible to have the PDR applied if all other eligibility checks are satisfied. Otherwise, this flight is not eligible to have this PDR applied.
- b. If the flight is not eligible for the application of any PDR routes that have adapted ERR indicators, or there are no PDRs adapted with ERR indicators, then those PDR routes without adapted ERR indicators, if any are adapted, are considered for application.

If more than one PDR is applicable to a given flight, the PDR that has its transition point most distant from the departure point along the route is the one applied. PDRs are adapted as a series of fixes. Each fix adapted along a PDR has an altitude range(s), FPAs, and a priority code specified for posting purposes. A PDR can have one or more transition fixes adapted and can be associated with one or more adapted airports and one or more adapted D-lines.

A status indicator is adapted for each PDR, designating the PDR as active or inactive. This indicator can be changed dynamically by an SA input message. Each PDR also has adapted the aircraft class(es), the optional ERR indicator(s), the optional RIEE indicator(s) and the altitude range at which the PDR applies.

8.2.2.1 Adapted Route. Airway segments may be altered by substitution of a PDR if during route conversion, a fix is found that is adapted as a transition fix for a PDR associated with the departure

airport. The search for a transition fix is limited by the application of two parameters; Internal Departure Logic Distance (IDLD) and External Departure Logic Distance (EDLD). As specified below, the adapted value of IDLD (or both IDLD and EDLD) is compared to distance measured along the filed route of flight:

- a. If the first adapted fix exceeding IDLD miles, measured from the departure point, is internal to the center or is the first external adapted fix, then only those adapted fixes up to and including this fix will be examined.
- b. If an external adapted fix is encountered before IDLD miles is exceeded, then both IDLD and EDLD are applied; measurement along the route starts at the external fix for comparison to EDLD. The transition fix search is discontinued at, but includes, the adapted fix beyond the first parameter value exceeded. If alphanumerics are not adapted, the filed route is not altered.

If no adapted transition fix is found, then the search for a transition fix is terminated, and no PDR is applied. If a transition fix is found, the appropriate PDR applies, provided (1) the PDR is active, (2) the PDR is appropriate to the aircraft class, and the ERR or RIEE indicator(s) (if applicable) at the filed altitude, (3) the cumulative distance along the filed route from the departure point to the transition fix does not exceed PDR/PAR Application Distance Parameter (PADP) miles if PADP is adapted in miles or does not exceed PADP route segments if PADP is adapted in route segments, and (4) the PDR does not affect the conversion of a coded route segment, a STAR, or an adapted direct preferential route. The PDR, if any, finally applied is the one which satisfies all of the above conditions and which has its transition fix furthest from the departure point, but within the IDLD/EDLD limits as specified. If a delay is filed in field 10 prior to the transition fix of the PDR, the delay is not applied. A filed delay on the transition fix of the PDR is applied.

PDR adaptation can contain characters to be printed in the route field of proposed flight strips (see NAS-MDs-314 and 315). The transition fix is inserted into the alphanumerics unless the alphanumerics are in field 10 format and contain the transition fix. Any characters in field 10 format are associated with the adapted elements of the PDR. The characters will not contain an implied junction between two routes if the implied fix is a transition fix for this PDR. If the proposed flight plan is to be transmitted to an adjacent center, the route field to be transmitted contains the PDR characters merged into the filed route of flight. When the flight becomes active and the adaptation indicator specifies that the PDR characters are in field 10 format, the PDR characters are merged into the filed route of the flight plan which is to be transmitted to the adjacent center. If the filed route contains the same characters as the PDR contains, the PDR is applied but the PDR characters are not merged into the filed route.

If the alphanumerics are in field 10 format, the only characters that are merged are those adapted between the departure point and the transition fix.

Figure 8-2 shows an example of PDR application to adapted routes. The illustration shows an airport having a PDR adapted for eastbound flights on airway V1 with BBB adapted as the transition fix on V1 for the PDR. If TERM1.V1.TERM2 is filed in field 10, route conversion extracts from adaptation a list of fixes along V1 from TERM1 through TERM2, inclusive, i.e., TERM1, AAA, BBB, EEE, TERM2. Fix BBB is determined to be a PDR transition fix, and the list of fixes between the departure point, TERM1, and fix BBB is replaced with the fixes from the applicable PDR adaptation.

The resultant list of fixes represents the fixes to be converted: TERM1, CCC, DDD, BBB, EEE, TERM2.

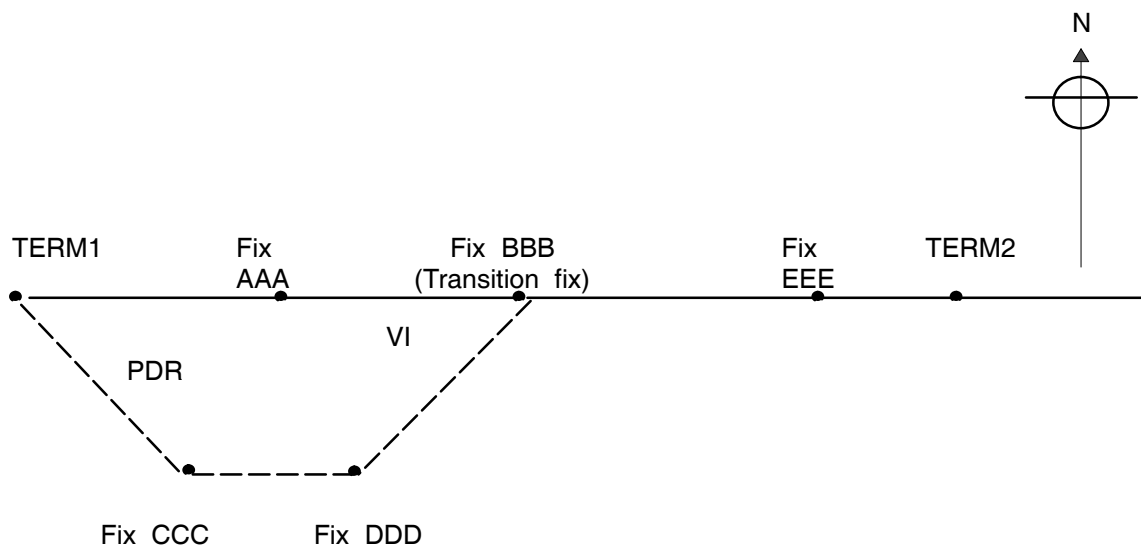


FIGURE 8-2. PDR APPLICATION TO ADAPTED ROUTES

8.2.2.2 Direct Route. Direct routes may qualify for PDR application if none of the conditions specified in section 8.2.2 apply and if the application of a PDR does not affect the conversion of a coded route segment, a STAR, or an adapted direct preferential route. Direct route segments may be altered by substitution of a PDR if, within IDLD and EDLD limits, either of the following two conditions exist:

- a. A fix adapted as a transition fix for a currently active, applicable (based on aircraft class, the ERR or RIEE indicator(s) (if applicable) altitude and PADP) PDR for the departure airport appears as a filed fix in field 10; or
- b. An applicable (based on aircraft class, altitude, and ADDP) D-line that has a currently active PDR which is applicable for the aircraft class, and the ERR or RIEE indicator(s) (if applicable) is intersected by a direct route segment between the first filed fix beyond IDLD miles and the departure point.

In either case above, the PDR must be applicable to the departure airport. The PDR associated with a transition fix will take precedence over one associated with a D-line.

The two parameters IDLD and EDLD, will be applied, as follows, in the search for filed transition fixes and D-line intersections:

- a. If the first filed fix exceeding IDLD miles, measured from the departure point, is internal to center or is the first external filed fix, then only those filed fixes (or D-line intersections) up to and including this fix will be examined. If no adapted transition fix (or D-line) is found, then the search is discontinued and no PDR is applied.
- b. If an external filed fix is encountered before IDLD miles is exceeded, then both parameters are applied; measurement along the route starts at the external fix for comparison to EDLD. The transition fix (and D-line intersection) search is continued to and including the filed fix beyond the first parameter value exceeded. If no adapted transition fix (or D-line) is found, then the search for adapted transition fix (or D-line) is terminated, and a PDR is not applied.

PDR adaptation can contain characters to be printed in the route field of proposed flight strips (see NAS-MD-314 and 315). The transition fix is inserted into the alphanumeric unless the alphanumeric is in field 10 format and contain the transition fix. The first filed fix after the D-line is inserted into the alphanumeric. If alpha-numerics are not adapted, the filed route is not altered. Any characters in field 10 format are associated with the adapted elements of the PDR. The characters will not contain an implied junction between two routes if the implied fix is a transition fix for this PDR.

If the proposed flight plan is to be transmitted to an adjacent center, the route field to be transmitted contains the PDR characters merged into the filed route of flight. When the flight becomes active and the adaptation indicator specifies that the PDR characters are in field 10 format, the PDR characters are merged into the filed route of the flight plan which is to be transmitted to the adjacent center. If the filed route contains the same characters as the PDR, the PDR is applied; however, the PDR characters are not merged into the filed route.

If the alphanumeric is in field 10 format, the only characters that are merged are those adapted between the departure point and the transition fix.

If a delay is filed in field 10 prior to the transition fix of the PDR or prior to the second filed endpoint of the direct route segment intersecting the D-line, the delay is not applied. A filed delay at the T-fix or the end point of the direct route segment intersecting the D-line is applied.

Figure 8–3 shows an airport with a D-line (DL210) adapted to the airport. In the illustration, if TERM1..DD is filed in field 10, direct route processing determines that the route intersects DL210. The D-line adaptation specifies the PDR to be applied and the fix at which the PDR is to be terminated, in this example fix CC. Postings for the flight are generated as specified by PDR adaptation from departure point to fix CC. Postings from fix CC to fix DD are developed according to direct route posting rules, as specified in section 7.3.

8.2.3 Departure Strip Posting Determination

For an adapted departure route from an adapted airport, departure strips are posted in the FPAs listed in SID, PDR, and PDAR adaptation. For departures from either an adapted airport or from a non-adapted airport, departure strips are posted in the FPAs listed in adaptation for coded routes whose departure point is on the coded route.

For a non-adapted departure route from an adapted, internal airport, the center departure strip is posted in the first center FPA encountered in route records if the Departure Strip Printing Parameter (PDSP) is set to FIRST. If PDSP is set to last, the FPA of each Primary Converted Fix along the route of flight (starting in the first center FPA) is compared to the list of eligible FPAs to receive the center departure strip for this adapted airport, until an FPA in the route is found which is not in the list of eligible FPAs, or the last primary converted fix is encountered. The last center FPA in the route which compared to an eligible FPA is then selected to receive the center departure strip. If the FPA of the first primary center converted fix is not in the list of eligible FPAs, or if the airport is non-adapted, the first primary center FPA in the route records receives the center departure strip. The center departure strip is the only primary posting in the FPA to which it is sent. The center departure strip, unless it is a duplicate, is the first primary center posting along the route of flight; center FPAs prior to the FPA receiving the center departure strip will not be posted. If no center FPA is found in the route records no center departure strip is posted.

For a non-adapted departure from a non-adapted internal airport, the center departure strip is posted in the first center FPA encountered in the route records. For an airfile, an en route strip is posted in the first center FPA encountered in the route records. If no center FPA is found in the route records, no center strip is produced.

For flights that originate from an external airport, no center departure strip processing is performed.

PDSP is applied for non-adapted proposed departure flights and non-adapted departure flights initially entered active. PDSP is reapplied when a non-adapted proposed departure flight is departed. The PDSP-determined FPA receives the center departure strip. Posting of en route strips begins in that FPA except that any priority 15 postings before the PDSP-determined FPA are not suppressed.

For an airfile or from a non-adapted airport, a departure strip, or an en route strip, as appropriate, is posted in the first center FPA encountered in the route records. If no center FPA is found in the route records, no proposed center strip is posted.

For flights that originate from an external airport, no proposed center strip processing is performed.

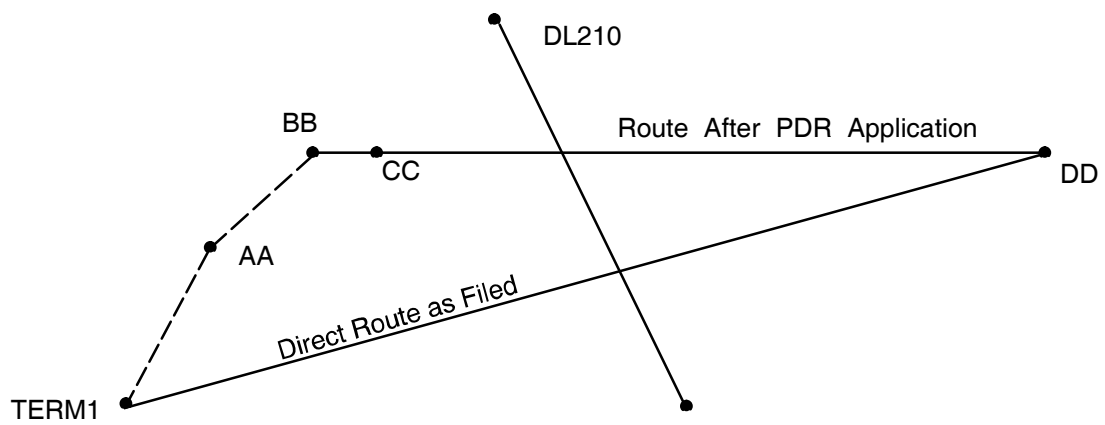


FIGURE 8-3. PDR APPLICATION TO DIRECT ROUTE

8.2.4 Duplicate Departure Strip Posting Determination

For flights departing via adapted departure routes and coded routes whose departure point is on the coded route, duplicate departure strips are posted in the FPAs listed in SID, PDR, PDAR and coded route adaptation if the processing altitude is within the altitude range associated with the FPAs. The processing altitude is determined as specified in section 10.0.

For flights departing via non-adapted departure routes, duplicate postings may be adapted for the departure airport. If this adaptation is specified for an FPA, the duplicate posting applies whenever the requested altitude of the flight is within the altitude range adapted to the FPAs in airport adaptation. The processing altitude is determined as specified in section 10.0.

For an airfile or from a non-adapted airport, no duplicate strip processing is performed.

8.3 ARRIVAL ROUTES

The following are the conversion and posting requirements for airport arrival routes. Airport arrival routes include Standard Terminal Arrival Routes (STAR), Preferential Arrival Routes (PAR), Preferential Departure Arrival Routes (PDAR), and non-adapted arrivals.

8.3.1 Standard Terminal Arrival Route Application

A STAR must be filed by name, must be entered at a single fix, and is adapted to serve one or more airports.

The STAR adaptation may contain a route for each transition fix adapted for the STAR. This adapted route is the route from the transition fix to the entry fix of the STAR.

Posting requirements for STARs are indicated in adaptation. Each fix has an adapted altitude range(s), FPAs, and a priority code for posting purposes.

Substitute characters to be printed on flight strips in place of the requested altitude can be adapted for each fix. An altitude may be adapted to be transmitted to an adjacent center or to an FDEP-equipped approach control. A transmitted altitude is only applicable if the coordination fix for which it is adapted is an applicable outbound coordination fix or approach control coordination fix. Transmitted altitudes for approach controls apply to overflights only.

No applicable STARs can be overridden by any other arrival or departure preferential route.

Each STAR contains an active/inactive indicator that can be changed dynamically by a Switch Activity (SA) input message. Adaptation data specify the aircraft class(es), the optional ERR indicator(s), the optional RIEE indicator(s) and the altitude range(s) to which the STAR applies.

When a STAR has adapted RIEE indicators it can only be considered for application using the RIEE indicators when parameter ICAO Route Equipment Eligibility (IREE) is "ON" and the referent flight plan has filed data in both elements of field 910 that match those adapted RIEE indicator letters.

In addition to all other eligibility checks the logic in table 8-3 is used for considering the application of a filed adapted STAR name when RIEE and/or ERR indicators, adapted or not adapted, are/are not considered.

TABLE 8-3. STAR RIEE/ERR ELIGIBILITY

Field 910 Elements a. and b. Contents	Parameter IREE Setting	STAR With Only RIEE Indicators Adapted	STAR With RIEE and ERR Indicators Adapted	STAR With Only ERR Indicators Adapted	STAR With No RIEE and No ERR Indicators Adapted
Data in Both Elements	ON	Consider for RIEE Indicators Only	Consider for RIEE Indicators Only	Reject or Incomplete Route Ind.	Consider
	OFF	Reject or Incomplete Route Indicator	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider
Data in Only one Element or No Data	ON or OFF	Reject or Incomplete Route Indicator	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider

Key:

- RIEE = Adapted Route ICAO Equipment Eligibility indicators, optionally adapted for preferential routes, SIDs and STARs.
- IREE = Adapted dynamic parameter ICAO Route Equipment Eligibility.
- ERR = Adapted Equipment Restricted Route indicators, optionally adapted for preferential routes, SIDs and STARs.

8.3.2 Preferential Arrival Route Application

Preferential Arrival Routes are not filed in the flight plan but are conditionally applied by the program based on the criteria in following subsections. The flight is ineligible for PAR application if:

- a. The flight is not an arrival as defined in section 10.5.
- b. VFR or VFR/(d)dd appear in field 8/9.
- c. A PDAR is applicable.
- d. Field 10 contains a filed STAR immediately preceding the destination fix.
- e. An asterisk (*) suffixed to the destination airport in field 10.
- f. The last segment of the filed route of flight is an adapted direct route consisting of a preferential route.
- g. The destination airport has no current active PAR applicable.

If none of the preceding conditions apply, the flight plan is eligible for application of a PAR. Final eligibility of a route for application of a PAR is determined by an examination of each filed route segment. The criteria used in selection of a PAR differ with each route segment depending upon whether the route segment is adapted or direct.

A flight is ineligible for PAR RIEE and ERR eligibility considerations (Table 8-4) when an overcast symbol (⊕) is suffixed to the destination fix. Only those PAR routes without adapted RIEE and ERR indicators, if any are adapted, will be considered for application.

If the referent flight plan contains data in both elements of field 910 (element a. (EQP) and element b. (SRV)) and parameter IREE is "ON", the following eligibility checks are made for each PAR under consideration, prior to any further checks:

- a. If the PAR has one or more RIEE indicators adapted and if
- b. the equipment (EQP) and surveillance (SRV) letters in field 910 of the flight plan are adapted in one or more RIEE indicators for the PAR, then the flight plan is eligible to have this PAR applied. Otherwise, this flight is not eligible to have this PAR applied.

If more than one PAR is eligible to be applied for the referent flight plan, the PAR that has the highest priority adapted RIEE indicator that contains the referent field 910 letters, is considered for application. If the highest priority adapted RIEE indicator is the same for two or more PARs, the PAR that has its transition point most distant from the destination point along the route is the one considered for application.

If the flight is not eligible for the application of any PAR routes that have adapted RIEE indicators or there are no PARs adapted with RIEE indicators, then those PAR routes without adapted RIEE and ERR indicators, if any are adapted, are considered for application.

In addition to all other eligibility checks the logic in table 8–4 is used for considering the application of a PAR when RIEE and/or ERR indicators, adapted or not adapted, are/are not considered.

TABLE 8–4. PAR RIEE/ERR ELIGIBILITY

Field 910 Elements a. and b. Contents	Parameter IREE Setting	PAR With Only RIEE Indicators Adapted	PAR With RIEE and ERR Indicators Adapted	PAR With Only ERR Indicators Adapted	PAR With No RIEE and No ERR Indicators Adapted
Data in Both Elements	ON	Consider for RIEE Indicators Only	Consider for RIEE Indicators Only	Do not consider	Consider
	OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider
Data in Only one Element or No Data	ON or OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider

Key:

RIEE = Adapted Route ICAO Equipment Eligibility indicators, optionally adapted for preferential routes, SIDs and STARS.

IREE = Adapted dynamic parameter ICAO Route Equipment Eligibility.

ERR = Adapted Equipment Restricted Route indicators, optionally adapted for preferential routes, SIDs and STARS.

If the referent flight plan does not have data in one or both elements of field 910 (element a. (EQP) and/or element b. (SRV)) or if parameter IREE is “OFF” and the referent flight’s airborne equipment qualifier in field 03 has one or more ANC indicators adapted, the following eligibility checks are made prior to any further checks:

- a. If one of the adapted ANC indicators matches one of the adapted ERR indicators, if present, for the referent PAR route, this flight is eligible to have the PAR applied if all other eligibility checks are satisfied. Otherwise, this flight is not eligible to have this PAR applied.

- b. If the flight is not eligible for the application of any PAR routes that have adapted ERR indicators, or there are no PARs adapted with ERR indicators, then those PAR routes without adapted ERR indicators, if any are adapted, are considered for application.

If more than one PAR is applicable to a given route, the PAR with its transition point most distant from the destination airport along the route is the one applied. Substitute characters to be printed on flight strips in place of requested altitude can be adapted for each fix. An altitude may be adapted to be transmitted to an adjacent center or to an FDEP-equipped approach control. A transmitted altitude is only applicable if the coordination fix for which it is adapted is an applicable outbound coordination fix or approach control coordination fix. Transmitted altitudes for approach controls apply to overflights only. A PAR is described as a series of fixes in adaptation. Each fix adapted along a PAR has an altitude range(s), FPAs, and a priority code specified for posting purposes. Each PAR may be associated with one or more airports one or more transition fixes, and may have transition lines adapted.

A status indicator is adapted for each PAR designating the PAR as active or inactive. This indicator can be changed dynamically by the Switch Activity (SA) input message. Each PAR also has adapted the aircraft class(es), the optional ERR indicator(s), the optional RIEE indicator(s) and the altitude range(s) at which the PAR applied.

8.3.2.1 Adapted Route. Coded route segments, SIDs, PDRs, and adapted direct preferential routes are not subject to alteration by a PAR. Airway segments can be altered by a PAR if route examination determines that the adapted route segment contains the fix that is adapted as a transition fix for the destination airport, provided that: (1) the PAR is active and (2) the PAR is appropriate to the aircraft class, the ERR or RIEE indicator(s) (if applicable) and applies at en route altitude and (3) the distance along the filed route from transition fix to the destination airport does not exceed PADP miles if PADP is adapted in miles and (4) the segments along the route from transition fix to destination airport does not exceed PADP segments if PADP is adapted in segments.

PAR adaptation may also contain substitute characters to be printed in the route field of flight strips. These substitute characters are printed on the strip for the first postable fix in the FPA that contains the route alteration. The transition fix is inserted into the alphanumerics, unless the alphanumerics are in field 10 format and contain the transition fix. If the alphanumerics are not adapted, the filed route is not altered. If the substitute characters match a sequence of characters in the filed route of flight, the substitute characters are not printed. If a delay is filed in field 10 at or after the transition fix of the PAR, the delay is not applied. Any characters in field 10 format will be associated with the adapted elements of the PAR.

If the alphanumerics are in field 10 format, the only characters that are printed are those adapted between the transition fix and the destination.

Figure 8-4 shows an example of PAR application to an adapted route. The illustration shows an airport having a PAR adapted for flights arriving at TERM2 on V1 with CCC adapted as a transition fix on V1 for the PAR. If TERM1.V1.TERM2 is filed in field 10, route conversion extracts from adaptation a list of fixes along V1 from TERM1 through TERM2 inclusive, i.e., TERM1, AAA, BBB, CCC, DDD, EEE, TERM2. Fix CCC is determined to be a PAR transition fix and the list of fixes between the transition fix, CCC, and TERM2 is replaced with the list of fixes from the applicable PAR adaptation.

The resultant list of fixes represents the fixes to be converted:

TERM1, AAA, BBB, CCC, FFF, GGG, TERM2.

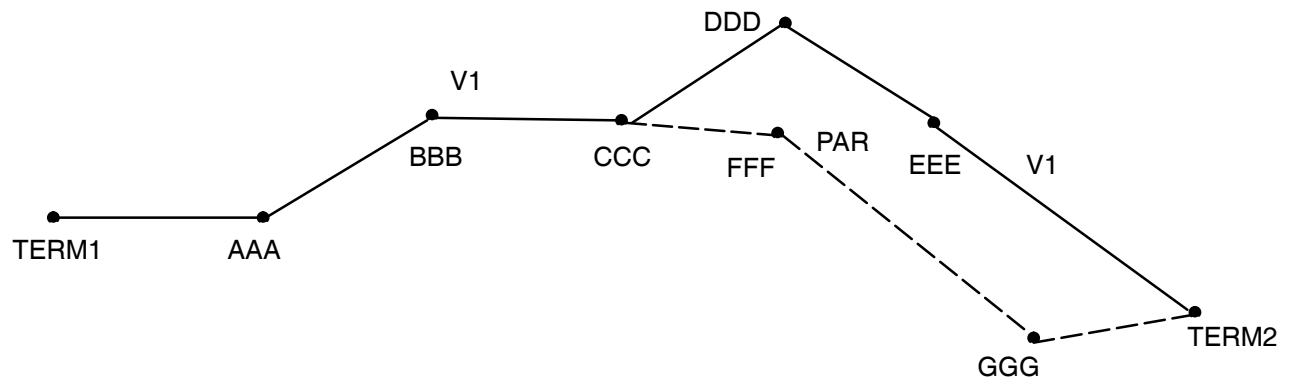


FIGURE 8-4. PAR APPLICATION TO ADAPTED ROUTES

8.3.2.2 Direct Route. Direct routes qualify for PAR application if none of the conditions specified so far in section 8.3.2 apply and if the application of a PAR does not affect the conversion of a coded route segment, a SID, a PDR, or an adapted direct preferential route and if either of the following exist:

- a. A fix adapted as a transition fix for a currently active applicable (based on aircraft class, the ERR or RIEE indicator(s) (if applicable), altitude, and PADP) PAR for the destination airport, appears as a filed fix in field 10.
- b. An applicable (based on aircraft class, altitude, and ADDP) arrival transition line is intercepted and a currently active PAR, which is applicable for the aircraft class, and the ERR or RIEE indicator(s) (if applicable) is adapted for that line.

Figure 8-5 shows an airport having an A-line adapted (AL211) to it. If L..TERM2 is filed in field 10, direct route processing determines that the route intersects AL211.

The A-line adaptation specifies the PAR to be applied and the fix at which the PAR is to be entered, in this case, Fix C.

Postings for the flight are in accordance with en route direct route posting rules up to the point where the direct route intersects the A-line. Remaining postings are as indicated by the PAR adaptation data and consist of C, D, and TERM2. Fix E is generated as a result of the route of flight intersecting the A-line. This fix is inserted into the flight plan as an FRD relative to the FPF for the appropriate FPA.

A PAR applied because of a filed transition fix in Field 10 takes precedence over a PAR resulting from an A-line intercept. PAR adaptation may also contain substitute characters to be printed in the route field of flight strips. These substitute characters are printed on the strip for the first postable fix in the FPA that contains the route alteration. The transition fix is inserted into the alphanumerics, unless the alphanumerics are in field 10 format and contain the transition fix. If alphanumerics are not adapted, the filed route is not altered. If the substitute characters match a sequence of characters in the filed route of flight, the substitute characters are not printed. Any characters in field 10 format will be associated with the adapted elements of the PAR. If a delay is filed in field 10 at or after the transition fix of the PAR or at or after the A-line intersection, it is not applied.

If the alphanumerics are in field 10 format, the only characters that are printed are those adapted between the transition fix and the destination.

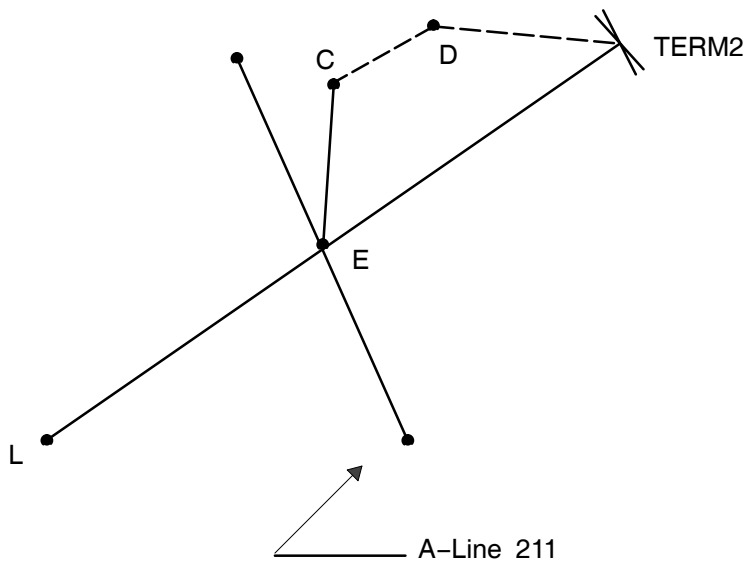


FIGURE 8-5. PAR APPLICATION TO A DIRECT ROUTE

8.4 NON-ADAPTED ARRIVALS

Arrival flights (as defined in section 10.5) that do not qualify for PAR or PDAR application and do not contain a STAR in field 10 may be processed as non-adapted arrivals. If the destination is internal at the ground, it is processed as described in this section. If the destination is external at the ground, an attempt is made to apply an A-line as described here; if no A-line is applicable the flight is processed as described in section 8.8.2.

The route of flight is eligible for non-adapted arrival processing to the destination from the last encounter of the following:

- a. The exit fix of the last coded route
- b. The exit fix of a filed SID
- c. The transition fix for an applied PDR
- d. The end of the non-adapted departure processing.

Eligible direct route segments are examined for intersections with applicable A-lines having adapted posting altitude. If one is found and either the filed altitude is not of the form altitude/fix/altitude, or that fix is prior to the A-line intersection, the non-adapted arrival is posted by the rules for direct routes intersecting A-lines with adapted posting altitude (see section 8.4.1, first paragraph).

All references to ARDP and ARAP refer to those values, if any, adapted for the destination airport. If the destination is not an adapted airport or satellite, or if the airport does not have an ARDP and ARAP adapted, then the system parameters ARDP and ARAP are used.

If there are no eligible direct route segments that intersect an applicable A-line with posting altitude within its altitude range, or one is located at or prior to the fix in altitude/fix/altitude, the non-adapted arrival is posted by the ARDP rules. If the distance along the eligible route of flight is greater than ARDP miles, the ARDP point is that point which is ARDP miles from the destination point along the route of flight. If the route of flight includes a DRDP point that is within the distance criterion of the ARDP point, the FPAs that were not posted according to DRDP rules are posted between the en route altitude and the altitude used for processing according to DRDP rules at the DRDP point according to applicable airway or direct route posting rules. Otherwise, it is the exit fix of the coded route or SID, the transition fix of the PDR, or the end of the non-adapted departure processing.

Points where altitude transitions occur are converted for potential posting as specified in section 10.8.

8.4.1 Direct Routes

When a direct route segment intercepts an A-line within A-line/D-line Distance Parameter (ADDP) miles, the A-line must apply to the aircraft class at the processing altitude and have an adapted posting altitude.

- a. If the adapted posting altitude is less than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the A-line intersection and the filed route of flight contains an adapted arrival fix (ARFIX) between the A-line intercept point and the destination, post as following:
 1. The fix posting for an intercept point is posted in all appropriate FPAs from the en route altitude to the adapted posting altitude.

2. Postings for subsequent postable fixes, to and including the ARFIX, are posted at the adapted posting altitude. The ARFIX is posted in all appropriated FPAs from the adapted posting altitude to the ground.
 3. The remainder of the route from the ARFIX to destination is converted at ground altitude but only approach control and ARTS III FPAs are posted.
- b. If the adapted posting altitude is less than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the A-line intersection and the filed route of flight does not contain an adapted ARFIX between the A-line intercept point and the destination, post as follows:
 1. The fix posting for an intercept point is posted in all appropriate FPAs from the en route altitude to the adapted posting altitude.
 2. Postings for subsequent postable fixes to and including the destination fix are posted at the adapted posting altitude. The destination fix is posted in all appropriate FPAs from the adapted posting altitude to the ground.
 - c. If the adapted posting altitude is greater than or equal to the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the A-line intersection and the filed route of flight contains an adapted arrival fix (ARFIX) between the A-line intercept and the destination, post as follows:
 1. Postings to and including the ARFIX are posted at en route altitude. The ARFIX is posted in all appropriate FPAs from the en route altitude to the ground.
 2. The remainder of the route from the ARFIX to the destination is converted at ground altitude but only approach control and ARTS III FPAs are posted.
 - d. If the adapted posting altitude is greater than or equal to the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the A-line intersection and the filed route of flight does not contain an adapted ARFIX between the A-line intercept and the destination, post as follows:
 1. Postings to and including the destination are posted at en route altitude. The destination is posted in all appropriate FPAs from the en route altitude to the ground.

When a direct route segment does not intercept an applicable A-line with adapted posting altitude or when such an intercepted A-line is at or prior to the fix in altitude/fix/altitude, the processing applied depends on the following condition:

- a. When the Arrival Route Distance Parameter (ARDP) is not zero miles and ARAP is less than en route altitude and either the filed altitude is not form altitude/fix/altitude or that fix is prior to the ARDP point, process as follows:
 1. Post in the FPA containing the ARDP point, at the en route altitude, according to direct route posting priorities.
 2. Post in the underlying FPAs of the ARDP point, from the en route altitude to the Arrival Route Altitude Parameter (ARAP), relative to their FPFs; except for the FPA at ARAP, which is posted according to direct route posting priorities.
 3. Post subsequent postable fixes along the route at ARAP to and including the destination, or ARFIX if adapted, except that the destination, or ARFIX if adapted, is posted in all appropriate FPAs from ARAP to the ground.

4. If an ARFIX is adapted, the remainder of the route from the ARFIX to destination is converted at ground altitude but only approach control and ARTS III FPAs are posted.
- b. When ARDP is zero miles or the ARDP point is at or prior to the fix in altitude/fix/altitude, process as follows:
 1. If the filed route of flight contains an adapted ARFIX within Arrival Fix Search Distance (AFSD) miles of the destination, post all postable fixes preceding the ARFIX at the en route altitude and post the ARFIX in all appropriate FPAs from the en route altitude to the ground. The remainder of the route from the ARFIX to destination is converted at ground altitude, but only approach control and ARTS III FPAs are posted.
 2. If the filed route of flight does not contain an adapted ARFIX within AFSD miles of the destination, post all postable fixes preceding the destination at the en route altitude and post the destination in all appropriate FPAs from the en route altitude to the ground.
 - c. When ARDP is not zero, but ARAP is greater than or equal to en route altitude, process as in condition b (for ARDP equal to zero) but use ARDP miles for the ARFIX search.

8.4.2 Airways

Process an airway as follows:

- a. If ARDP is not zero and ARAP is less than en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the ARDP point:
 1. Post the ARDP point if it is a converted fix; otherwise, post the first converted fix which exceeds ARDP, in all appropriate FPAs from the en route altitude to the ARAP altitude. Postings are according to airway adaptation.
 2. Post subsequent postable fixes along the converted route at the ARAP altitude to and including destination, or ARFIX if adapted except that the destination, or ARFIX if adapted, is posted in all appropriate FPAs from ARAP to the ground.
 3. If an ARFIX is adapted, the remainder of the route from the ARFIX to the destination is converted at ground altitude but only approach control and ARTS III FPAs are posted.
- b. If ARDP is zero miles or if the ARDP point is at or prior to the fix in altitude/fix/altitude and an ARFIX is adapted on the airway within AFSD miles of the destination, post the ARFIX in all appropriate FPAs from the en route altitude to the ground. The remainder of the route from the ARFIX to destination is converted at ground altitude, but only approach control and ARTS III FPAs are posted. If an ARFIX is not adapted or is not found within AFSD miles of the destination, post the destination in all appropriate FPAs from the en route altitude to the ground.
- c. If ARDP is not zero but ARAP is equal to or greater than en route altitude, process as in condition b (ARDP equal zero), but use ARDP miles for the ARFIX search.

8.5 NON-ADAPTED DEPARTURES

Departure flights (as defined in section 10.2) that do not contain a SID in field 10 and do not qualify for PDR or PDAR application may be processed as non-adapted departures. If the departure is internal at the ground, it is processed as described in this section. If the departure is external at the ground,

an attempt is made to apply a D-line as described here; if no D-line is applicable, the flight is processed as described in section 8.8.1.

The route of flight is eligible for non-adapted departure processing from the departure point to the first encounter of the following:

- a. The entry fix of the first coded route
- b. The entry fix of a filed STAR
- c. The transition fix for a PAR
- d. The A-line intersection used to apply a PAR
- e. The destination fix.
- f. The last acceptable format and logic checked element. This includes the fix preceding an XXX, VFR, or DVFR, the direction fix for an airway exiting the center to a name only fix, as well as the fix preceding an element for which there is insufficient adaptation data.

Eligible direct route segments are examined for intersections with applicable D-lines. If one is found and either the filed altitude is not of the form altitude/fix/altitude or that fix is subsequent to the D-line intersection, the non-adapted departure is posted by the rules for direct routes intersecting D-lines (see section 8.5.1).

All references to DRDP and DRAP refer to those values, if any, adapted for the departure airport. If the departure point is not an adapted airport or satellite, or if the airport does not have a DRDP and DRAP adapted, then the system parameters DRDP and DRAP are used.

If there are no eligible direct route segments which intersect an applicable D-line or one is located at or subsequent to the fix in altitude/fix/altitude, the non-adapted departure is posted by the DRDP rules. If the distance along the eligible route of flight is greater than DRDP miles, the DRDP point is that point which is DRDP miles from the departure point along the route of flight. If this point is not on a direct route, the DRDP point is the next adapted fix. Otherwise, it is the end of the eligible portion of the route. Points where altitude transitions occur are converted as specified in section 10.8.

8.5.1 Direct Routes

When a direct route segment intercepts a D-line within ADDP miles, the D-line must apply to the aircraft class at the processing altitude. If the D-line is applicable and has no applicable PDR, the processing applied depends on the following conditions:

- a. If the D-line has an adapted posting altitude which is less than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is subsequent to the D-line intersection, post the departure point in all appropriate FPAs from ground to the adapted posting altitude. Post in all appropriate FPAs along the route between the FPA containing the intercept point and the departure point at the adapted posting altitude and post the fix posting for the intercept point from the adapted posting altitude to the en route altitude in all appropriate FPAs. Postings for subsequent postable fixes are posted at the en route altitude using direct route posting rules as specified in section 7.3.2.

- b. If the D-line does not have an adapted posting altitude or the adapted posting altitude is greater than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is subsequent to the D-line intersection, post the departure point in all appropriate FPAs from the ground to the en route altitude. Postings for subsequent postable fixes are posted at the en route altitude using direct route posting rules as specified in section 7.3.2.

When a direct route segment does not intercept an applicable D-line or when such an intercepted D-line is at or subsequent to the fix in altitude/fix/altitude and the Departure Route Distance Parameter (DRDP) is not zero and the Departure Route Altitude Parameter (DRAP) altitude is less than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude or that fix is subsequent to the DRDP point, post the departure point in all appropriate FPAs from the ground to DRAP altitude. Post in all appropriate FPAs along the route between the FPA containing the DRDP point and the departure point according to direct route posting priorities at DRAP altitude. Post the DRDP point in all appropriate FPAs, relative to their FPFs, from DRAP to the en route altitude. Subsequent postable fixes are posted at the en route altitude.

When a direct route segment does not intercept an applicable D-line or when such an intercepted D-line is at or subsequent to the fix in altitude/fix/altitude and DRDP is zero or DRAP is greater than or equal to en route altitude or the DRDP point is at or subsequent to the fix in altitude/fix/altitude, post the departure point in all appropriate FPAs from the ground to the en route altitude. Postings for subsequent postable fixes are posted at the en route altitude.

8.5.2 Airways

When an airway is filed in the route of flight and DRDP is not zero and DRAP is less than the en route altitude and either the filed altitude is not of the form altitude/fix/altitude, or that fix is subsequent to the DRDP point, post the departure point in all appropriate FPAs from the ground to DRAP altitude. Post all other postable fixes on the converted route at DRAP altitude up to the DRDP point. Post that fix in all appropriate FPAs from DRAP altitude to the en route altitude. Postings are according to airway adaptation. Subsequent postable fixes are posted at the en route altitude.

When an airway is filed in the route of flight and DRDP is zero or DRAP is greater than or equal to en route altitude or the DRDP point is at or subsequent to the fix in altitude/fix/altitude, post the departure point in all appropriate FPAs from the ground to the en route altitude. Postings for subsequent postable fixes are posted at the en route altitude.

8.6 PREFERENTIAL DEPARTURE ARRIVAL ROUTE APPLICATION

A Preferential Departure Arrival Route (PDAR) is applied if all the following conditions apply:

- a. The flight is a departure as defined in section 10.2 and is an arrival as defined in section 10.5.
- b. An asterisk (*) is not suffixed to the point of departure or the destination point.
- c. The departure and arrival airports represent a combination for which a currently active, applicable PDAR has been adapted and is appropriate to the specified aircraft class and is at the processing altitude.
- d. VFR or VFR/(d)dd does not appear in field 8/9.

- d. Field 10 does not contain a coded route or active SID or active STAR.
- e. The distance along the route from departure to destination does not exceed PADP miles if PADP is adapted in miles or PADP segments, if PADP is adapted in segments.
- f. A flight is ineligible for PDAR RIEE and ERR eligibility considerations (Table 8-5) when an overcast symbol (\oplus) is suffixed to the departure fix and/or destination fix. Only those PDAR routes without adapted RIEE and ERR indicators, if any are adapted, will be considered for application.
- g. If parameter IREE is "ON" and the referent flight plan contains data in both elements of field 910 (element a. (EQP) and element b. (SRV)), the following eligibility checks are made for each PDAR under consideration:
 - 1. If the PDAR has one or more RIEE indicators adapted and if
 - 2. the equipment (EQP) and surveillance (SRV) letters in field 910 of the flight plan are adapted in one or more RIEE indicators for the PDAR, then the flight plan is eligible to have this PDAR applied. Otherwise, this flight is not eligible to have this PDAR applied.

If more than one PDAR is eligible to be applied for the referent flight plan, the PDAR that has the highest priority adapted RIEE indicator that contains the referent field 910 letters, is considered for application. If the highest priority adapted RIEE indicator is the same for two or more PDARs, the PDAR that was encountered first in adaptation is the one considered for application.

If the flight is not eligible for the application of any PDAR routes that have adapted RIEE indicators or there are no PDARs adapted with RIEE indicators, then those PDAR routes without adapted RIEE and ERR indicators, if any are adapted, are considered for application.

In addition to all other eligibility checks the logic in table 8-5 is used for considering the application of a PDAR when RIEE and/or ERR indicators, adapted or not adapted, are/are not considered.

- h. If parameter IREE is "OFF" or there is no data in one or both elements of field 910 and the PDAR has adapted ERR indicator(s) the flight must have at least one ANC indicator, adapted for the airborne equipment qualifier in field 03, that matches an ERR indicator. If the PDAR does not have adapted ERR indicators and the flight has adapted ANC indicators, this PDAR can be applied if there are no other applicable PDAR routes that have matching adapted ERR indicators.

When a PDAR is applied, it is converted and posted the same as a PDR or PAR as applicable for that portion of flight. The PDAR provides for complete departure-to-destination processing and is not subject to being overridden by any other preferential route.

TABLE 8-5. PDAR RIEE/ERR ELIGIBILITY

Field 910 Elements a. and b. Contents	Parameter IREE Setting	PDAR With Only RIEE Indicators Adapted	PDAR With RIEE and ERR Indicators Adapted	PDAR With Only ERR Indicators Adapted	PDAR With No RIEE and No ERR Indicators Adapted
Data in Both Elements	ON	Consider for RIEE Indicators Only	Consider for RIEE Indicators Only	Do not consider	Consider
	OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider
Data in Only one Element or No Data	ON or OFF	Do not consider	Consider for ERR Indicators Only	Consider for ERR Indicators Only	Consider

Key:

- RIEE = Adapted Route ICAO Equipment Eligibility indicators, optionally adapted for preferential routes, SIDs and STARS.
- IREE = Adapted dynamic parameter ICAO Route Equipment Eligibility.
- ERR = Adapted Equipment Restricted Route indicators, optionally adapted for preferential routes, SIDs and STARS.

8.7 CONNECT FIX PROCESSING

Airports or fixes may be served by airways and coded routes that pass near, but not directly over the airport or fix. In such cases, flight plans can be filed as though the airport or fix is on the route.

To permit this type of filed route, an airport or fix that is served by a nearby airway or coded route can be adapted as an airport or fix off the airway or coded route with suitable connect fixes to the route also adapted. A connect fix may be any fix on an airway or coded route. A flight can be processed in either of two ways:

- a. From the airport or off-airway fix direct to the connect fix and then along the adapted route, or
- b. From the connect fix direct to the airport or off-route fix

If two connect fixes are adapted, the first connect fix along the route of flight on the adapted route is used to process to or from the filed fix or airport. Direct processing, in this case, means that the straight-line distance between the airport or off-route fix and the connect fix is used for time calculation but other direct route processing is not applied. The following examples illustrate the use of connect fixes with off-route airports and off-route fixes.

In figure 8-6, TERM1 and TERM3 are adapted as airports off-airway V1 with FIXA, FIXB, and FIXC adapted as connect fixes. Thus, TERM1.V1.TERM2 in field 10 is permissible and FIXA is used as the connect fix for TERM1. If TERM3.V1.TERM1 is filed in field 10, FIXB is the connect fix for TERM3 and FIXA is the connect fix for TERM1. If TERM3.V1.TERM2 is filed in field 10, FIXC is the connect fix for TERM3.

In figure 8-7, FIXB is adapted as a fix off-airways V1 and V2 and FIXA is adapted as a connect fix to V2 and FIXC adapted as a connect fix to V1. If TERM1.V2.FIXB.V1.TERM2 is filed in field 10, FIXC is the connect fix for FIXB on V1, and FIXA is the connect fix for FIXB on V2.

In figure 8-8, FIXB is adapted as a fix off V2, and FIXA adapted as a connect fix on V2. If TERM1.V2.FIXB.V1.TERM2 is filed in field 10, FIXA is the connect fix for FIXB on V2.

8.8 EXTERNAL DEPARTURE AND ARRIVAL PROCESSING

Associated with each airport in external arrival/departure airport adaptation are altitude and distance data.

8.8.1 Departure Processing

External departure processing is applied to a flight plan if all of the following conditions are satisfied:

- a. The departure airport is adapted in external arrival/departure airport adaptation
- b. PDR, PDAR, SID, and D-line processing does not apply
- c. The departure fix is not on a coded route.
- d. The departure point is the coordination fix or the computed distance from the departure point to the coordination fix does not exceed the departure distance adapted for the external airport. The distance is measured in a straight line, from the departure point to the coordination fix.
- e. The flight is a departure as defined in section 10.2 and the departure fix is external at the ground; or, the flight is not a departure as defined in section 10.2, VFR or DVFR is not the second element, and the coordination fix is external at the adapted altitude.

The NAD point is the same as the DRDP point defined in section 8.5, where the distance being considered is the adapted departure distance for the external airport rather than DRDP. If the above conditions are satisfied and the adapted altitude is less than the en route altitude, and either the altitude is not of the form altitude/fix/altitude or that fix is the coordination fix or is subsequent to the NAD point, then the flight is converted at the adapted altitude to the NAD point. The flight is then transitioned to the en route altitude as described in section 10.8. Subsequent elements are converted at the en route altitude. The route is posted by applicable adapted or direct route rules.

Distance is measured first in a straight line from the departure point to the coordination fix and thence along the route.

If the flight is a departure as defined in section 10.2, the departure fix is converted from ground altitude to the adapted or en route altitude, and is posted in all internal strata according to applicable airway or direct route posting rules.

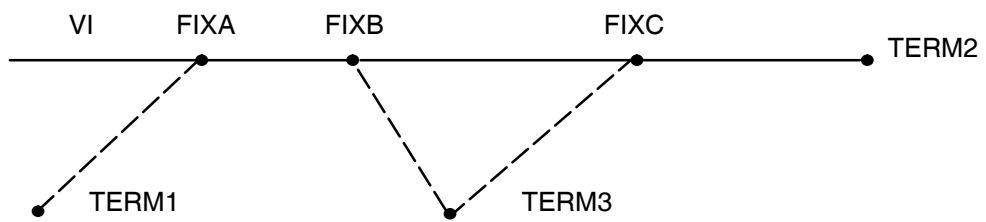


FIGURE 8-6. CONNECT FIX WITH TWO AIRPORTS OFF-AIRWAY

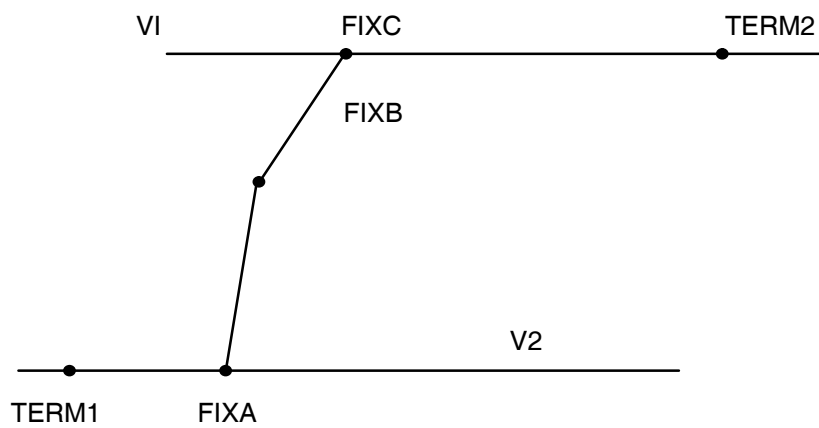


FIGURE 8-7. CONNECT FIX WITH OFF-AIRWAY FIX

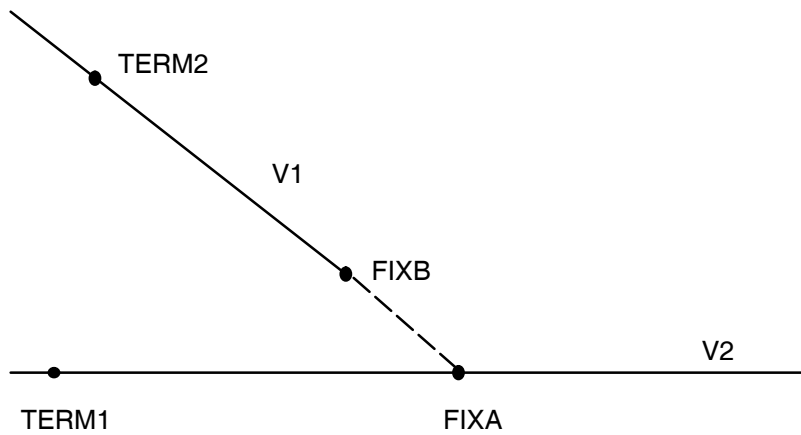


FIGURE 8-8. CONNECT FIX TO CONNECT FIX

8.8.2 Arrival Processing

External arrival processing is applied to a flight plan if all of the following conditions are satisfied.

- a. The arrival airport is adapted in external arrival/departure airport adaptation.
- b. PAR, PDAR, STAR, and A-line processing does not apply.
- c. The flight does not arrive at a fix on a coded route.
- d. The flight is an arrival as defined in section 10.5 and the destination is external at the ground.

The NAA point is the point that is the adapted distance from the external terminal, or if this point is on an airway, the fix that is prior to the point. If the above conditions are satisfied and the adapted altitude is less than the en route altitude, and either the filed altitude is not of the form altitude/fix/altitude or that fix is prior to the NAA point, then the flight is processed at the en route altitude up to the NAA point. The flight is then transitioned to the adapted altitude as described in section 10.8. Subsequent fixes are processed at the adapted altitude. Fix conversion ceases as described in section 6.3. The route is posted by applicable adapted and direct route rules.

External arrival processing cannot overlap D-line processing, external departure processing or processing of an applied PDR or a coded route. Route posting, according to external arrival processing rules specified above, is accomplished for that portion of the arrival route, within the adapted arrival distance, that is beyond:

- a. The transition fix of an applied PDR
- b. The DRDP point for a non-adapted departure, when D-line processing does not apply to the departure
- c. The exit fix of the last coded route
- d. The adapted departure distance point
- e. The D-line route segment intersection, when D-line processing applies to the departure.

If the route of flight includes an external departure that is within the distance criterion of an external arrival, the FPAs that were not posted according to external departure processing are posted between the en route altitude and the altitude used for processing the external arrival at an adapted distance from the external departure airport, according to applicable airway or direct route posting rules.

When the destination is the last converted fix and is external at ground altitude, it is converted from the en route or adapted altitude to ground altitude. It is posted in all internal strata according to applicable airway or direct route posting rules.

The altitude on the intercenter coordination message is the en route altitude.

8.9 NAS — ARTS III PROCESSING

Each ARTCC can transmit arrivals, departures, and overflights of ARTS III adapted airspace to ARTS III facilities.

8.9.1 Departures

Each proposed flight plan from an ARTS III FPA causes an interfacility flight plan message to be sent from the ARTCC to the ARTS III facility as specified in NAS-MD-315.

8.9.2 Arrivals

Each flight plan filed to arrive at an airport served by an ARTS III facility causes an interfacility flight plan message to be sent from the ARTCC to the ARTS III facility as specified in NAS-MD-315.

8.9.3 Overflights

Each overflight through an ARTS III FPA causes an interfacility Flight Plan message to be sent to the ARTS III facility, as specified in NAS-MD-315.

Each overflight message contains two Fixes, an entry point into, and an exit point from, the ARTS III FPA.

8.9.4 Host Non-Host (HNH) Processing

When an original or amended flight plan enters host ARTS airspace its track data and response messages will be subject to HNH processing by the host center when parameter Host Non-Host Status (HNHS) is on for the subject ARTS, the subject ARTS is not inhibited by an Inhibit Transmission (IS) message and either of the following conditions is met:

- a. Inbound — If the flight enters host ARTS airspace inbound, even if that airspace is assigned to a center sector FPA, from an adjacent center and there is no converted host center fix on the route of flight prior to entering the airspace of the subject ARTS, or if the entered ARTS airspace is not assigned to a center sector FPA that has parameter ARTS Airspace Handoff Rules (AAHR) set to “ON”, the Host ARTS identifier is specified in the Initiate Transfer message (see NAS–MD–311, section 7.2) from the adjacent center.
- b. Outbound — If the flight enters an adjacent center’s airspace outbound from host ARTS airspace and there is no converted host center fix on the route of flight prior to entering the adjacent center’s airspace.

8.10 AUTOMATIC ROUTE REPROCESSING FOR PROPOSED FLIGHTS

The Reprocess Flight Route Switch (RFRS) parameter controls whether route conversion is automatically reapplied for proposed flight plans. Route conversion is automatically reapplied for proposed flight plans when the RFRS parameter is ON.

8.10.1 Automatic Reprocessing Enabled

When RFRS is ON then Reprocess Flight Route Time (RFRT) minutes prior to DSPI, TDSI or SSPI, whichever results in the earliest strip printing time for a proposed flight plan, route conversion is reapplied, with the following exceptions:

- a. If a non-flow control flight strip has already been printed for a proposed flight plan, that was not the result of an SR message, at initial examination for route reprocessing, route conversion is not reapplied.
- b. If, at the time the proposed flight plan should have route conversion reapplied, a correction is pending for the flight plan, a referred reject (see NAS–MD–314) is generated for the flight plan and route conversion is not reapplied.
- c. The flight is an F–type (flush) flight plan.
- d. The system is in an active phase of planned shutdown.

When route conversion is applied to a proposed flight plan due to automatic route conversion, SIDs and/or STARs are converted as filed in field 10 of the flight plan regardless of current Switch Activity (SA) settings. Route conversion will apply currently active PDRs or PDARs as applicable.

When route conversion is applied to a proposed flight plan due to automatic route conversion, the revision number on non-flow strips will be incremented as specified in NAS-MD-314, section 4.3.1.1. In addition, interfacility messages to ARTS, adjacent NAS, and/or Central Flow Automation Facility (CFAF), if applicable, will occur as specified in NAS-MD-315.

8.10.2 Automatic Route Reprocessing Disabled

When RFRS is OFF, the processing described in section 8.10.1 does not apply. Additionally, when RFRS is OFF the Reprocess Preferential Departure Switch (RPDS) parameter cannot be ON (see NAS-MD-311).

9.0 ROUTE OVERLAP

Preceding sections of this specification describe various route types that may overlap or be substituted for other route types. Relationships among the route types are specified in this section. Route overlap is the substitution of a preferential route for a filed route during route conversion.

Stereo routes are substituted for the stereo tag before route conversion.

Adapted direct routes are substituted, where applicable, before route conversion. Adapted direct routes will not be substituted if the assigned or proposed altitude is VFR or VFR/ddd and the adapted direct route contains a PAR, PDR or PDAR.

A SID, STAR, or Type 2 or Type 4 coded route may require partial route substitution for a transition route, during logic checking and before route conversion.

The application of PDARs, PDRs, and PARs may require partial route substitution before route conversion.

These route substitutions are done in the following order:

- a. Stereo routes.
- b. SID, STAR, and coded route transition routes.
- c. PDARs. A PDAR may not overlap a SID, a STAR, or a coded route.
- d. Adapted direct routes which are PDRs. An adapted direct route PDR may not overlap a SID, a STAR, a coded route, or a PDAR; it may overlap a STAR transition route.
- e. PDRs. A PDR may not overlap a SID, a STAR, a coded route, a PDAR, or an adapted direct route PDR; it may overlap a STAR transition route.
- f. Adapted direct routes which are PARs. An adapted direct route PAR may not overlay a SID, a STAR, a coded route, a PDAR, an adapted direct route PDR, or a PDR; it may overlap a coded route transition or SID transition route.
- g. PARs. A PAR may not overlap a SID, a STAR, a coded route, a PDAR, an adapted direct route PDR, a PDR, or an adapted direct route PAR; it may overlap a SID or coded route transition.
- h. Other adapted direct routes. An adapted direct route may not overlap a SID, a STAR, a coded route, any PDR, any PAR, or a PDAR; it may overlap a SID, STAR or coded route transition.

10.0 ALTITUDE PROCESSING

This section specifies the rules for processing the route of flight with regard to assigned, requested, and adapted altitudes.

10.1 ALTITUDES

From input sources the program recognizes the altitudes as field 08 (assigned altitude) or field 09 (requested altitude). The program determines what altitude to use for processing and the different rules that may be applicable for printing, depending on whether the flight is an active or inactive flight plan. The program may be required to print these altitudes in box 17 or box 20 of a flight progress strip. An adapted altitude may replace field 08 or field 09 for processing and printing.

The definitions of the different altitude terms are as follows:

- a. Adapted altitude. An altitude derived from adaptation.
 1. Printed altitude. The altitude printed in box 17 or box 20 of a flight progress strip. This altitude is determined by the program, and may be derived from field 08, field 09, adaptation, or a combination of any two of them, as specified in NAS-MD-314.
 2. Processing altitude. The program-selected altitude from field 08, field 09, or adaptation to determine route conversion and postability.
 3. Substitute altitude. Characters adapted for strip printing associated with PAR, STAR, or PDAR adaptation, to be used only for printing in box 20 of the flight progress strip associated with this fix. A substitute altitude is not a processing altitude.
- b. Adapted altitude range. When pertaining to an adapted route, such as a PAR, the PAR is applicable only if the program-determined processing altitude is within the adapted range(s) of altitude of the PAR.
- c. Altitude categories. The three altitude categories are:
 1. OTP – OTP and OTP/(d)dd
 2. VFR – VFR and VFR/(d)dd
 3. IFR – all other field altitudes
- d. Amended altitude. An altitude changed by an Amendment message (AM) or a Departure message (DM). If the amended altitude is in a different stratum in Altitude Stratification Adaptation, the amended altitude causes reprocessing of the flight plan.
- e. Arrival altitude. The altitude determined by the program as the processing altitude for adapted or nonadapted arrival routes.

- | | | |
|----|---------------------|--|
| f. | Assigned altitude. | The altitude entered in field 08 of a flight plan message (FP, AM, or DM). The assigned altitude may or may not be the processing altitude. In strip printing, assigned altitude is the altitude printed in box 17 of the flight progress strip. |
| g. | Departure altitude. | The altitude determined by the program as the processing altitude for adapted or nonadapted departure routes. |
| h. | En route altitude. | The altitude used for processing the segments between departure and arrival processing, or an online altitude used for overflights. |
| i. | Filed altitude. | An altitude in field 08 or field 09 of a flight plan, or as amended. |
| j. | Online altitude. | An altitude that is sent or received as part of an ICM. It is sent or received as the en route altitude; however, external adaptation or nonadapted arrival logic may specify another altitude to be used for initial processing and printing. |
| k. | Requested altitude. | The altitude entered as field 09 and/or printed in box 20 of a flight progress strip. |

The following altitude formats may be input to a flight plan, and if determined to be the processing altitude, are used to process the pertinent route segments and intercenter messages for the flight, except when adaptation specifies otherwise.

10.1.1 Single Altitude

When a single altitude is contained in a flight plan, it is used for processing.

10.1.2 Blocked Altitudes

When blocked altitudes are contained in a flight plan, the highest altitude of the block is used for processing.

10.1.3 OTP or VFR

When the letters OTP or VFR without a suffixed altitude appear in the flight plan, the on-top parameter (OTOP) is used as the altitude for processing. When an altitude is suffixed to the letters OTP or VFR, the suffixed altitude is used for processing.

10.1.4 Above

When the letters ABV with a suffixed altitude appear in the flight plan, the suffixed altitude is used for processing.

10.1.5 Altitude/Fix/Altitude

The rules for processing altitude/fix/altitude format are specified in section 10.8.1.

10.2 DEPARTURES

A departure flight is one that is filed with a P- or D-time, with VFR, DVFR, or tailoring not the second element, and with the departure fix as the coordination fix (field 06).

The following rules apply to proposed departures, activation messages, and external departures.

10.2.1 Proposed Departures

A proposed departure must have an altitude entered for field 09. The altitude is amendable prior to departure, and if amended, the amended field replaces the previous stored field and causes reprocessing if the amended altitude is within a different adapted altitude stratum. The altitude used for processing is the altitude entered in field 09 except when adaptation specifies otherwise and/or non-adapted departure processing applies. The altitude rules for processing non-adapted departures are specified in section 8.5.

10.2.2 Activation Messages

The following rules apply when activating a flight with a Departure (DM) message, Amendment (AM) message with a D-time, or entering a flight plan with a D-time, except when adaptation specifies otherwise and/or non-adapted departure processing applies.

When activating a flight with a Departure (DM) message or an Amendment (AM) message with a D-time and when the activation message does not contain a field 08, process using the altitude in field 09 of the referent proposed flight plan. Field 09 becomes field 08 and delete field 09. When an activation message contains a field 08 and it is equal to or higher than the field 09 altitude, process the flight on the field 08 altitude of the activation message and delete the field 09 altitude. If the activation message contains a field 08, if the format is not altitude/fix/altitude, and if the altitude is lower than the field 09 altitude, retain both altitudes and process the flight at the field 09 altitude. If an altitude in the format of altitude/fix/altitude is included in the activation message, the requested altitude is deleted and processing is as specified in section 10.8.1. The altitude rules for processing non-adapted departures are specified in section 8.5.

10.2.3 External Departures

The altitude rules for processing external departures are specified in section 8.8.

10.3 AIRFILES

An airfile is a flight plan which is not a departure as defined in section 10.2, which is not an external departure as specified in section 8.8.1, and whose first converted fix is internal at the filed altitude. Any flight whose second element is VFR or DVFR is an airfile. If the flight is initially entered with an E-time, it is processed at the entered field 08 altitude. If it is activated with a field 07 amendment only changing a P-time to an E-time, field 09 becomes field 08 and field 09 is deleted. If it is activated with a field 07 amendment and a field 08 altitude amendment, process the flight at the field 08 altitude and delete the field 09 altitude.

10.4 INBOUND FLIGHTS RECEIVED FROM ADJACENT CENTERS

The altitude used for processing an inbound flight from an adjacent center is the altitude received on the intercenter message. If a flight is entering the center on a coded route the altitude received in the intercenter message is used to process the coded route. Unless an adapted altitude is applicable (refer to section 10.6), the altitude received in the intercenter message is used for processing at the exit fix of the coded route. If an altitude in the format altRalt is received on an intercenter message, the flight is processed at the second altitude and the first altitude is deleted. The altitude rules for processing external departures are specified in section 8.8.

10.5 ARRIVAL FLIGHTS

An arrival flight is one that contains no XXX, VFR, or DVFR after the second element, that is completely logic checked through the destination with no errors encountered, and whose route contains no elements for which there is insufficient adaptation data.

The following altitude rules apply to adapted arrival, non-adapted arrival, and external arrivals.

10.5.1 Adapted Arrivals

The altitude used for processing a PAR or STAR is the previous processed altitude prior to the PAR or STAR. The altitude used for processing a PDAR is as specified in section 10.2.1.

10.5.2 Non-Adapted Arrivals

The altitude rules for processing non-adapted arrivals are specified in section 8.4.

10.5.3 External Arrivals

The altitude rules for processing external arrivals are specified in section 8.8.

10.6 CODED ROUTES

10.6.1 Processing Altitude on the Coded Route

The altitude used for processing to the entry fix of a coded route is used for processing until the first fix is encountered with an adapted altitude, with the following exceptions:

- a. If the departure point is the first fix on a coded route which has an altitude adapted, process the flight at the adapted altitude until a different adapted altitude is encountered or until the coded route is exited.
- b. If the entry fix is the departure point and does not have an adapted altitude, process the flight at the requested or assigned altitude as specified in sections 10.2.1 and 10.2.2, until an adapted altitude is encountered; then process at the adapted altitude(s).
- c. If the entry fix of the coded route is also the Departure Route Distance Parameter (DRDP) miles point of a non-adapted departure, the altitude used for processing the coded route is the higher of the assigned or requested altitude until a fix with an altitude adapted is reached.
- d. If the first converted fix is the first fix on a coded route which has an adapted altitude and if it is external to the center area at the adapted altitude and if VFR or DVFR is not the second element, process the flight at the adapted altitudes until the coded route is exited.
- e. If the first fix on the coded route with an adapted altitude is the exit fix of that coded route, the adapted altitude is ignored.

An adapted altitude, or if two altitudes are adapted for a fix, the second altitude, represents the altitude used in fix-time calculations for all flights that traverse the coded route and is applied until reaching a subsequent fix that has a different altitude adapted or until the coded route is exited.

The rules for processing an altitude transition as a result of altitude/fix/altitude filed in field 08 for a Type 2 or 4 coded route are specified in section 10.8.1.

The rules for processing an amendment to field 08, applicable to Type 2 or 4 coded routes, are specified in section 10.7.1.

10.6.2 Processing Altitude When Exiting the Coded Route

The altitude used for processing when exiting a Type 2 or 4 coded route is the same altitude used for processing just before entering the coded route with the following exceptions:

- a. If the entry fix of the coded route is the departure point or if the entry fix was the DRDP point, the altitude used for exiting the coded route is the higher of the assigned or requested altitude.
- b. The latest field 08 amendment is the altitude for processing when exiting the coded route.
- c. When altitude transition processing is performed as a result of altitude/fix/altitude filed in field 08 and when the fix in field 08 occurs on a Type 2 or 4 coded route, the altitude change is not applied if an adapted altitude had been previously applied, except the second altitude is applied at the exit fix of the coded route.
- d. If the destination point is the exit fix of the coded route, then the last adapted altitude on the coded route is the altitude used for processing at the exit fix.
- e. If the exit fix of a coded route is also the Arrival Route Distance Parameter (ARDP) miles point for a non-adapted arrival, Arrival Route Altitude Parameter (ARAP) altitude is used when exiting the coded route.
- f. If the entry fix to a coded route was also the exit fix of a preceding coded route that had an altitude adapted on that route, the altitude used for exiting the second coded route will be the higher of the requested or the assigned altitude.
- g. If the exit fix of a coded route is also the entry fix to another coded route that has an altitude adapted on the entry fix, then this adapted altitude is used when exiting the first coded route.

10.7 AMENDMENTS

When en route altitude amendments to an active flight plan cause reprocessing, all FPAs between the old and new altitudes, at the point of altitude transition (flight plan present position fix) are converted for potential posting (refer to section 10.8). All fixes behind the flight plan present position fix are discarded except fixes for which strip printing updates, or interfacility transmission has been initiated; such fixes are retained until output action is completed. If the flight plan present position fix is a non-adapted point that was generated as a result of Hold-at-Present-Position, the amended altitude is applied at the next converted fix.

However, if the amendment takes place while the aircraft is on a PDR, PDAR or SID and the flight plan present position fix is the departure point, each FPA is to be converted only once for that fix.

10.7.1 Field 08

An amendment to field 08 of an active flight plan causes reprocessing if:

- a. Either the old or new altitude has the format altitude/fix/altitude or
- b. The new field 08 is in a different adapted altitude stratum from the old field 08 and field 09 is not present or

- c. Field 09 is present and the entered field 08 is in a different adapted altitude stratum from field 09.
- d. The amendment is from VFR or VFR/(d)dd to any other altitude.

Exceptions to the above are delineated later in this subsection. An amendment to field 08 of an active flight plan causes deletion of field 09 if it is present.

If the new altitude is of the format altitude/fix/altitude, posting encompasses, at the present position fix, all FPAs that lie between the previous processed altitude and the first altitude of the altitude/fix/altitude except as indicated in section 10.7. At the fix specified in field 08, posting encompasses all FPAs between the prefixed and suffixed altitudes. Subsequently, the second altitude is used for processing. For exceptions refer to section 10.8.1.

An amendment to field 08 of an active flight plan is the altitude to be used for processing from the flight plan present position fix to the destination, except as follows:

- a. If the flight plan present position fix occurs within a PDR, PDAR, SID, STAR, or PAR or if the flight plan present position fix is the departure point of a PDR, PDAR, or SID, then the same PDAR, PDR, SID, STAR, or PAR associated route data is applied at the amended altitude upon conversion regardless of its applicability at the new altitude or of its activity status. If an adapted direct route was instrumental in the application of a PDR or PAR, then the same adapted direct route is applied at the amended altitude.
- b. If the flight plan present position fix is within DRDP miles or D-line intercept point of the point of departure and the flight was previously processed as a non-adapted departure, and either the amended altitude is not of the form altitude/fix/altitude, or the fix in the altitude/fix/altitude amendment is subsequent to the DRDP or D-line intercept the DRAP altitude or the adapted posting altitude, if applicable continues to be applied until DRDP miles or the D-line intercept point, at which point, the amended en route altitude is applied. If the flight was previously processed as an external departure and the flight plan present position fix is within an adapted distance of the external airport, the adapted posting altitude, if applicable, continues to be applied for that adapted distance, at which point, the amended en route altitude is applied. If any adapted direct routes were applied within the non-adapted departure portion of the route of flight, then the same adapted direct routes are reapplied. The amended altitude information is appropriately displayed, printed, or transmitted as specified in NAS-MDs-314 and 315.
- c. If the flight plan present position fix is within ARDP miles or A-line intercept point of the destination, or within an adapted distance of the external airport, and the flight was previously processed as a non-adapted arrival, the amendment does not cause the route to be recon-verted. The ARAP altitude or the adapted posting altitude continues to be used as the basis of processing. The amended altitude information is appropriately displayed or transmitted as specified in NAS-MDs-314 and 315.
- d. If the flight plan present position fix is on Type 2 or 4 coded route and has an adapted altitude(s), the amended altitude is applied, starting with the exit fix of the coded route. The amended altitude information is appropriately displayed, printed, or transmitted as specified in NAS-MDs-314 and 315.
- e. If the flight plan present position fix is on an adapted direct route, then the same adapted direct route is applied at the amended altitude upon conversion, regardless of its applicability at the new altitude.

- f. If the flight plan present position fix is the destination fix or the last converted fix, the amendment does not cause the route to be reconverted. If the flight plan present position fix is a non-adapted point that was generated as a result of HOLD-at-Present-Position and the next converted fix is the destination fix or the last converted fix, the route is not reconverted. The amended altitude information is appropriately displayed or transmitted as specified in NAS-MDs-314 and 315.

10.7.2 Field 09

A field 09 to an active flight plan cannot be amended.

10.8 TRANSITIONS

Route conversion ensures that route records for all FPAs that overlie a fix at which an altitude transition occurs and that are within the range of transition are generated for potential posting, except as indicated in section 10.7. Altitude transitions occur as a result of:

- a. Altitude amendments.
- b. Altitude/fix/altitude in field 08 at the specified fix (refer to section 10.8.1).
- c. Non-adapted arrivals (refer to section 8.4).
- d. Non-adapted departures (refer to section 8.5).
- e. External departure/arrivals (refer to section 8.8).
- f. Climb or descent from en route altitude to the first fix having an adapted altitude on a Type 2 or 4 coded route (refer to sections 10.6 and 7.2.2).
- g. Climb or descent from coded route altitude to en route route (assigned or requested) altitude at the exit fix on a Type 2 or 4 coded route (refer to sections 10.6 and 7.2.2).

If the altitude transition falls on a junction between two routes (direct or adapted), the altitude transition is associated with the preceding route segment with the following exceptions:

- a. If the junction is between a coded route and another type of route, the transition is always associated with the coded route.
- b. If the ARDP point falls on a junction between two route segments, and item a above does not apply, that transition is associated with the following route segment.
- c. If the transition is at a connect fix for an off airway/coded route fix, the transition is associated with the airway/coded route, not with the connect segment.

10.8.1 Altitude/Fix/Altitude

The following rules apply when altitude transition processing is performed as a result of altitude/fix/altitude entered in field 08:

- a. Only a filed endpoint is valid for entry as a fix in field 08 if the altitude change is to occur on a direct route segment or an adapted direct route segment.
- b. If the altitude change is to occur on an adapted route (excluding preferential routes and Type 2 or 4 coded route fixes that have altitude adapted), the fix in field 08 may be any fix adapted on that route.

- c. If a proposed flight plan is activated as a departure or an initial flight plan is filed with a D-time and the altitude in field 08 is in the form of alt/fix/alt, the second altitude is used to find an applicable PDR/PDAR. If one is found, it is examined to determine whether the fix, (in alt/fix/alt), is on the preferential route prior to the PDR/PDAR transition fix or D-line intersection.

If it is, the PDR/PDAR is used and processing is applied as specified in the first two sentences of section 10.8.1,f.

If the PDR/PDAR selected above is not also applicable at the first altitude or if no PDR/PDAR is found at the second altitude, the first altitude is used to find an applicable PDR/PDAR and the entire route is processed as specified in the first two sentences of section 10.8.1,f.

If an alt/fix/alt is filed in field 08 and the fix (in alt/fix/alt) is an A-line or PAR transition fix or a subsequent fix on the PAR, the first altitude is used in applying the PAR and processing is applied as specified in the first two sentences in section 10.8.1,f. If the fix is not encountered prior to the PAR T-FIX or is not on the PAR, the first altitude is used to process the PAR.

If an alt/fix/alt amendment occurs when the present position is on a preferential route, processing is applied as specified in section 10.7.1 a.

- d. If the fix in field 08 occurs on a Type 2 or 4 coded route, the altitude change is not applied if an adapted altitude has been previously applied except the second altitude is applied at the exit fix of the coded route.
- e. If the fix in field 08 occurs as a loop fix on a Type 2 coded route, the altitude transition is invalid and is not applied.
- f. Except for preferential routes, the altitude preceding the fix name is used for processing to the fix. The altitude following the fix is used for processing after the fix. If the fix is not on the filed or converted route, use the altitude preceding the fix for processing. For altitude/fix/altitude processing on preferential routes, see paragraph c.
- g. When the fix in alt/fix/alt is the first converted fix and VFR or DVFR is not the second element, the transition is not applied if the coordination fix is external to the center area at the second altitude.
- h. When the fix in an amendment of ALT/FIX/ALT is the present position fix, an altitude transition will be posted from the previous processing altitude to the second altitude.

11.0 AIRCRAFT IDENTIFICATION COLOR

For adapted routes or direct route segments, the Aircraft Identification (AID) color is computed by analyzing the true heading of the route into the fix being posted. When the first converted fix is also the first posted fix, the AID color is computed by analyzing the true heading of the route into the second converted fix. The following two parameters determine between which true headings the color must be, highlighted or black:

Color Heading 1 (CHDA) 0-359, degrees.

Color Heading 2 (CHDB) 0-359, degrees.

The following rules apply to the adapted values of the parameters CHDA and CHDB:

- a. If the values of CHDA and CHDB are 0 degrees, the AIDs will be printed in black.
- b. If the values of CHDA and CHDB are equal, other than 0 degrees, the AIDs will be printed with highlighting.
- c. If the values of CHDA and CHDB are unequal, the AIDs will be printed with highlighting for a true heading equal to the value of CHDA, clockwise, to and including the true heading equal to the value of CHDB; AIDs for remaining true headings will be printed in black.

APPENDIX A

DISTANCE-BEARING EQUATIONS

The methods and equations described in this appendix are given only as suggestions and illustrations. They are not intended to preclude the use of more efficient methods of achieving the specified results.

The equations described in this appendix are used for computation of distance and bearing throughout the system.

1. Distance (Great Circle Arc)

$$d = R\theta$$

where:

R is the conformal radius of the earth and:

$$\theta = \text{Cos}^{-1} \left[1 - \frac{8R^2 [(X_2 - X_1)^2 + (y_2 - y_1)^2]}{(4R^2 + x_1^2 + y_1^2)(4R^2 + x_2^2 + y_2^2)} \right]$$

x_i, y_i are the coordinates, relative to the stereographic point of tangency, of the points between which distance is to be calculated.

2. Bearing

Initial true bearing between two points is computed by:

$$\theta_u = \tan^{-1} \left(\frac{x_2 - x_1}{y_2 - y_1} \right)$$

where:

θ_u is the true bearing uncorrected for polar parallax, β .

x_i, y_i - coordinates, relative to system origin of the two points.

The correction angle, β , is computed by:

$$\omega = \frac{(4R \sin \phi + 2 \text{Cos } \phi y') x'}{(4R^2 + x'^2 - y'^2) \text{Cos } \phi - 4R \sin \phi y'}$$

$$\beta = \tan^{-1} \omega$$

$$= \omega - \frac{\omega^3}{3}$$

where:

R = Conformal radius of earth

ϕ = Conformal latitude of the stereographic point of tangency

x', y' = Coordinates, relative to the stereographic point of tangency, of the initial point.

The final corrected true bearing is then:

$$\theta_c = \theta_u + \beta$$

The above equation for β yields a correction factor for a single point. Point-to-point bearing in the system is actually computed by an average correction factor between the two points, and the equation for θ_c above becomes:

$$\theta_c = \theta_u + \frac{\beta_1 + \beta_2}{2}$$

APPENDIX B

STRAIGHT LINE INTERSECTION

The methods and equations described in this appendix are given only as suggestions and illustrations. They are not intended to preclude the use of more efficient methods of achieving the specified results.

When conditions permit the processing of direct route segments by the straight line method, the point of intersection between a route and boundary is determined by the simultaneous solution of the linear equations representing the route segment and the boundary segment. As an illustration, let (x_{R1}, y_{R1}) and (x_{R2}, y_{R2}) be the coordinates of the end points of a route segment and (x_{b1}, y_{b1}) and (x_{b2}, y_{b2}) be the coordinates of the endpoints of a boundary segment.

The linear equation of the route segment in point/slope form is:

$$y - y_{R1} = m_R (x - x_{R1})$$

where:

$$m_R = \text{slope of route segment} = \frac{y_{R2} - y_{R1}}{x_{R2} - x_{R1}}$$

The negative y intercept of the route c_R , may be expressed by:

$$c_R = m_R x_{R2} - y_{R2}$$

The boundary line segment may be similarly described by:

$$y - y_{b1} = m_b (x - x_{b1})$$

where:

$$m_b = \text{slope of boundary line} = \frac{y_{b2} - y_{b1}}{x_{b2} - x_{b1}}$$

The negative of the y- intercept of the boundary, c_b is:

$$c_b = m_b x_{b2} - y_{b2}$$

The point of intersection of the two lines may then be calculated by:

$$x = \frac{c_b - c_R}{m_b - m_r} \text{ and } y = m_b x - c_b$$

The x and y coordinates calculated by the above equations must lie on that segment of each line between the specified endpoints; otherwise, the route and boundary segments do not intersect.

$$y - y_f = - \frac{1}{m_R} (x - x_f)$$

where:

x_f, y_f are the coordinates of the focal point fix.

APPENDIX C

GREAT CIRCLE INTERSECTION

The methods and equations described in this appendix are given only as suggestions and illustrations. They are not intended to preclude the use of more efficient methods of achieving the specified results.

The procedure used to determine the point of intersection between two great circle arc segments on the conformal sphere is as follows:

- a. Convert the coordinates of the endpoints of both arc segments from the system stereographic projection plan to the gnomonic projection plan having the same point of tangency. The equations for the transformation are:

$$X_g = \frac{X_s - X_o}{\sqrt{(X_s - X_o)^2 + (Y_s - Y_o)^2}} \cdot 4E_o^2$$

$$Y_g = \frac{Y_s - Y_o}{\sqrt{(X_s - X_o)^2 + (Y_s - Y_o)^2}} \cdot 4E_o^2$$

where:

X_s, Y_s = are the system stereographic coordinates of an endpoint of an arc segment relative to the system origin (ϕ, ϕ point).

X_o, Y_o = are the stereographic coordinates of tangency of the projection plan.

E_o = is the radius of the conformal sphere.

X_g, Y_g = are the gnomonic coordinates of the arc segment endpoint.

- b. Perform a straight line intersection according to equations in Appendix B, using the gnomonic coordinates for the arc segment endpoints. Gnomonic projections have the property that all great circle arcs on the conformal sphere project as straight lines on the projection plan. This property makes a straight line intersection a valid determination of the crossing point of the two arc segments.
- c. If an intersection point has been found by the equations in Appendix B, its coordinates are converted from the gnomonic projection plan to the system stereographic projection plan. The equations for this transformation are:

$$X_{is} = \frac{2X_{ig}}{1 + \left[1 + \frac{X_{ig}^2 + Y_{ig}^2}{E_o^2} \right]^{1/2}} + X_o$$

$$Y_{is} = \frac{2Y_{ig}}{1 + \left[1 + \frac{X_{ig}^2 + Y_{ig}^2}{E_o^2} \right]^{1/2}} + Y_o$$

where:

X_{ig}, Y_{ig} = are the gnomonic coordinates of the intersection point.

X_o, Y_o = are the stereographic coordinates of the point of tangency of the projection plan.

E_o = is the radius of the conformal sphere.

X_{is}, Y_{is} = are the system stereographic coordinates of the intersection point relative to the system origin (ϕ, ϕ point).

APPENDIX D

COORDINATE CONVERSION

The methods and equations described in this appendix are given only as suggestions and illustrations. They are not intended to preclude the use of more efficient methods of achieving the specified results.

1.0 X, Y TO LAT/LONG

The following equations are used to convert x, y coordinates to geodetic latitude and longitude.

$$\begin{aligned}x' &= x - x_t \\ y' &= y - y_t\end{aligned}$$

where:

- x, y = the x, y coordinates, relative to the system origin, of the point to be converted.
- x', y' = Coordinates, relative to the stereographic point of tangency, of the point to be converted.
- x_t, y_t = Coordinates, relative to the system origin, of the stereographic point of tangency.

$$\sin \phi = \frac{(4R^2 - x'^2 - y'^2) \sin \phi_o + 4Ry' \cos \phi_o}{4R^2 + x'^2 + y'^2}$$

$$\lambda = \lambda_o - \tan^{-1} \left[\frac{4Rx'}{(4R^2 - x'^2 - y'^2) \cos \phi_o - 4Ry' \sin \phi_o} \right]$$

where:

- R = Conformal radius of the Earth
- ϕ_o = Conformal latitude of stereographic point of tangency
- ϕ = Conformal latitude of the point being converted
- λ = Longitude of the point being converted
- λ_o = Longitude of the stereographic point of tangency

Conformal latitude is converted to geodetic latitude by:

$$\phi_g = \sin^{-1} \left[\frac{\sin \phi}{.9932773 + .0066625 (\sin \phi)^2} \right]$$

where:

$\sin \phi$ is as defined previously in this appendix.

The resultant geodetic latitude is then converted from radians to degrees and minutes using a conversion factor of 1 radian = 3437.7468 minutes.

2.0 LAT/LONG TO X, Y

The geodetic latitude and the longitude are converted from degrees and minutes to radians using a conversion factor of .00029089 radians per minute. Geodetic latitude is converted to the sine of Conformal latitude by:

$$\sin \phi = .9932773 \sin \phi_g + .0066625 \sin^3 \phi_g$$

The final conversion to x and y is accomplished by:

$$X = 2R \left(\frac{\sin \Delta\lambda (\cos \phi)}{1 + \sin \phi \sin \phi_o + \cos \phi \cos \phi_o \cos \Delta\lambda} \right) + X_t$$

$$Y = 2R \left(\frac{\sin \phi \cos \phi_o - \cos \phi \sin \phi_o \cos \Delta\lambda}{1 + \sin \phi \sin \phi_o + \cos \phi \cos \phi_o \cos \Delta\lambda} \right) + Y_t$$

where:

$$\Delta\lambda = \lambda_o - \lambda$$

3.0 FRD TO X, Y

given:

- x_1, y_1 = stereographic coordinates of the base fix
- x_2, y_2 = stereographic coordinates of the point being converted
- ϕ = angle specified in the FRD
- d = distance specified in the FRD
- x_o, y_o = stereographic coordinates of the point of tangency
- R = conformal radius of the Earth
- x_2 = $r \sin \alpha + x_1$
- y_2 = $r \cos \alpha + y_1$

where:

$$r = 2R \left[\frac{\left(\frac{x_1 - x_o}{2R} \right) \sin \alpha + \left(\frac{y_1 - y_o}{2R} \right) \cos \alpha \sqrt{\left\{ \left(\frac{x_1 - x_o}{2R} \right) \cos \alpha - \left(\frac{y_1 - y_o}{2R} \right) \sin \alpha \right\}^2 + \frac{1}{\tan^2 \left(\frac{d}{2R} \right)}}}{\frac{1}{\sin^2 \left(\frac{d}{2R} \right) \left\{ 1 + \left(\frac{x_1 - x_o}{2R} \right)^2 + \left(\frac{y_1 - y_o}{2R} \right)^2 \right\}} - 1} \right]$$

$$\alpha = \phi + \beta + \omega$$

and

β = correction factor for polar parallax at the base fix

ω = magnetic variation at the base fix

provided:

$$d > 0, \left(\frac{x_1 - x_0}{2R} \right)^2 + \left(\frac{y_1 - y_0}{2R} \right)^2 < \frac{1}{\tan^2 \left(\frac{d}{2R} \right)}$$

4.0 X, Y TO FRD

Distance is computed by the equations described in Appendix A.

The direction angle, α , is computed by:

$$\phi = \tan^{-1} \frac{x_2 - x_1}{y_2 - y_1}$$

$$\alpha = \theta + \beta + \omega$$

where:

x_1', y_1 = stereographic coordinates of the base fix

x_2', y_2 = stereographic coordinates of the point being converted