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Lufthansa Systems FMS Workshop Greater China

Zhuhai 06.03. – 08.03.2013

Martin Zillig
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汉莎系统FMS大中华区研讨会

2013年3月6日-3月8日，珠海

Martin Zillig

汉莎系统 飞行导航公司 导航数据标准部主任

Agenda

ARINC 424

- History & Purpose
- File Structure and Record Layout
- Path Terminator
- Route Types
- Coding Demonstration

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议题

ARINC 424

- 历史 & 目的
- 文件结构与记录格式
- 航径终结码
- 航路类型
- 编码演示

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ARINC 424 - History

- The requirement for on-board navigation data bases was identified in the **1970s** with the development of the **1st Flight Management Systems (FMS)**.
- *ARINC 424 - **first edition was published in May 1975** and adapted by the industry in July 1975. Since that time there have been 20 revisions which expanded the document from 9 files and 165 data fields to over 20 files and 500 data fields.*
- With the implementation of the area navigation methods, and the capability to use inputs from different sensors, **the requirement to have access to a sophisticated on-board navigation data base became mandatory (TGL 10).**
- *ARINC 424 has been continuously improved and adjusted over the years in order to accommodate new navigational procedures, capabilities, standards and technical characteristics. Working Group Meetings are held on a yearly basis. Representatives from the airlines, FMSs, Flight Planning- and Simulator Provider attend these meetings.*

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ARINC 424 – 历史

- 对机载导航数据库的需求，伴随着20世纪70年代第一代飞行管理系统（FMS)的出现而产生的。
- ARINC424 第一版于1975年5月发布，并于1975年7月被采纳为行业标准。目前已历经20次修订，由原来的9卷165个数据字段、扩展到当今的20多卷500个数据字段。
- 随着区域导航方法的应用，使用多种传感器的输入数据成为可能，使用复杂机载导航数据库变成强制性要求（TGL 10）。
- 多年来，ARINC424一直在进行完善和调整，以适应新的导航程序、能力、标准和技术特点。每年都会举行工作组会议。航空公司、FMS公司、飞行计划和飞机模拟机供应商都会参加这些会议。

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ARINC 424 - Purpose

ARINC 424 is a standard for **exchange of aeronautical data** between **data houses** and various users of aeronautical data such as **FMS Manufacturer**, Simulator Operator or Flight Planning Provider

Prepared by the AEEC

Specification 424 — Adopted by the AEEC Executive Committee — May 21, 1975

Summary of Document Supplements

Supplement	Adoption Date	Published
Specification 424-1	June 19, 1980	September 8, 1980
Specification 424-2	December 9, 1981	February 5, 1982
Specification 424-3	November 4, 1982	January 17, 1983
Specification 424-4	October 12, 1983	November 10, 1983
Specification 424-5	October 10, 1984	March 18, 1985
Specification 424-6	November 7, 1985	January 31, 1986
Specification 424-7	October 8, 1986	January 14, 1987
Specification 424-8	February 28, 1989	October 15, 1989
Specification 424-9	October 26, 1989	March 2, 1990
Specification 424-10	August 16, 1993	August 20, 1993
Specification 424-11	August 16, 1983	August 20, 1993
Specification 424-12	May 17, 1994	September 15, 1994
Specification 424-13	May 23, 1995	December 31, 1995
Specification 424-14	August 24, 1999	February 11, 2000
Specification 424-15	January 12, 2000	February 11, 2000
Specification 424-16	April 8, 2002	August 30, 2002
Specification 424-17	May 5, 2004	August 31, 2004
Specification 424-18	October 5, 2005	November 23, 2005
Specification 424-19	October 22, 2008	December 19, 2008
Specification 424-20	October 6, 2011	December 12, 2011

- **Different systems** and platforms can make use of **the same data basis.**
- The document is **not** meant to be a **prescriptive document for procedure design** experts
- **Not intended** to be used for data exchange **between state authorities and data houses**
- Latest Version adopted is Specification **424-20** (Oct 2011)

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ARINC 424 – 目的

ARINC 424 是一种数据标准，它用于在航空数据供应商和航空数据用户（如FMS制造商、飞机模拟机运营人和飞行计划供应商）之间进行航空数据交换。

Prepared by the AEEC

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Specification 424-17	May 5, 2004	August 31, 2004
Specification 424-18	October 5, 2005	November 23, 2005
Specification 424-19	October 22, 2008	December 19, 2008
Specification 424-20	October 6, 2011	December 12, 2011

- 不同的系统和平台可以使用同一基础数据。
- 该文件并不是程序设计人员必须使用的指定文件。
- 局方与数据供应商之间不进行数据交换。
- 采用的最新版本是**424-20** (2011年10月发布)

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ARINC 424 – General Aspects

- **Individual navigation systems require different formats for navigation reference data.**
- **The available storage in many avionics systems prevents all procedures or data elements from being loaded into the airborne database.**
- **Airlines are cost driven and hence do not upgrade equipment unless there is a clear benefit.**
- **The system life cycle of most avionics equipment is 15 to 20 years.**
- **Over the years, different earth models, geodesic calculations and uses of variables such as magnetic variation have been used.**

Differences in avionics systems need to be considered during the processing of aeronautical data. As a result, databases from the same datahouse but on different platforms may not always be consistent.

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ARINC 424 – 概述

- 不同的导航系统需要使用不同的导航数据格式。
- 许多航电系统的可用存储空间，妨碍了将所有程序或数据元素装载至机载数据库。
- 除非有明显收益，出于费用考虑，航空公司通常不会进行设备升级。
- 多数航电设备的寿命周期为**15**到**20**年。
- 多年来，曾使用过多种不同的地球模型、大地测量计算方法及多个不同的变量，如磁差。

在处理航空数据的过程中，需要考虑航电系统的差异化。因此，同一导航数据供应商提供的数据在不同的平台上可能并不完全相同。

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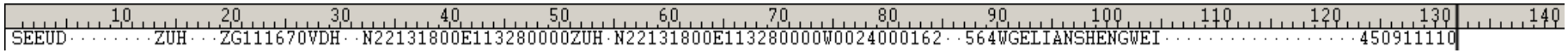
ARINC 424 – File Structure

- **Sorted in alpha/numerical order**
- **Divided into standard (S) and tailored (T) records**
- **S records ordered by Area Code**
- **T records ordered by Airline Code**
- **Individual records divided in sections/sub-sections of max. 132 characters**
  - **Record:** A single line of computer data made up of the fields necessary to define fully a single piece of information
  - **Field:** The collection of characters needed to define one item of information
- **Each record uniquely defined and stored in the master user file**



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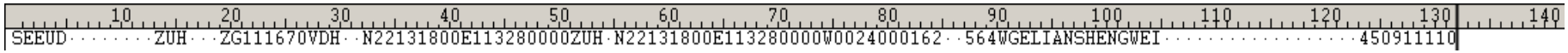
ARINC 424 –文件结构

- 按字母/数字顺序分类
- 分为标准（S）数据和客户化（T）数据
- 标准数据按照区域代码排序
- 客户化数据按照航空公司代码排序
- 各条记录被分为不同章/节，最多包含132位字符。
  - 记录：每一行计算机数据，由定义的一条完整信息字段组成
  - 字段：定义一条信息所需的文本字符的集合
- 对每一条记录进行专门定义，并存储在主用户文件夹内



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ARINC 424 – Record Layout – VHF Navaid

Contains:

- Customer / Area code
- Station Identifier
- Navaid Name
- Coordinates, for VOR and / or DME
- Frequency
- Elevation (DME)
- Variation/Declination
- Datum Code etc.

4.1.2.1 VHF NAVAID Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Blank (Spacing) (1)	
14 thru 17	VOR Identifier (4)	5.33
18 thru 19	Blank (Spacing) (2)	
20 thru 21	ICAO Code (2)	5.14
22	Continuation Record No. (1)	5.16
23 thru 27	VOR Frequency (5)	5.34
28 thru 32	NAVAID Class (5)	5.35
33 thru 41	VOR Latitude (9)	5.36
42 thru 51	VOR Longitude (10)	5.37
52 thru 55	DME Ident (4)	5.38
56 thru 64	DME Latitude (9)	5.36
65 thru 74	DME Longitude (10)	5.37
75 thru 79	Station Declination (5)	5.66
80 thru 84	DME Elevation (5)	5.40
85	Figure of Merit (1)	5.149
86 thru 87	ILS/DME Bias (2)	5.90
88 thru 90	Frequency Protection (3)	5.150
91 thru 93	Datum Code (3)	5.197
94 thru 118	VOR Name (25)	5.71
119 thru 121	Blank (Spacing) (3)	
122	Route Inappropriate DME (1)	5.297
123	DME Operational Service Volume (1)	5.277
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 –记录格式 – 甚高频（VHF）导航台

包含:

- 客户 / 区域代码
- 导航台识别码
- 导航台名称
- VOR 和/ 或DME台坐标
- 频率
- 标高 (DME)
- 磁差/磁倾角
- 数据代码等.

4.1.2.1 VHF NAVAID Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Blank (Spacing) (1)	
14 thru 17	VOR Identifier (4)	5.33
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52 thru 55	DME Ident (4)	5.38
56 thru 64	DME Latitude (9)	5.36
65 thru 74	DME Longitude (10)	5.37
75 thru 79	Station Declination (5)	5.66
80 thru 84	DME Elevation (5)	5.40
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124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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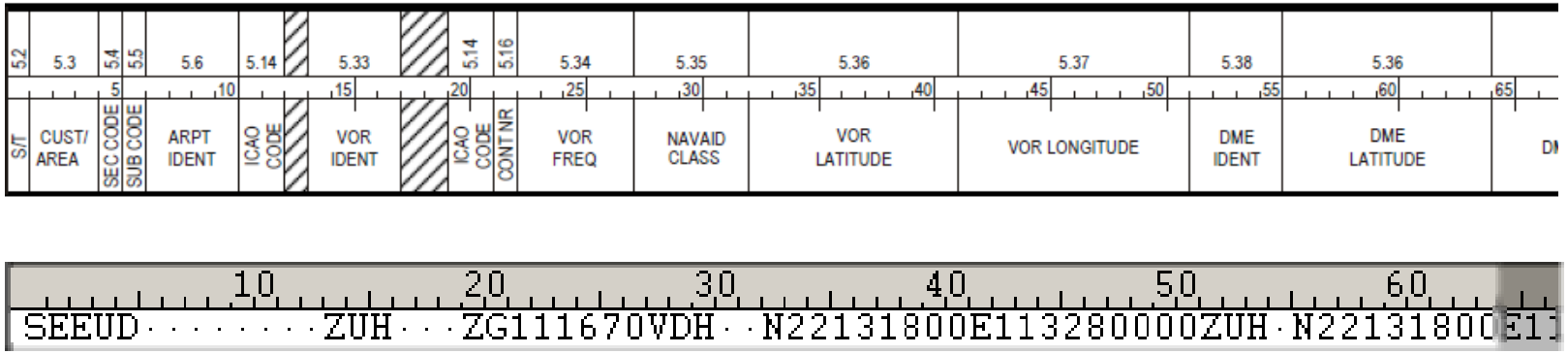
ARINC 424 – Record Layout – VHF Navaid

Example:

- **Lianshengwei VORDME**

ident: **ZUH** country code: **ZG** freq: **116.70 MHz** class: **VDH**
latitude: **N 22° 13’18.00’’** longitude: **E 113° 28’ 00.00’’**



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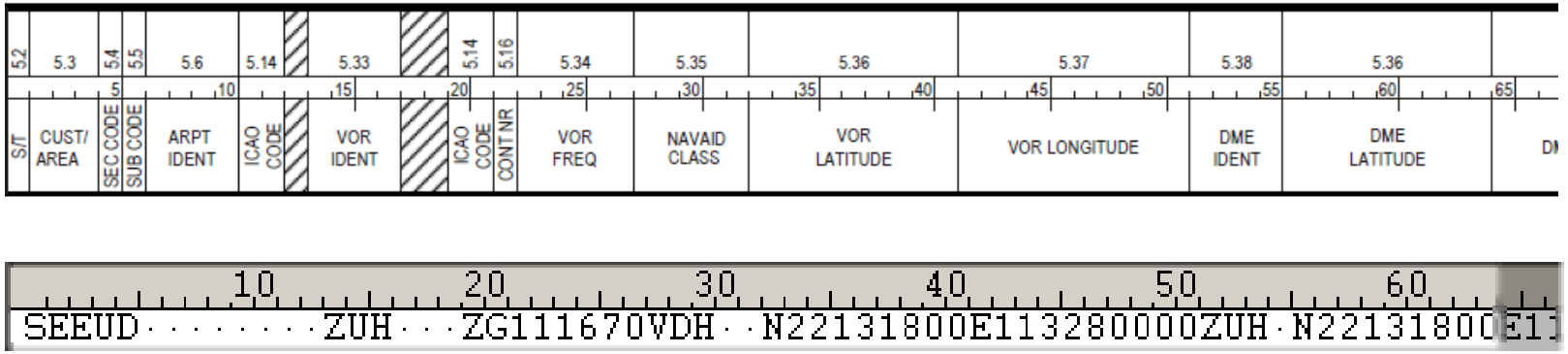
ARINC 424 –记录格式 – 甚高频（VHF）导航台

例:

- **Lianshengwei VORDME**

识别码: **ZUH** 国家代码: **ZG** 频率: **116.70 MHz** 类别: **VDH**
纬度: **N 22° 13’18.00”** 经度: **E 113° 28’ 00.00”**



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ARINC 424 – Record Layout – Waypoint

Contains:

- Waypoint ID
- Type
  - ✓ ENR or Terminal
  - ✓ RNAV
  - ✓ IAF/IF/FACF/FAF/MAPt
  - ✓ Stepdown (Terminal only)
  - ✓ Arc centre (Terminal only)
  - ✓ SID/STAR/APP/Multiple
- Usage
  - ✓ RNAV airway
  - ✓ Terminal

4.1.4.1 Waypoint Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5 Note 1
7 thru 10	Region Code (4)	5.41 Note 2
11 thru 12	ICAO Code (2)	5.14
13	Subsection (1)	5.5 Note 1
14 thru 18	Waypoint Identifier (5)	5.13
19	Blank (Spacing) (1)	
20 thru 21	ICAO Code (2)	5.14
22	Continuation Record No. (1)	5.16
23 thru 26	Blank (Spacing) (4)	
27 thru 29	Waypoint Type (3)	5.42
30 thru 31	Waypoint Usage (2)	5.82
32	Blank (Spacing) (1)	
33 thru 41	Waypoint Latitude (9)	5.36
42 thru 51	Waypoint Longitude (10)	5.37
52 thru 74	Blank (Spacing) (23)	
75 thru 79	Dynamic Magnetic Variation (5)	5.39
80 thru 84	Reserved (Expansion) (5)	
85 thru 87	Datum Code (3)	5.197
88 thru 95	Reserved (Expansion) (8)	
96 thru 98	Name Format Indicator (3)	5.196
99 thru 123	Waypoint Name/Description (25)	5.43
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 –记录格式 – 航路点

包含:

- 航路点代码
- 类型
  - ✓ 航路或终端区
  - ✓ 区域导航（RNAV）
  - ✓ IAF/IF/FACF/FAF/MAPt
  - ✓ 梯级下降 (仅用于终端区)
  - ✓ 圆弧中心 (仅用于终端区)
  - ✓ 离场/进场/进近/混合类型
- 用途
  - ✓ RNAV航路
  - ✓ 终端区

4.1.4.1 Waypoint Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5 Note 1
7 thru 10	Region Code (4)	5.41 Note 2
11 thru 12	ICAO Code (2)	5.14
13	Subsection (1)	5.5 Note 1
14 thru 18	Waypoint Identifier (5)	5.13
19	Blank (Spacing) (1)	
20 thru 21	ICAO Code (2)	5.14
22	Continuation Record No. (1)	5.16
23 thru 26	Blank (Spacing) (4)	
27 thru 29	Waypoint Type (3)	5.42
30 thru 31	Waypoint Usage (2)	5.82
32	Blank (Spacing) (1)	
33 thru 41	Waypoint Latitude (9)	5.36
42 thru 51	Waypoint Longitude (10)	5.37
52 thru 74	Blank (Spacing) (23)	
75 thru 79	Dynamic Magnetic Variation (5)	5.39
80 thru 84	Reserved (Expansion) (5)	
85 thru 87	Datum Code (3)	5.197
88 thru 95	Reserved (Expansion) (8)	
96 thru 98	Name Format Indicator (3)	5.196
99 thru 123	Waypoint Name/Description (25)	5.43
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 – Record Layout – Holding

Contains:

- Region Code
- Fix Identifier
- Inbound Course
- Turn Direction
- Leg Length
- Leg Time
- Holding Speed
- Min Altitude
- Max Altitude
- Cycle Date

- 4.1.5.1 Holding Pattern Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5
7 thru 10	Region Code (4)	5.41 Note 1
11 thru 12	ICAO Code (2)	5.14 Note 1
13 thru 27	Blank (Spacing) (15)	
28 thru 29	Duplicate Identifier (2)	5.114
30 thru 34	Fix Identifier (5)	5.13
35 thru 36	ICAO Code (2)	5.14
37	Section Code (1)	5.4
38	Subsection Code (1)	5.5
39	Continuation Record No. (1)	5.16
40 thru 43	Inbound Holding Course (4)	5.62
44	Turn Direction (1)	5.63
45 thru 47	Leg Length (3)	5.64
48 thru 49	Leg Time (2)	5.65
50 thru 54	Minimum Altitude (5)	5.30
55 thru 59	Maximum Altitude (5)	5.127
60 thru 62	Holding Speed (3)	5.175
63 thru 65	RNP (3)	5.211
66 thru 71	Arc Radius (6)	5.204
72 thru 74	Vertical Scale Factor (3)	5.293
75 thru 77	RVSM Minimum Level (3)	5.294
78 thru 80	RVSM Maximum Level (3)	5.295
81	**Leg Inbound/Outbound Indicator (1)**	**5.298**
82 thru 98	Reserved (Expansion) (**17**)	
99 thru 123	Name (25)	5.60
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 –记录格式 – 等待

包含:

- 地区代码
- 定位点识别码
- 入航航迹
- 转弯方向
- 出航边长度
- 出航边时间
- 等待速度
- 最低等待高度
- 最大等待高度
- 周期

- 4.1.5.1 Holding Pattern Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Subsection Code (1)	5.5
7 thru 10	Region Code (4)	5.41 Note 1
11 thru 12	ICAO Code (2)	5.14 Note 1
13 thru 27	Blank (Spacing) (15)	
28 thru 29	Duplicate Identifier (2)	5.114
30 thru 34	Fix Identifier (5)	5.13
35 thru 36	ICAO Code (2)	5.14
37	Section Code (1)	5.4
38	Subsection Code (1)	5.5
39	Continuation Record No. (1)	5.16
40 thru 43	Inbound Holding Course (4)	5.62
44	Turn Direction (1)	5.63
45 thru 47	Leg Length (3)	5.64
48 thru 49	Leg Time (2)	5.65
50 thru 54	Minimum Altitude (5)	5.30
55 thru 59	Maximum Altitude (5)	5.127
60 thru 62	Holding Speed (3)	5.175
63 thru 65	RNP (3)	5.211
66 thru 71	Arc Radius (6)	5.204
72 thru 74	Vertical Scale Factor (3)	5.293
75 thru 77	RVSM Minimum Level (3)	5.294
78 thru 80	RVSM Maximum Level (3)	5.295
81	Leg Inbound/Outbound Indicator (1)	5.298
82 thru 98	Reserved (Expansion) (17)	
99 thru 123	Name (25)	5.60
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 – Record Layout – Airports

Contains:

- Airport ICAO Identifier
- ATA/IATA Designator
- Longest Runway
- Magnetic Variation
- Airport Elevation
- ARP Lat/Lon
- Speed Limit
- Transition Level/Altitude
- Airport Name
- Datum Code etc.

4.1.7.1 Airport Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Blank (Spacing) (1)	
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Subsection Code (1)	5.5
14 thru 16	ATA/IATA Designator (3)	5.107
17 thru 18	Reserved (Expansion) (2)	
19 thru 21	Blank (Spacing) (3)	
22	Continuation Record Number (1)	5.16
23 thru 27	Speed Limit Altitude (5)	5.73
28 thru 30	Longest Runway (3)	5.54
31	IFR Capability (1)	5.108
32	Longest Runway Surface Code (1)	5.249
33 thru 41	Airport Reference Point Latitude (9)	5.36
42 thru 51	Airport Reference Point Longitude (10)	5.37
52 thru 56	Magnetic Variation (5)	5.39
57 thru 61	Airport Elevation (5)	5.55
62 thru 64	Speed Limit (3)	5.72
65 thru 68	Recommended Navaid (4)	5.23
69 thru 70	ICAO Code (2)	5.14
71 thru 75	Transitions Altitude (5)	5.53
76 thru 80	Transition Level (5)	5.53
81	Public/Military Indicator (1)	5.177
82 thru 84	Time Zone (3)	5.178
85	Daylight Indicator (1)	5.179
86	Magnetic/True Indicator (1)	5.165
87 thru 89	Datum Code (3)	5.197
90 thru 93	Reserved (Expansion) (4)	
94 thru 123	Airport Name (30)	5.71
124 thru 128	File Record Number (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 –记录格式 – 机场

包含:

- 机场 ICAO 代码
- ATA/IATA 代码
- 最长跑道长度
- 磁差
- 机场标高
- ARP坐标
- 速度限制
- 过渡高度层/过渡高度
- 机场名称
- 数据代码等.

4.1.7.1 Airport Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Blank (Spacing) (1)	
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Subsection Code (1)	5.5
14 thru 16	ATA/IATA Designator (3)	5.107
17 thru 18	Reserved (Expansion) (2)	
19 thru 21	Blank (Spacing) (3)	
22	Continuation Record Number (1)	5.16
23 thru 27	Speed Limit Altitude (5)	5.73
28 thru 30	Longest Runway (3)	5.54
31	IFR Capability (1)	5.108
32	Longest Runway Surface Code (1)	5.249
33 thru 41	Airport Reference Point Latitude (9)	5.36
42 thru 51	Airport Reference Point Longitude (10)	5.37
52 thru 56	Magnetic Variation (5)	5.39
57 thru 61	Airport Elevation (5)	5.55
62 thru 64	Speed Limit (3)	5.72
65 thru 68	Recommended Navaid (4)	5.23
69 thru 70	ICAO Code (2)	5.14
71 thru 75	Transitions Altitude (5)	5.53
76 thru 80	Transition Level (5)	5.53
81	Public/Military Indicator (1)	5.177
82 thru 84	Time Zone (3)	5.178
85	Daylight Indicator (1)	5.179
86	Magnetic/True Indicator (1)	5.165
87 thru 89	Datum Code (3)	5.197
90 thru 93	Reserved (Expansion) (4)	
94 thru 123	Airport Name (30)	5.71
124 thru 128	File Record Number (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 – Record Layout – Runways

Contains:

- Runway ID
- Runway Length
- Runway Magnetic Bearing
- Threshold Co-ordinates
- Runway Gradient
- Threshold Elevation
- Threshold Crossing Height (TCH)
- Displaced Threshold Distance
- LOC/MLS/ILS Ref Path ID
- LOC/MLS/ILS Category/Class
- Runway Description
- etc….

4.1.10.1 Runway Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Blank (Spacing) (1)	
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Subsection Code (1)	5.5
14 thru 18	Runway Identifier (5)	5.46
19 thru 21	Blank (Spacing) (3)	
22	Continuation Record No. (1)	5.16
23 thru 27	Runway Length (5)	5.57
28 thru 31	Runway Magnetic Bearing (4)	5.58
32	Blank (Spacing) (1)	
33 thru 41	Runway Latitude (9)	5.36
42 thru 51	Runway Longitude (10)	5.37
52 thru 56	Runway Gradient (5)	5.212
57 thru 60	Blank (Spacing) (4)	
61 thru 66	(LTP) Ellipsoid Height (6)	5.225
67 thru 71	Landing Threshold Elevation (5)	5.68
72 thru 75	Displaced Threshold Distance (4)	5.69
76 thru 77	**Blank Spacing (2)**	
78 thru 80	Runway Width (3)	5.109
81	TCH Value Indicator (1)	5.270
82 thru 85	Localizer/MLS/ GLS Ref Path Identifier (4)	5.44
86	Localizer/ MLS/ GLS Category/ Class (1)	5.80
87 thru 90	Stopway (4)	5.79
91 thru 94	Second Localizer/ MLS/ GLS Ref Path Ident (4)	5.44
95	Second Localizer/ MLS/ GLS Category/ Class (1)	5.80
96 thru 98	**Threshold Crossing Height (3)**	**5.67**
99 thru 101	Reserved (Expansion) (3)	
102 thru 123	Runway Description (22)	5.59
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 –记录格式 – 跑道

包含:

- 跑道代码
- 跑道长度
- 跑道磁走向
- 入口坐标
- 跑道坡度
- 入口标高
- 跑道入口高 (TCH)
- 入口内移距离
- LOC/MLS/ILS参考航径代码
- LOC/MLS/ILS类别/等级
- 跑道描述信息
- 等….

4.1.10.1 Runway Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Blank (Spacing) (1)	
7 thru 10	Airport ICAO Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Subsection Code (1)	5.5
14 thru 18	Runway Identifier (5)	5.46
19 thru 21	Blank (Spacing) (3)	
22	Continuation Record No. (1)	5.16
23 thru 27	Runway Length (5)	5.57
28 thru 31	Runway Magnetic Bearing (4)	5.58
32	Blank (Spacing) (1)	
33 thru 41	Runway Latitude (9)	5.36
42 thru 51	Runway Longitude (10)	5.37
52 thru 56	Runway Gradient (5)	5.212
57 thru 60	Blank (Spacing) (4)	
61 thru 66	(LTP) Ellipsoid Height (6)	5.225
67 thru 71	Landing Threshold Elevation (5)	5.68
72 thru 75	Displaced Threshold Distance (4)	5.69
76 thru 77	**Blank Spacing (2)**	
78 thru 80	Runway Width (3)	5.109
81	TCH Value Indicator (1)	5.270
82 thru 85	Localizer/MLS/ GLS Ref Path Identifier (4)	5.44
86	Localizer/ MLS/ GLS Category/ Class (1)	5.80
87 thru 90	Stopway (4)	5.79
91 thru 94	Second Localizer/ MLS/ GLS Ref Path Ident (4)	5.44
95	Second Localizer/ MLS/ GLS Category/ Class (1)	5.80
96 thru 98	**Threshold Crossing Height (3)**	**5.67**
99 thru 101	Reserved (Expansion) (3)	
102 thru 123	Runway Description (22)	5.59
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

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ARINC 424 – Record Layout – SID/STAR/Approach

Contains:

- Procedure Identifier
- Route Type
  - SID / STAR
    - Runway Transition, Enroute Transition, Common Route
  - APCH
    - APCH Transition, APCH Type, MISAP
- Transition Identifier
- Sequence Number
- Waypoint Identifier
  etc.

continued on next page

4.1.9.1 Airport SID/STAR/Approach Primary Records

Column	Field Name (Length)		Reference
1	Record Type (1)		5.2
2 thru 4	Customer/Area Code (3)		5.3
5	Section Code (1)		5.4
6	Blank (Spacing) (1)		
7 thru 10	Airport Identifier (4)		5.6
11 thru 12	ICAO Code (2)		5.14
13	Subsection Code (1)		5.5
14 thru 19	SID/STAR/Approach Identifier (6)	Note 1	5.9, 5.10
20	Route Type (1)		5.7
21 thru 25	Transition Identifier (5)		5.11
26	**Procedure Design Aircraft Category or Type**		**5.301**
27 thru 29	Sequence Number (3)		5.12
30 thru 34	Fix Identifier (5)		5.13
35 thru 36	ICAO Code (2)		5.14
37	Section Code (1)		5.4
38	Subsection Code (1)		5.5
39	Continuation Record Number (1)		5.16
40 thru 43	Waypoint Description Code (4)		5.17
44	Turn Direction (1)		5.20
45 thru 47	RNP (3)	Note 4	5.211
48 thru 49	Path and Termination (2)		5.21
50	Turn Direction Valid (1)		5.22
51 thru 54	Recommended Navaid (4)		5.23
55 thru 56	ICAO Code (2)		5.14
57 thru 62	ARC Radius (6)		5.204
63 thru 66	Theta (4)		5.24
67 thru 70	Rho (4)		5.25
71 thru 74	Magnetic Course (4)		5.26
75 thru 78	Route Distance/Holding Distance or Time (4)		5.27

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ARINC 424 –记录格式 – SID/STAR/进近（1）

包含:

- 程序代码
- 航路类型
  - SID / STAR
    - 跑道过渡
      航路过渡,
      普通航路
  - 进近
    - 进近过渡,
      进近类型, 复飞
- 过渡航路代码
- 序号
- 航路点代码

等.

4.1.9.1 Airport SID/STAR/Approach Primary Records

Column	Field Name (Length)		Reference
1	Record Type (1)		5.2
2 thru 4	Customer/Area Code (3)		5.3
5	Section Code (1)		5.4
6	Blank (Spacing) (1)		
7 thru 10	Airport Identifier (4)		5.6
11 thru 12	ICAO Code (2)		5.14
13	Subsection Code (1)		5.5
14 thru 19	SID/STAR/Approach Identifier (6)	Note 1	5.9, 5.10
20	Route Type (1)		5.7
21 thru 25	Transition Identifier (5)		5.11
26	**Procedure Design Aircraft Category or Type**		**5.301**
27 thru 29	Sequence Number (3)		5.12
30 thru 34	Fix Identifier (5)		5.13
35 thru 36	ICAO Code (2)		5.14
37	Section Code (1)		5.4
38	Subsection Code (1)		5.5
39	Continuation Record Number (1)		5.16
40 thru 43	Waypoint Description Code (4)		5.17
44	Turn Direction (1)		5.20
45 thru 47	RNP (3)	Note 4	5.211
48 thru 49	Path and Termination (2)		5.21
50	Turn Direction Valid (1)		5.22
51 thru 54	Recommended Navaid (4)		5.23
55 thru 56	ICAO Code (2)		5.14
57 thru 62	ARC Radius (6)		5.204
63 thru 66	Theta (4)		5.24
67 thru 70	Rho (4)		5.25
71 thru 74	Magnetic Course (4)		5.26
75 thru 78	Route Distance/Holding Distance or Time (4)		5.27

continued on next page

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ARINC 424 – Record Layout – SID/STAR/Approach *continued*

Contains:

- Waypoint Description Codes
  - Essential
  - Fly-over waypoint
  - Stepdown fix
  - Pathpoint
  - IAF/IF/FAF/FACF/MAPt
  - Holding fix
- Turn Direction
- Path and Termination
- Recommended Navaid
- Arc Radius
- Theta / Rho
- Magnetic Course
- Route/Holding Distance/Time
- Altitude1, Altitude 2,
- Vertical Angle

71 thru 74	Magnetic Course (4)		5.26
75 thru 78	Route Distance/Holding Distance or Time (4)		5.27
79	RECD NAV Section (1)		5.4
80	RECD NAV Subsection (1)		5.5
81	**Leg Inbound/Outbound Indicator (1)**		**5.298**
82	Reserved (Expansion) (1)		
83	Altitude Description (1)		5.29
84	ATC Indicator (1)		5.81
85 thru 89	Altitude (5)		5.30
90 thru 94	Altitude (5)		5.30
95 thru 99	Transition Altitude (5)		5.53
100 thru 102	Speed Limit (3)		5.72
103 thru 106	Vertical Angle (4)		5.70
107 thru 111	Center Fix or TAA Procedure Turn Indicator (5)		5.144 or 5.271
112	Multiple Code or TAA Sector Identifier (1)		5.130 or 5.272
113 thru 114	ICAO Code (2)	Note 3	5.14
115	Section Code (1)	Note 3	5.4
116	Subsection Code (1)	Note 3	5.5
117	GNSS/FMS Indication (1)		5.222
118	Speed Limit Description (1)		5.261
119	Route Qualifier 1 (1)	Note 2	5.7
120	Route Qualifier 2 (1)	Note 2	5.7
121 thru 123	Vertical Scale Factor (3)		5.293
124 thru 128	File Record Number (5)		5.31
129 thru 132	Cycle Date (4)		5.32

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ARINC 424 –记录格式 – SID/STAR/进近（2）

包含:

- 航路点描述代码
  - 要点
  - 飞越航路点
  - 梯级下降点
  - 路径定位点
  - IAF/IF/FAF/FACF/MAPt
  - 等待定位点
- 转弯方向
- 航径和终结点
- 推荐导航台
- 弧半径
- 距离 / 磁方位
- 磁航线角
- 航路/等待距离/时间
- 高度1, 高度2,
- 下滑角

71 thru 74	Magnetic Course (4)		5.26
75 thru 78	Route Distance/Holding Distance or Time (4)		5.27
79	RECD NAV Section (1)		5.4
80	RECD NAV Subsection (1)		5.5
81	**Leg Inbound/Outbound Indicator (1)**		**5.298**
82	Reserved (Expansion) (1)		
83	Altitude Description (1)		5.29
84	ATC Indicator (1)		5.81
85 thru 89	Altitude (5)		5.30
90 thru 94	Altitude (5)		5.30
95 thru 99	Transition Altitude (5)		5.53
100 thru 102	Speed Limit (3)		5.72
103 thru 106	Vertical Angle (4)		5.70
107 thru 111	Center Fix or TAA Procedure Turn Indicator (5)		5.144 or 5.271
112	Multiple Code or TAA Sector Identifier (1)		5.130 or 5.272
113 thru 114	ICAO Code (2)	Note 3	5.14
115	Section Code (1)	Note 3	5.4
116	Subsection Code (1)	Note 3	5.5
117	GNSS/FMS Indication (1)		5.222
118	Speed Limit Description (1)		5.261
119	Route Qualifier 1 (1)	Note 2	5.7
120	Route Qualifier 2 (1)	Note 2	5.7
121 thru 123	Vertical Scale Factor (3)		5.293
124 thru 128	File Record Number (5)		5.31
129 thru 132	Cycle Date (4)		5.32

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Agenda

ARINC 424

- History & Purpose
- File Structure and Record Layout
- **Path Terminator**
- Route Types
- Coding Demonstration: *airport ID procedure ID tbd*

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议题

ARINC 424

- 历史 & 目的
- 文件结构与记录格式
- 航径终结码
- 航路类型
- 编码演示: *机场和程序待定*

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ARINC 424 - The Path and Terminator Concept

Quotes from ARINC 424:

- The **Path and Terminator concept** is a means to **permit coding of Terminal Area Procedures (**SID, STAR and Approach Procedures) without proliferating the number of named waypoints required to support such procedures.
- The Path and Terminator concept **includes a set of defined codes** referred to as **Path Terminators**.
- Each Code defines a **specific type of flight path** and a **specific type of termination** of that flight path.
- Path Terminators are assigned to all SID, STAR and Approach Procedure segments.

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ARINC 424 –航径和终结码概念

引自 ARINC 424:

- 引入航径和终结码概念的目的，是在不增加支持程序运行所需要命名的航路点的个数的情况下，可以实现对终端区程序（ SID, STAR 和进近程序）的编码。
- 航径和终结码的概念包含一系列具有一定意义的代码，它们被称为航径终结码
- 每一种代码代表了一种特定的飞行航径，该航径对应一个特定的终结类型。

- 航径终结码可用于所有的SID , STAR 和进近程序中的航段。

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ARINC 424 - The Path and Terminator Concept

- In order **to achieve these coding rule goals**, and to ultimately **simplify the path terminator matrix** currently required to define present-day terminal area procedures, it is in the interest of all user airlines to **prevail upon their government agencies and ATC authorities** to:

- Permit FMS-equipped airplanes to **fly tracks instead of procedural headings** and,

- **Design Terminal area procedures** to be compatible with the capabilities of the increasing number of **FMS-equipped airplanes** entering service.

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ARINC 424 -航径和终结码概念

- 为了实现满足ARINC424编码规则的目标，简化当前需要定义的终端区程序航径终结码矩阵，出于对航空公司利益的考虑，期望说服航空公司所在国政府代理机构和ATC当局，同意如下建议：
- 允许装有FMS的飞机按航迹飞行，而不是按程序航向飞行，且
- 设计终端区程序以适用于数量增长的加装有FMS的航空器。

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Why “Path” and “Terminator”?

- ***Path*** **- How do you get there - (Heading, Course, etc.)**
- ***Terminator*** **- The event or condition that causes leg sequencing**

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ARINC 424 -航径和终结码概念

为何使用“航径”和“终结”？

- 航径-如何到达目的地-（航向、航线角，等）
- 终结码-航段顺序连接的方式或条件

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Path / Terminator

1st letter – Path

I = Initial
C = Course or track
F = Course from a fix
H = Hold
D = Direct
P = Procedure turn
T = Track
A = Arc
R = Radius
V = Heading

2nd letter – Terminator

A = Altitude
D = DME distance
I = Intercept (next leg)
R = Radial
F = To fix / at fix
M = Manual Termination
C = Distance from fix

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航径 / 终结码

第一个字母 – 航径

I = 起始
C = 沿航线角或航迹至
F = 从定位点开始的航线角
H = 等待
D = 直飞
P = 程序转弯
T = 沿航迹至
A = 沿弧飞行
R = 沿固定半径转弯至
V = 保持航向至

第二个字母 – 终结码

A =高度
D = DME 距离
I = 切入 (下一航段)
R = 径向线
F = 至定位点 / 在定位点
M = 人工终结
C = 离定位点距离

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Course Legs

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保持航线角航段

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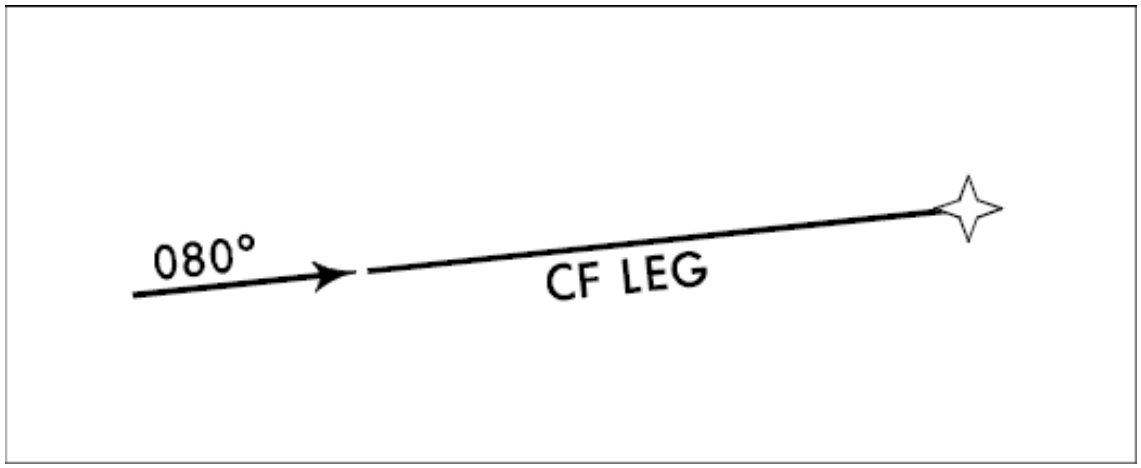
CF - Leg

- ICAO RNAV leg
- RNP leg

Course to a Fix



Path: Course 080°
Terminator: A database fix (either fly-by or fly-over)

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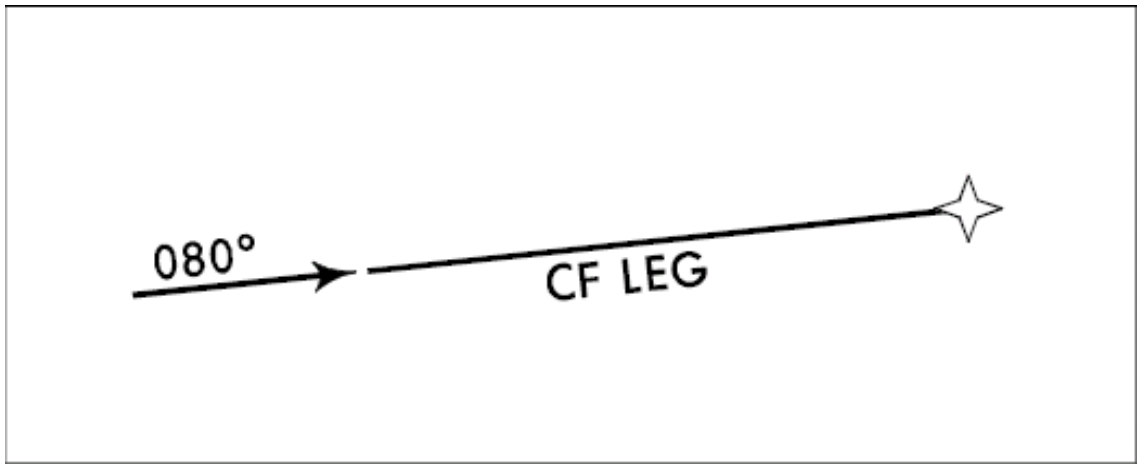
CF 航段

- ICAO RNAV航段
- RNP 航段

保持航线角至定位点（CF）



航径: 航线角 **080°**
终点: 一个数据库定位点 **(**飞越或旁切**)**

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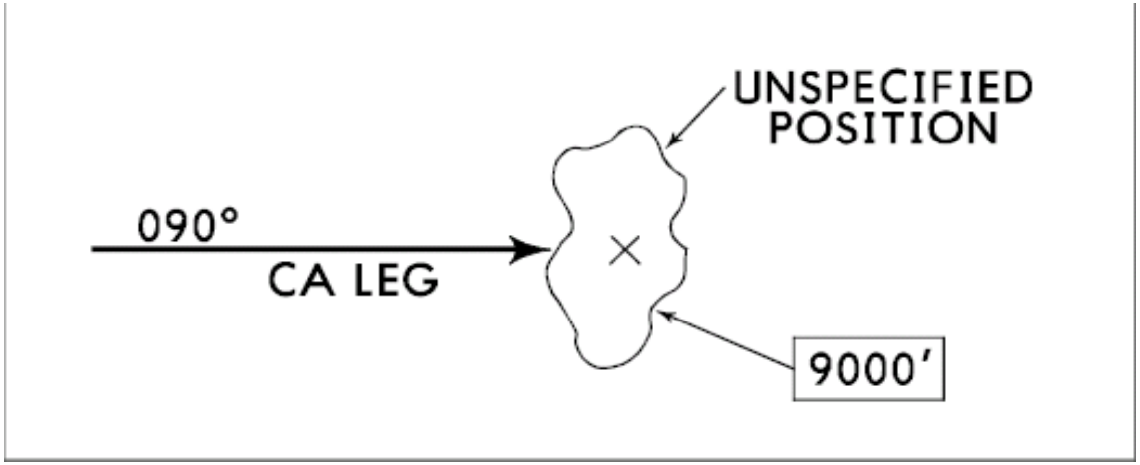
CA - Leg

- ICAO RNAV leg

Course to an Altitude



Path: **Course 090°**
Terminator: **9'000 feet**

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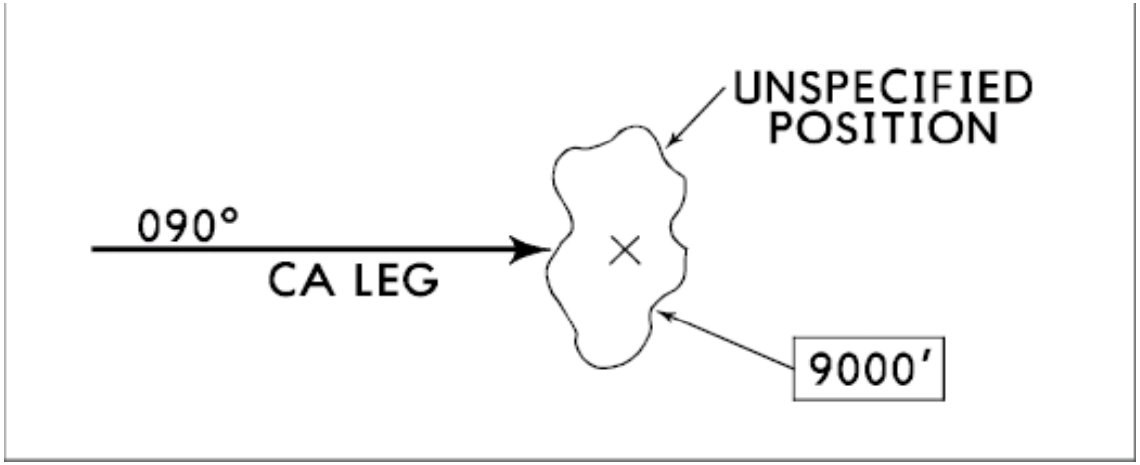
ICAO RNAV 航段

保持航线角至某高度（CA）



航径: 航线角 **090°**

终点: **9'000** 英尺

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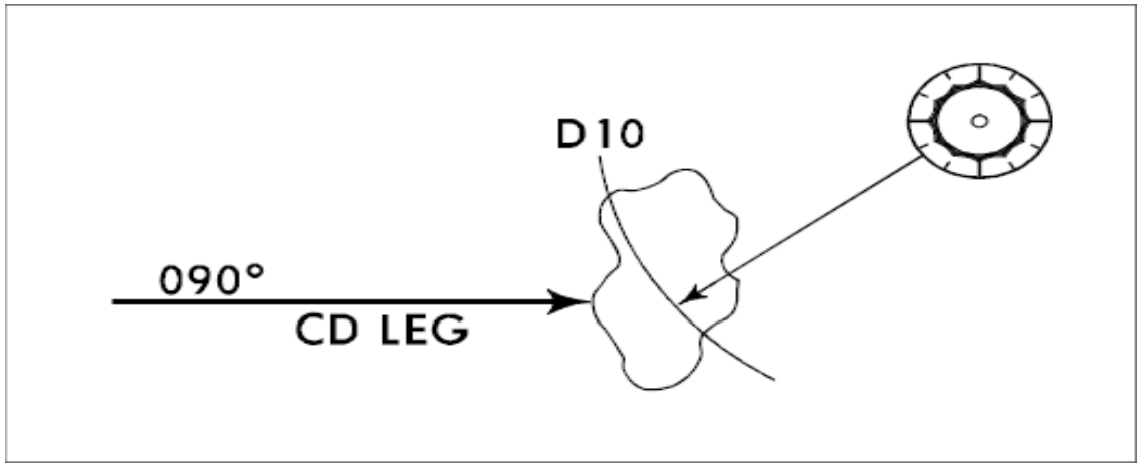
Course to a DME Distance



Path: **Course 090°**
Terminator: **10 DME (end is fly-over)**

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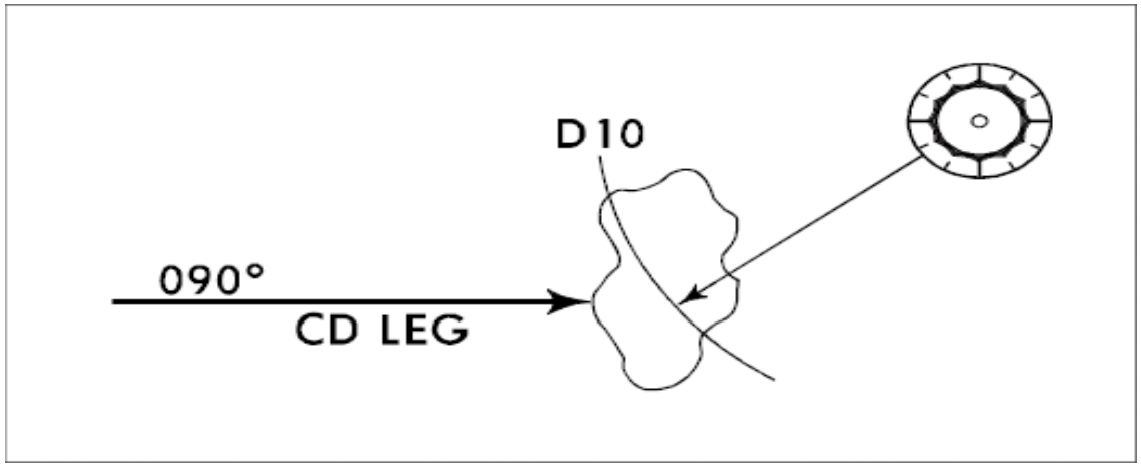
保持航线角至某 DME距离（CD）



航径: 航线角 **090°**

终点: **DME 10NM处 (终点为飞越)**

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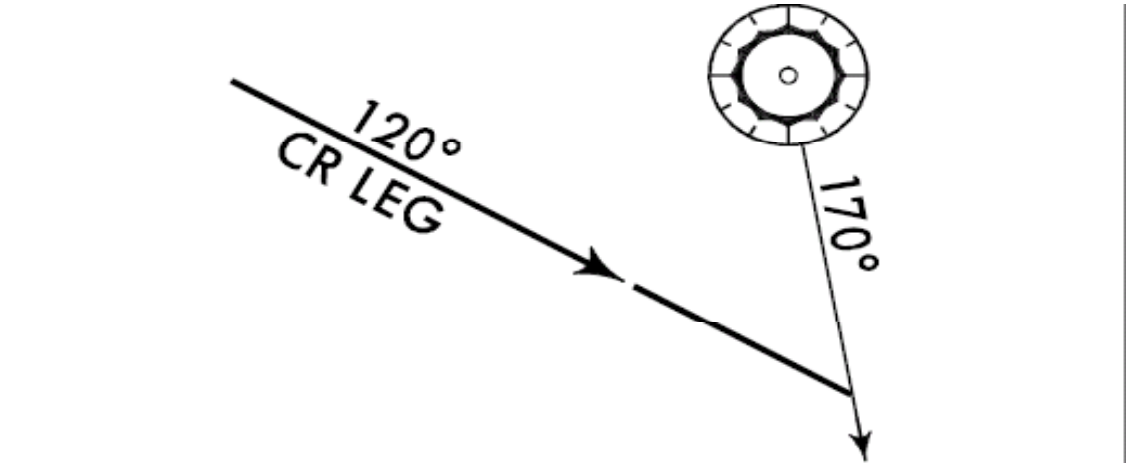
Course to a Radial Termination



Path: **Course 090°**
Terminator: **Crossing the VOR R170°**
(end is fly-over)

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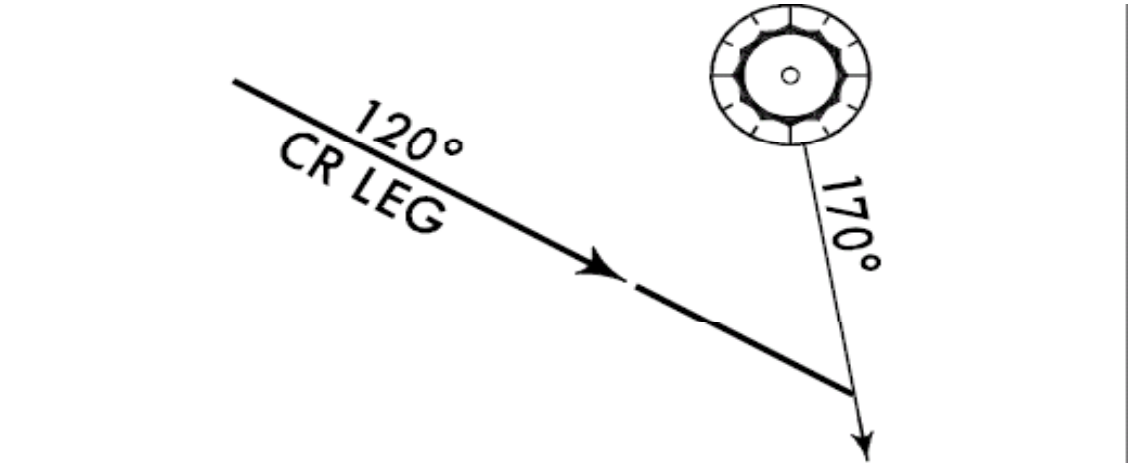
保持航线角至某径向线（CR）

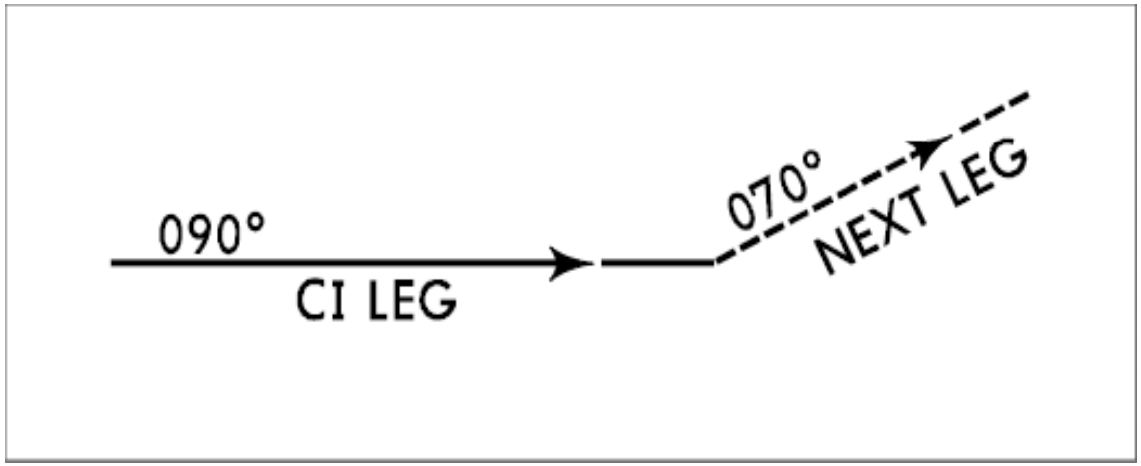


航径: 航线角 **090°**

终点: 与 **VOR R170°** 径向线相交 **(交点为飞越)**

Lufthansa Systems
IT that makes your life easier

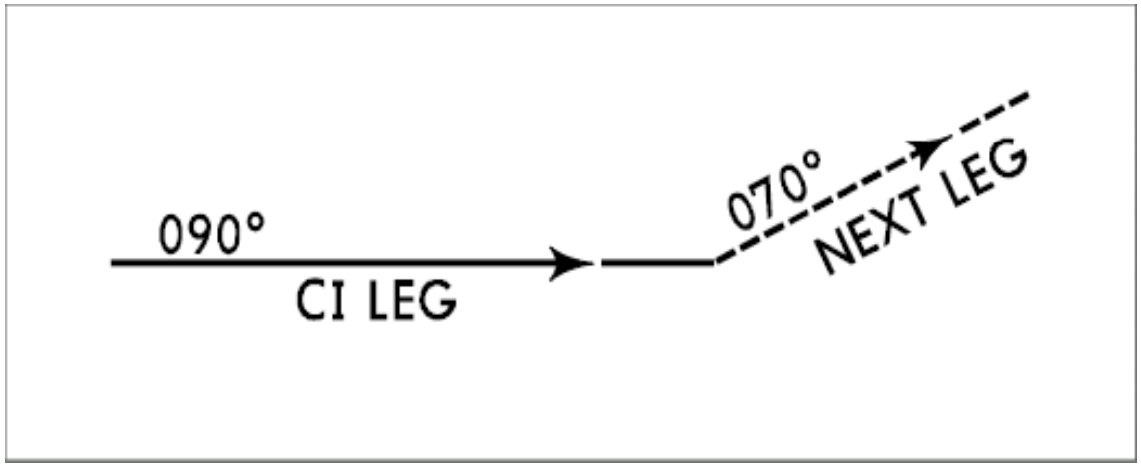
Course to a next-leg Intercept



Path: **Course 090°**
Terminator: **Intercept of the 070° course to the next fix**

Lufthansa Systems
IT that makes your life easier

保持航线角切入下一航段（CI）



航径: 航线角 **090°**
终点: 切入航线角为**070°** 的下一航段

Lufthansa Systems
IT that makes your life easier

Track Leg

Lufthansa Systems
IT that makes your life easier

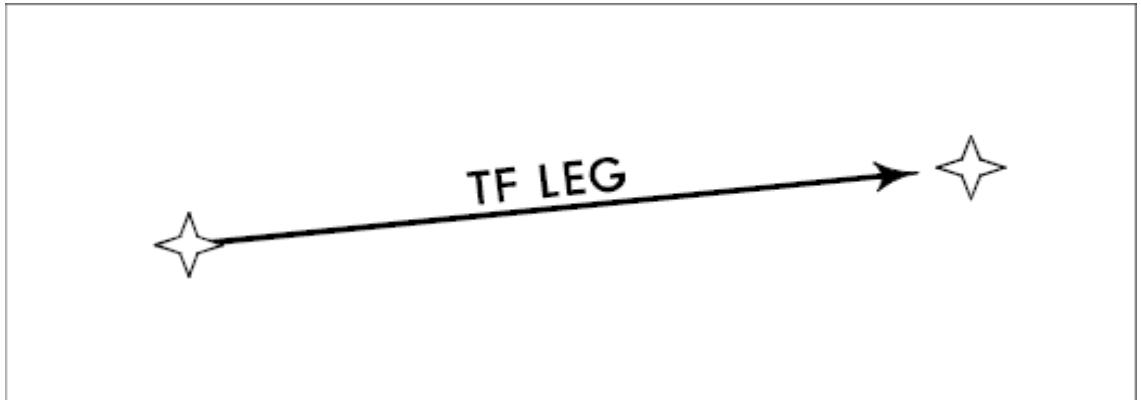
保持航迹航段

Lufthansa Systems
IT that makes your life easier

TF - Leg

- ICAO RNAV leg
- RNP leg

Track to a Fix



Path: Great Circle track between two database fixes

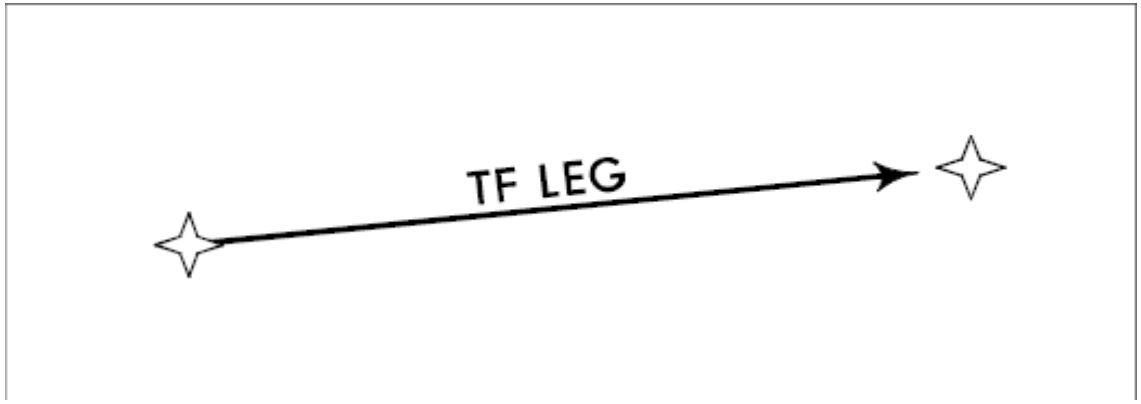
Terminator: The “to” database fix (either fly-by or fly-over)

Lufthansa Systems
IT that makes your life easier

TF 航段

- ICAO RNAV航段
- RNP 航段

保持航迹至某定位点（TF）



航径: 数据库中两定位点之间的大圆航迹
终点: 数据库中要“飞向”的定位点 (飞越或旁切)

Lufthansa Systems
IT that makes your life easier

Initial Fix

Lufthansa Systems
IT that makes your life easier

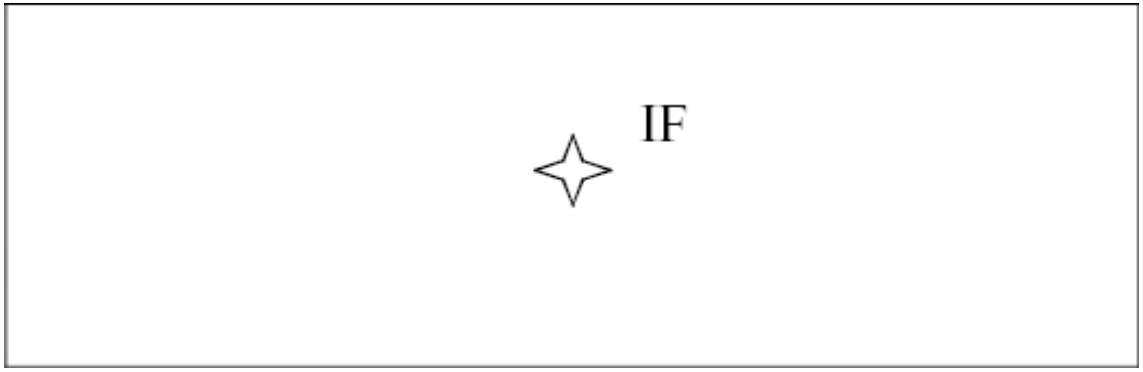
起始定位点

Lufthansa Systems
IT that makes your life easier

IF - Leg

- ICAO RNAV leg
- RNP leg

Initial Fix



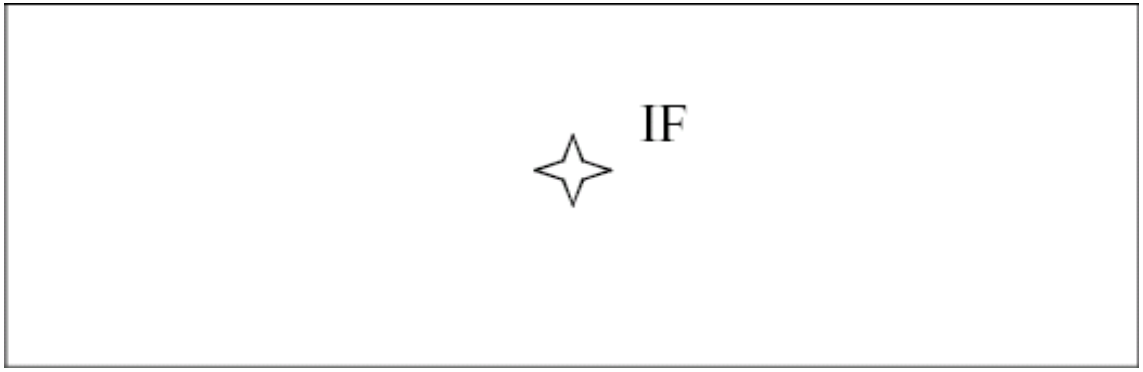
No real Path or Terminator.
The Initial Fix begins the series of records for a Procedure (APCH, SID, STAR)

Lufthansa Systems
IT that makes your life easier

IF 航段

- ICAO RNAV 航段
- RNP 航段

起始定位点（IF）



没有实际的航径或终点
起始定位点是一系列程序（**APCH, SID, STAR**）的起点

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Direct Leg

Lufthansa Systems
IT that makes your life easier

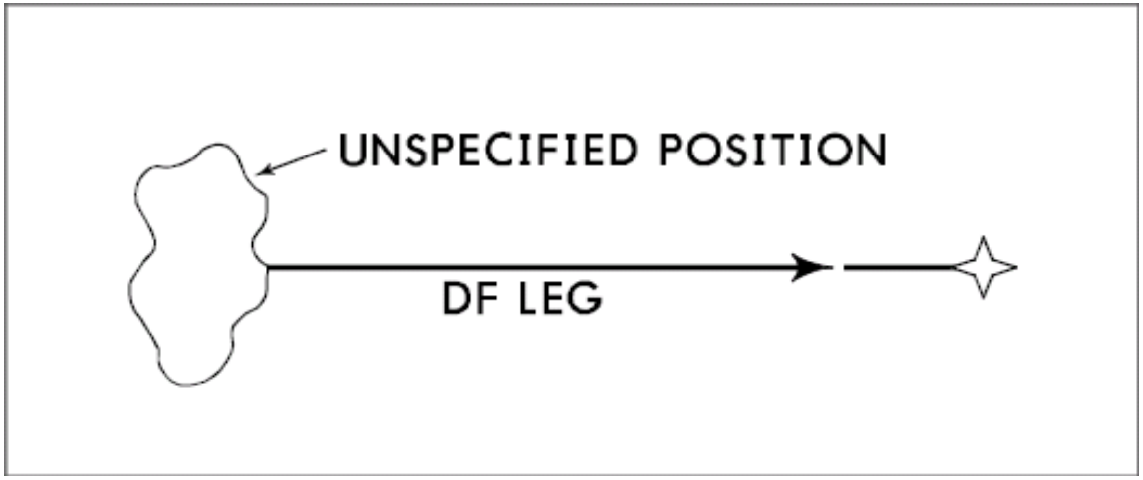
直飞航段

Lufthansa Systems
IT that makes your life easier

DF - Leg

- ICAO RNAV leg
- RNP leg

Direct to a Fix



Path: Great Circle Course from the present position to the “to” database fix

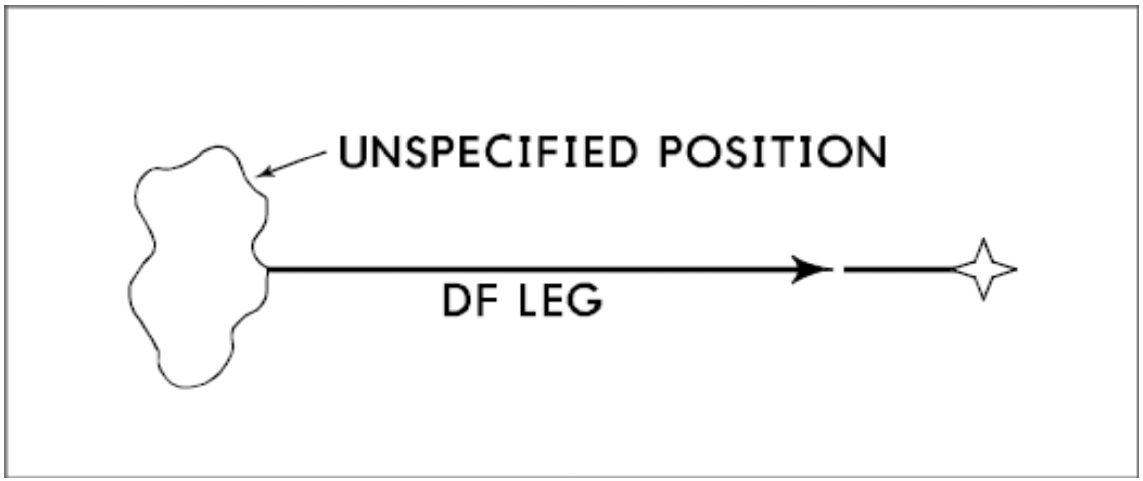
Terminator: The “to” database fix (either fly-by or fly-over)

Lufthansa Systems
IT that makes your life easier

DF 航段

- ICAO RNAV 航段
- RNP 航段

直飞某定位点（DF）



航径: 从当前位置“飞向”数据库中下一定位点的大圆航线
终点: 数据库中要“飞向”的定位点 (飞越或旁切)

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“Fix to” Legs
(from a fix to..)

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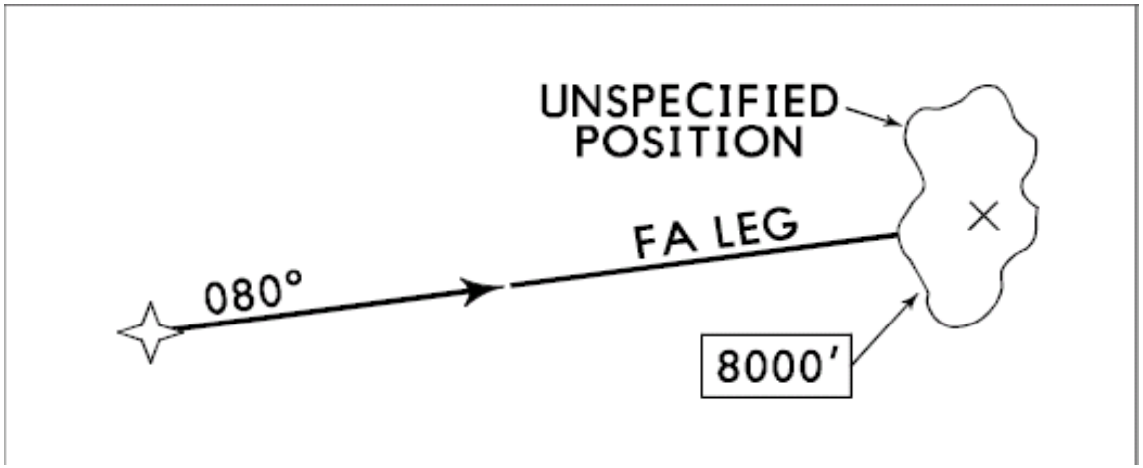
“定位点至” 航段 (从某定位点至..)

Lufthansa Systems
IT that makes your life easier

FA - Leg

- ICAO RNAV leg
- RNP leg

Course from a Fix to an Altitude



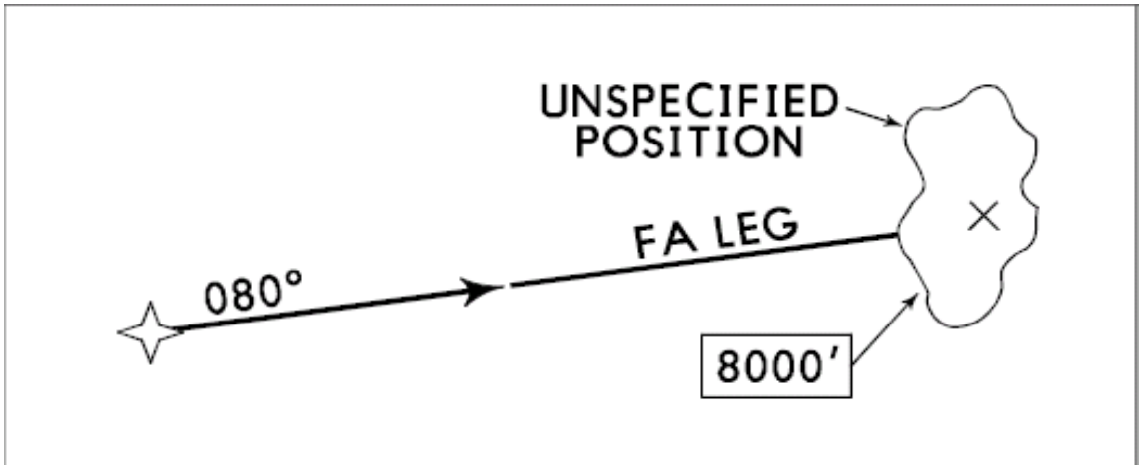
Path: Course 080° from the fix
Terminator: 8'000 feet (default leg for most SIDs)

Lufthansa Systems
IT that makes your life easier

FA 航段

- ICAO RNAV航段
- RNP 航段

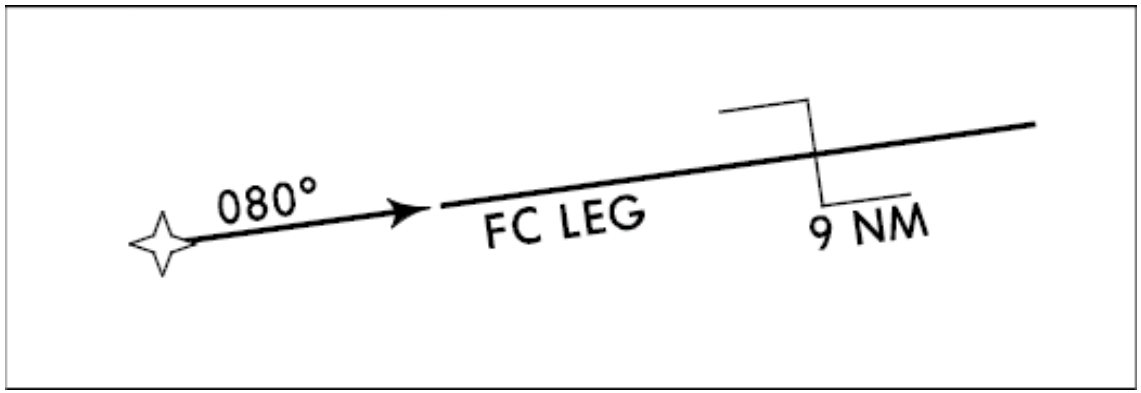
从某定位点保持航线角至某高度（FA）



航径: 从定位点保持航线角 **080°**
终点: **8’000英尺处 (多数SID程序默认航段)**

Lufthansa Systems
IT that makes your life easier

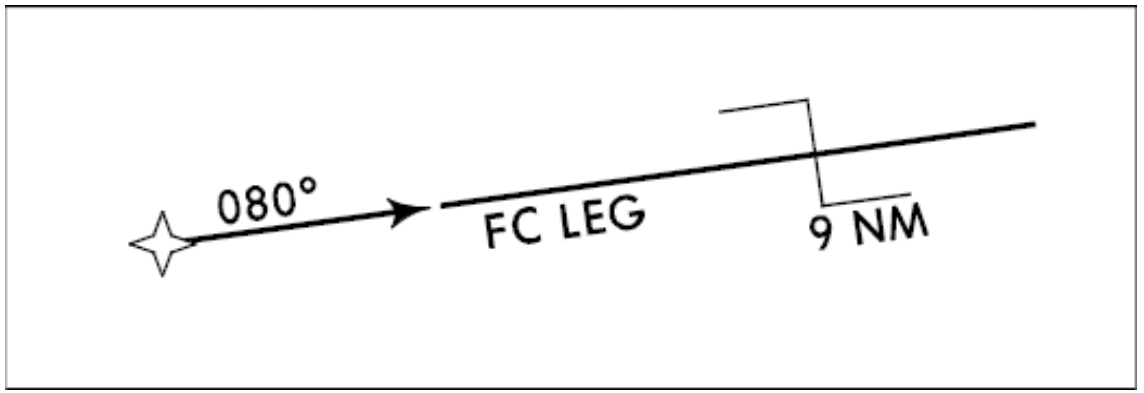
From a Fix on a Course to a distance



Path: **Course 080° from the fix**
Terminator: **9.0 NM outbound from the fix (not a DME Distance!)**

Lufthansa Systems
IT that makes your life easier

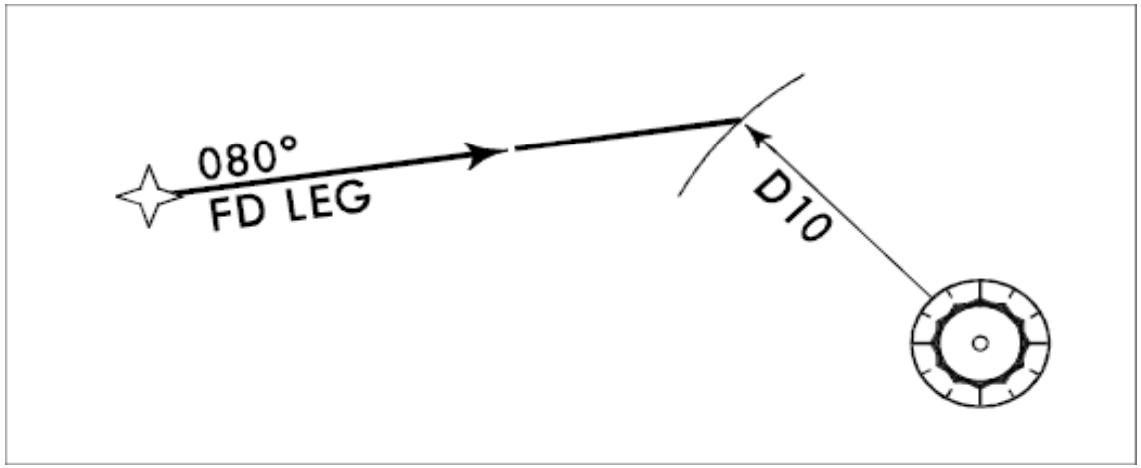
从某航线角上的某定位点至一距离点（FC）



航径: 从某定位点沿**080°** 航线角
终点: 沿出航边距定位点**9.0 NM**处 **(**不是 **DME** 距离**!)**

Lufthansa Systems
IT that makes your life easier

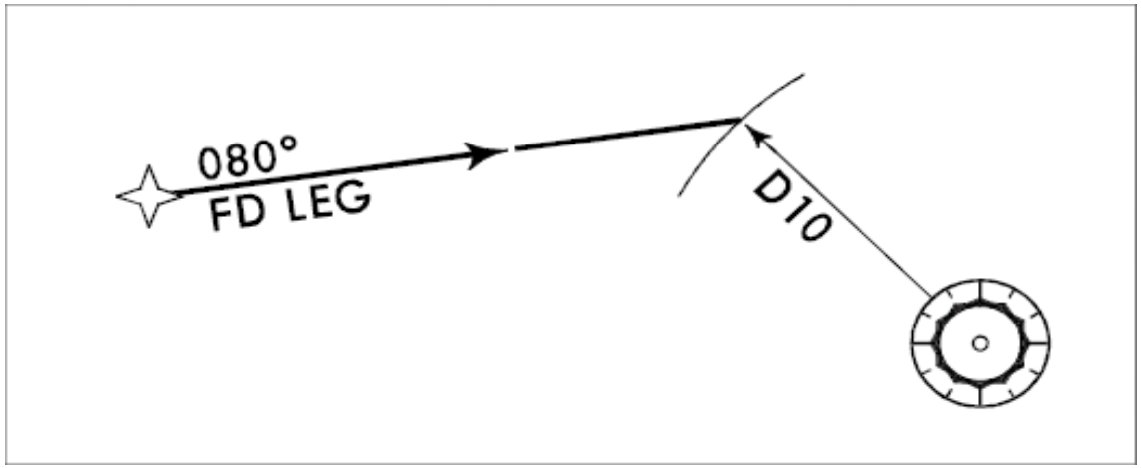
Course from a Fix to a DME Distance



Path: **Course 080° from the fix**
Terminator: **10 DME (end is fly-over)**

Lufthansa Systems
IT that makes your life easier

从某定位点保持航线角至某DME距离（FD）



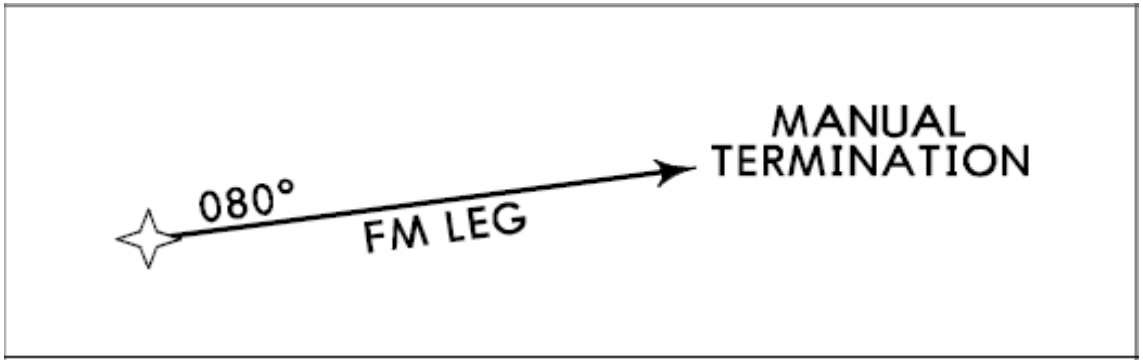
航径: 从定位点保持航线角**080°**

终点: **DME 10NM处 (末端为飞越)**

Lufthansa Systems
IT that makes your life easier

ICAO RNAV leg

Course from a Fix to a Manual Termination

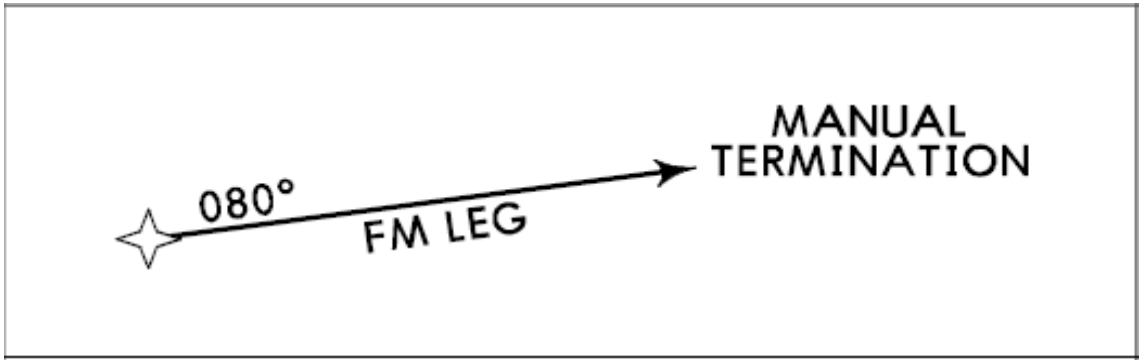


Path: **Course 080° from the fix**
Terminator: **Manual Termination**

Lufthansa Systems
IT that makes your life easier

ICAO RNAV 航段

从某定位点保持航线角至人工终点（FM）



航径: 从定位点保持航线角 **080°**
终点: 人工终点

Lufthansa Systems
IT that makes your life easier

ARC Legs

Lufthansa Systems
IT that makes your life easier

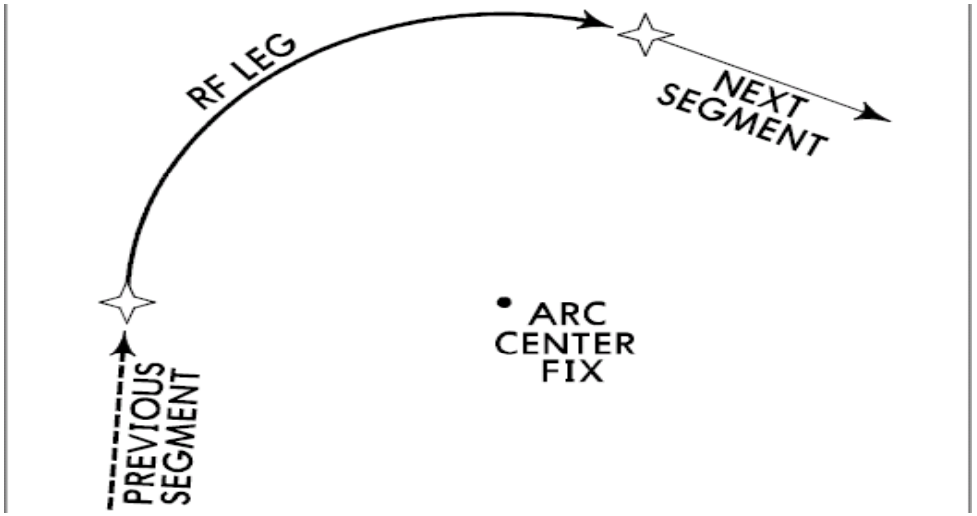
弧线航段

Lufthansa Systems
IT that makes your life easier

RF - Leg

- ICAO RNAV leg
- RNP leg

Constant Radius to a Fix



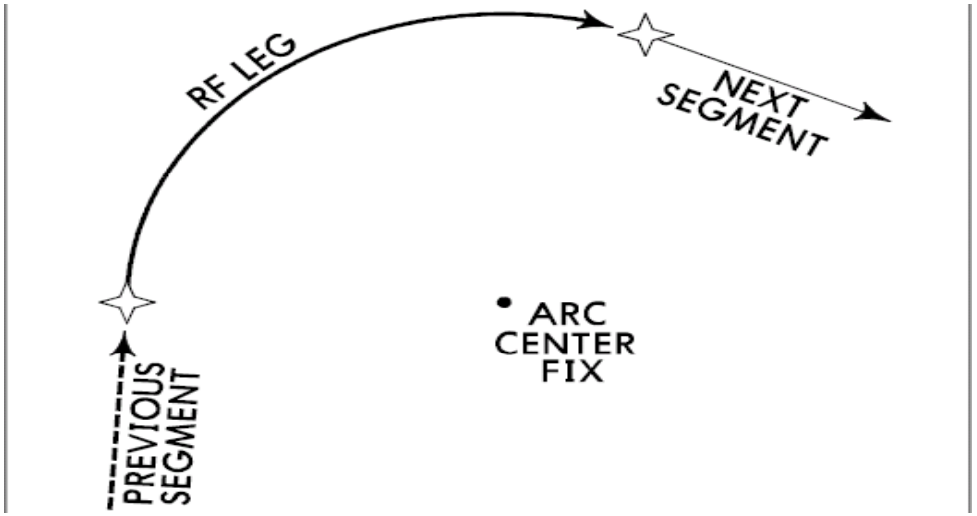
Path: Constant Radius Turn between two fixes

Terminator: The “to” database fix

Lufthansa Systems
IT that makes your life easier

- ICAO RNAV 航段
- RNP 航段

固定半径转弯至定位点（RF）



航径: 两定位点之间固定半径转弯
终点: 数据库中要“飞向”的定位点

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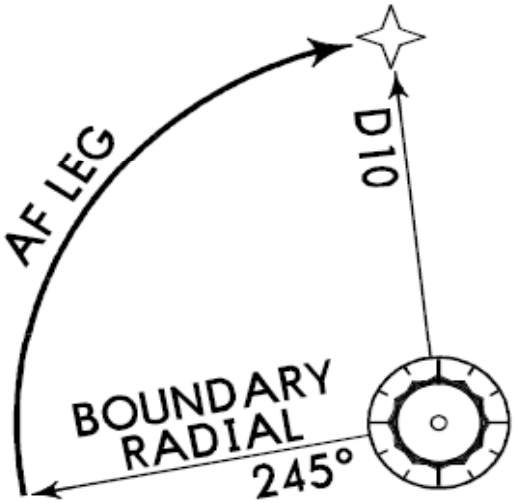
Constant DME Arc to a Fix

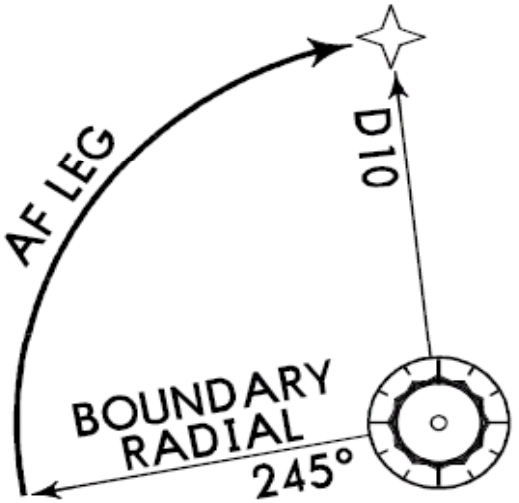


Path: **DME 10 ARC (must be a co-located VOR/DME or VORTAC**

Terminator: **The “to” database fix**

Lufthansa Systems
IT that makes your life easier

固定 DME 弧至定位点（AF）



航径: **DME 10NM弧（必须由合装的VOR/DME 或 VORTAC提供）**

终点: 到数据库中一定位点

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IT that makes your life easier

Hold Legs

Lufthansa Systems
IT that makes your life easier

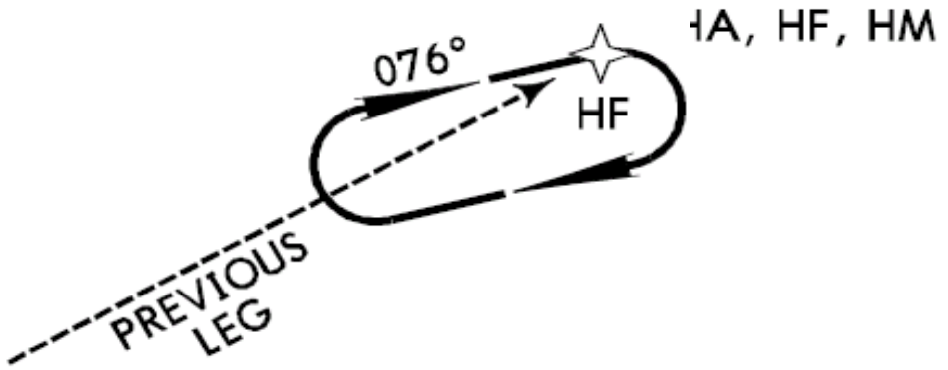
等待航段

Lufthansa Systems
IT that makes your life easier

HF - Leg

- ICAO RNAV leg
- RNP leg

Hold at a Fix



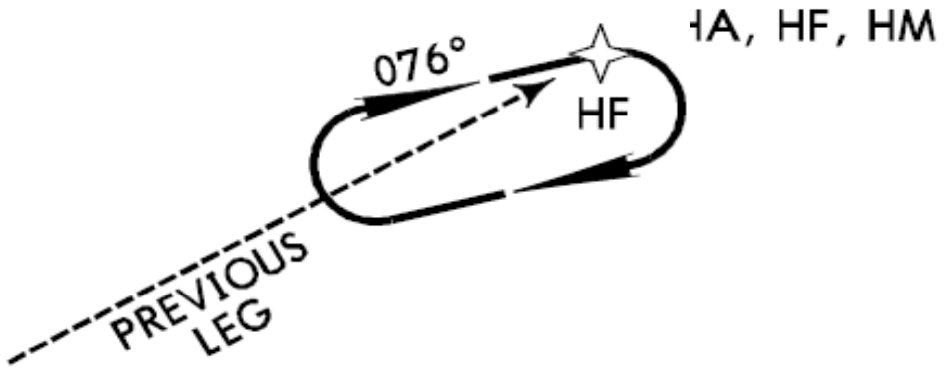
Path: 076° Inbound Course to the "to" fix

Terminator: 2nd fix crossing (one full circuit in the hold)

Lufthansa Systems
IT that makes your life easier

- ICAO RNAV 航段
- RNP 航段

在某定位点等待（HF）



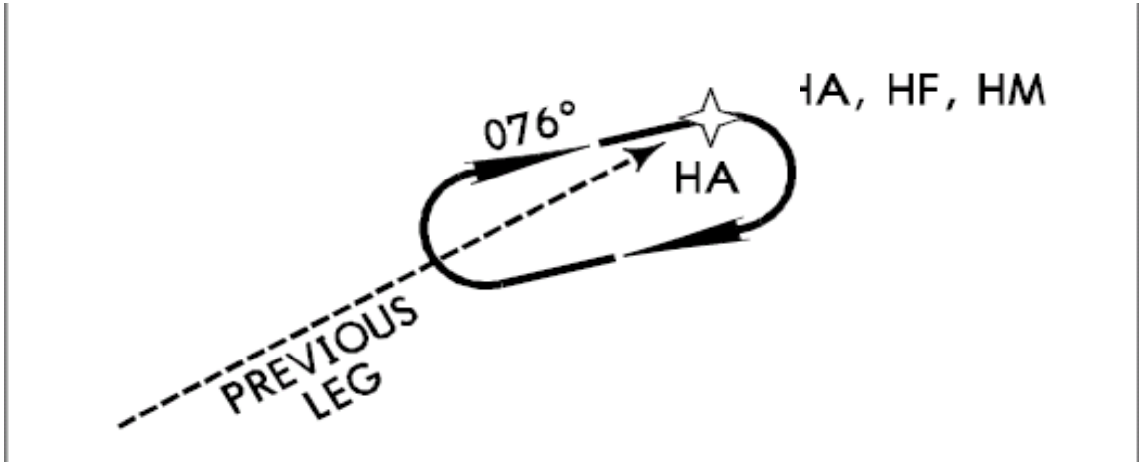
航径: 按**076°** 的入航航迹飞往定位点
终点: 二次过该定位点 **(**完成一次完整等待**)**

Lufthansa Systems
IT that makes your life easier

HA - Leg

- ICAO RNAV leg
- RNP leg

Hold at a Fix to an Altitude



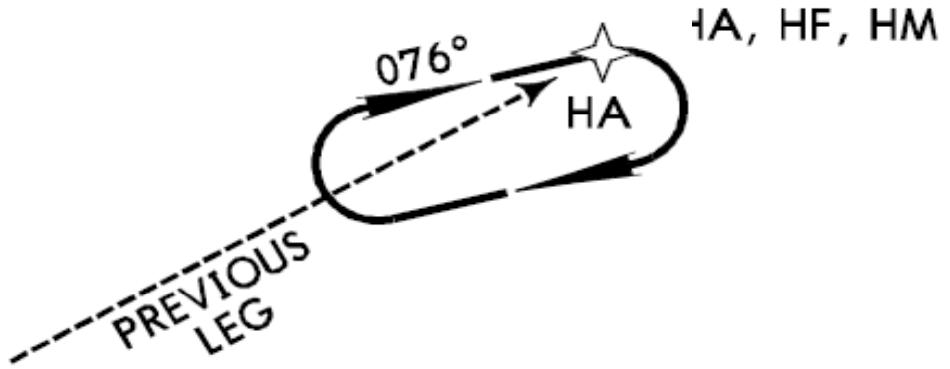
Path: **076° Inbound Course to the "to" fix**

Terminator: **Terminating Altitude (… climb in Hold to ….)**

Lufthansa Systems
IT that makes your life easier

- ICAO RNAV 航段
- RNP 航段

在某定位点等待爬升至另一高度（HA）



航径: 按**076°**入航航迹飞向定位点

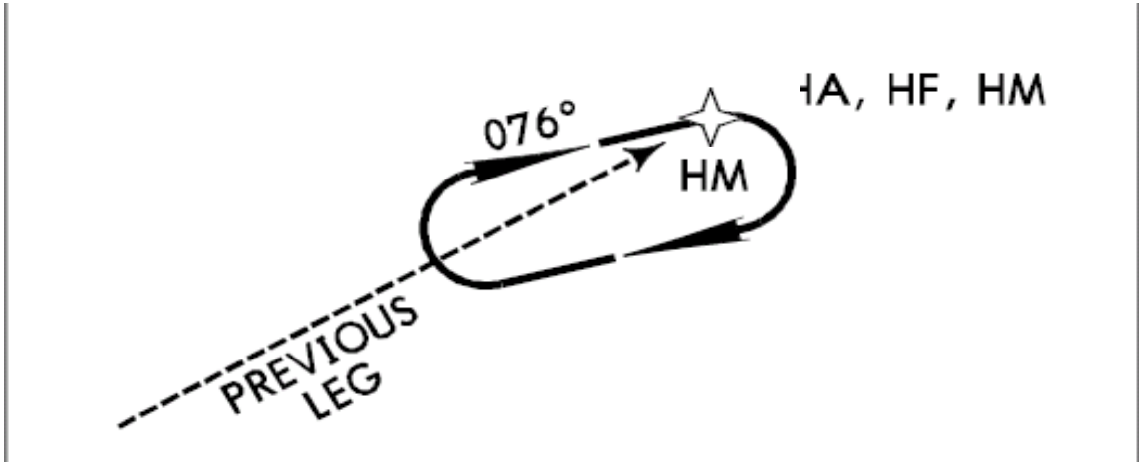
终点: 终止高度
(... 等待爬升至 ....)

Lufthansa Systems
IT that makes your life easier

HM - Leg

- ICAO RNAV leg
- RNP leg

Hold at a Fix to a Manual Termination



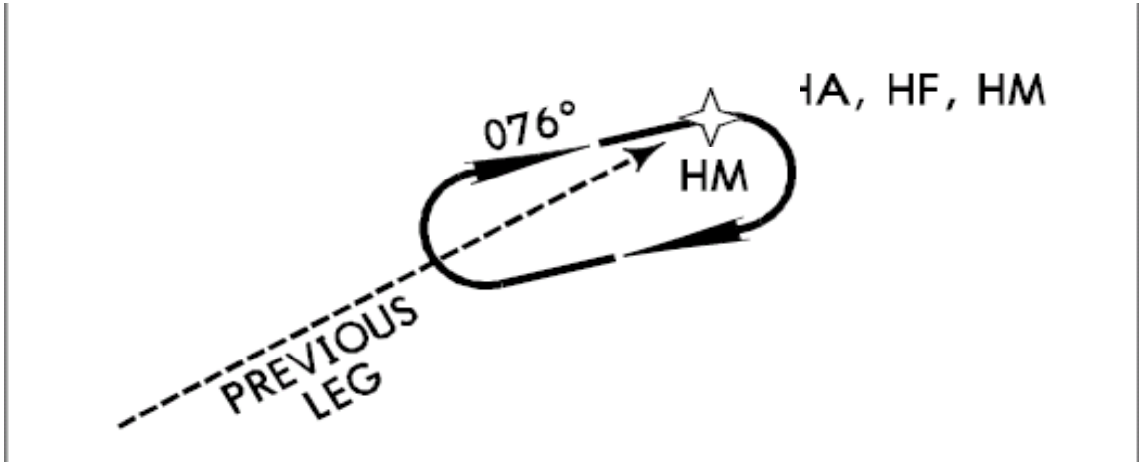
Path: **076° Inbound Course to the "to" fix**

Terminator: **Manual Termination**

Lufthansa Systems
IT that makes your life easier

- ICAO RNAV 航段
- RNP 航段

某定位点等待至人工终止（HM）



航径: 按**076°**的入航航迹飞向定位点

终结: 人工终止

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Procedure Turn Leg

Lufthansa Systems
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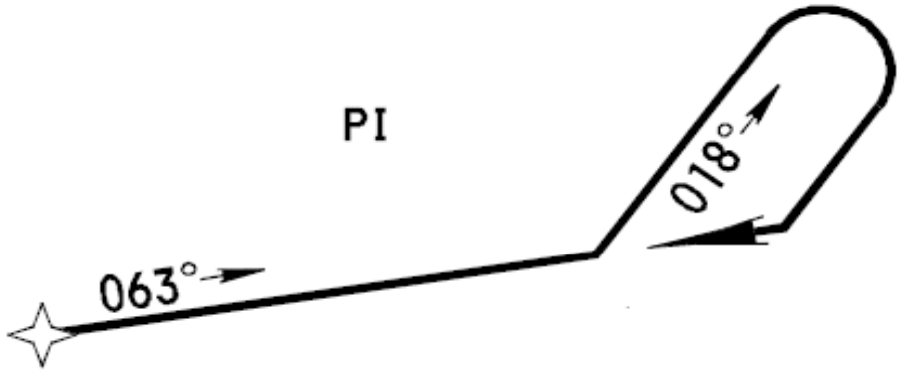
程序转弯航段

Lufthansa Systems
IT that makes your life easier

PI - Leg

Procedure Turn to an Intercept



Path: **Outbound (063°) leg from the fix, a 045° Procedure Turn (018°) and a left or right 180° turn to the next leg**

Terminator: **1st = Intercept / 2nd max. Excursion Time or Distance**

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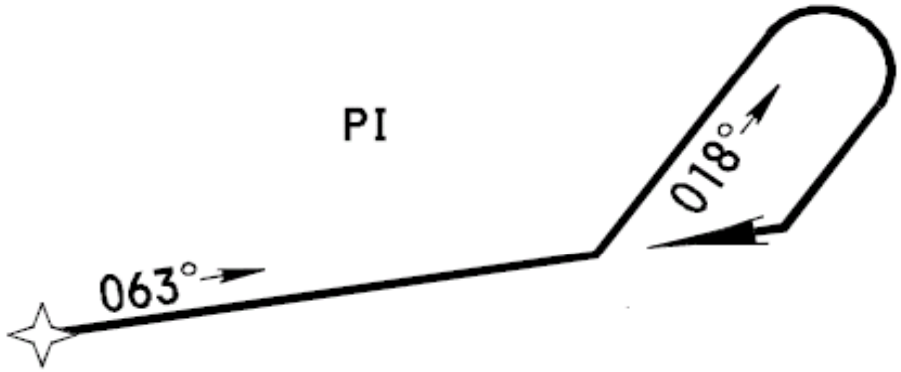
程序转弯至切入下一航段（PI）



航径: 从定位点出发沿出航航迹 **(063°)** 飞行, 接 **045°** 左（或右）转弯 **(018°)**，然后右（或左）转 **180°** 转弯切下一航段

终点: **180°** 转弯结束位置。出航航迹（**063°**）及偏置航迹（**018°**）长度，用时间或距离确定（*注：参考**ARINC424**第**18**版定义*）

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Heading Legs

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按航向飞行航段

Lufthansa Systems
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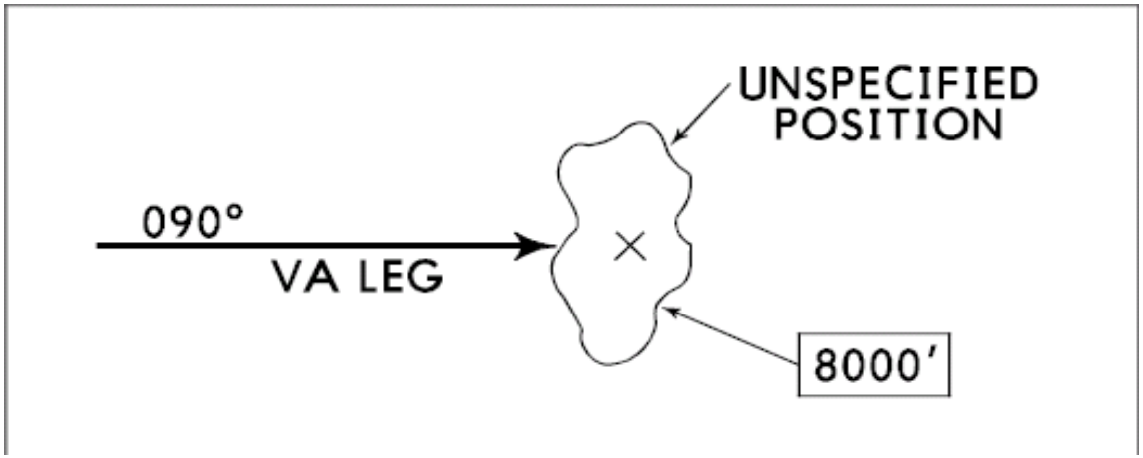
VA - Leg

- ICAO RNAV leg

Heading to an Altitude



Path: **Heading 090°**
Terminator: **8'000 feet**

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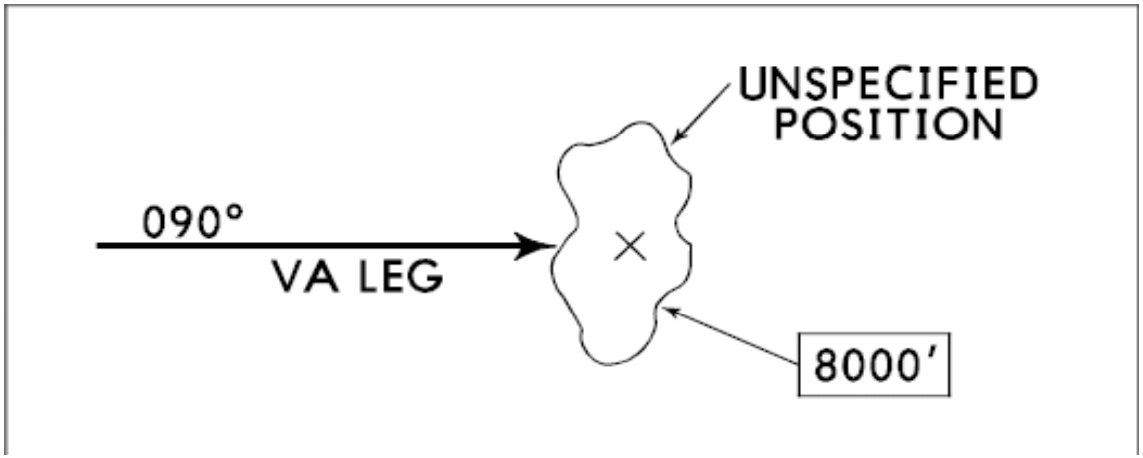
ICAO RNAV 航段

保持航向至某高度（HA）



航径: 航向 **090°**
终点: **8'000** 英尺

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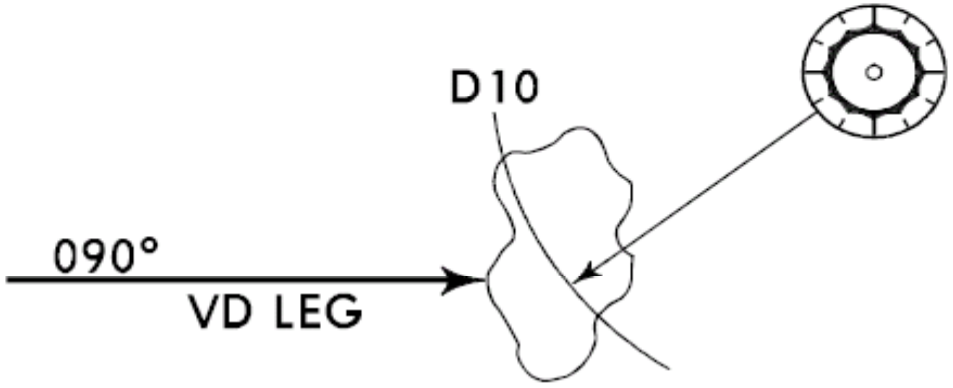
Heading to a DME Distance



Path: **Heading 090°**
Terminator: **10 DME (end is fly-over)**

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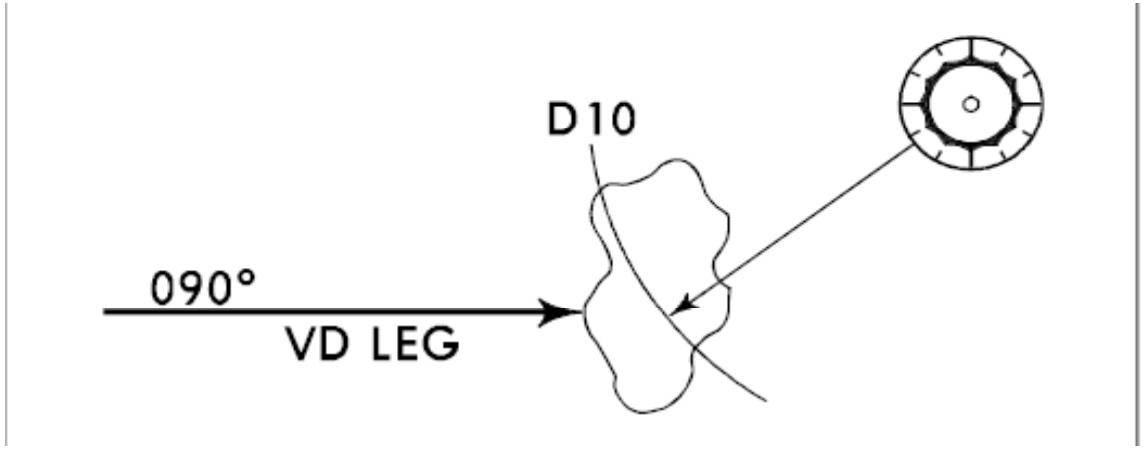
IT that makes your life easier

保持航向至某DME距离（HD）



航径: 航向 **090°**
终点: **DME 10NM处 (终点为飞越)**

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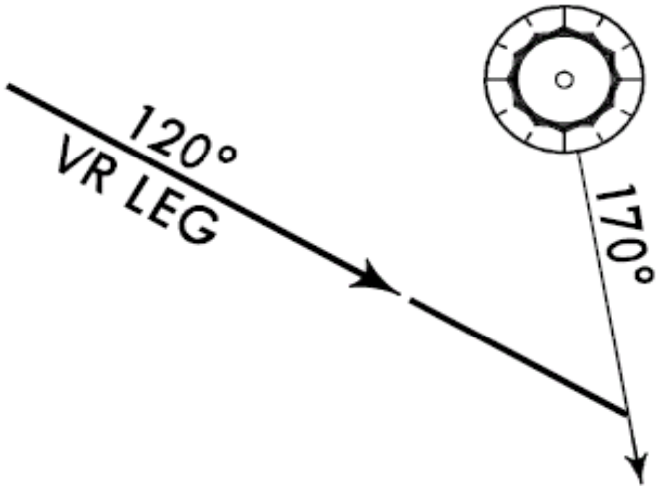
Heading to a Radial Termination



Path: Heading 120°
Terminator: Crossing the VOR R170°
(end is fly-over)

Lufthansa Systems
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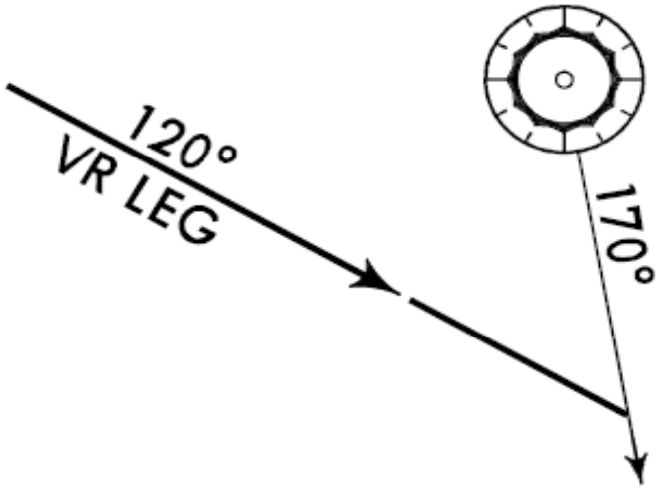
保持航向至某径向线（HR）



航径: 航向**120°**
终点: 与**VOR 170°** 径向线交叉点
(终点为飞越)

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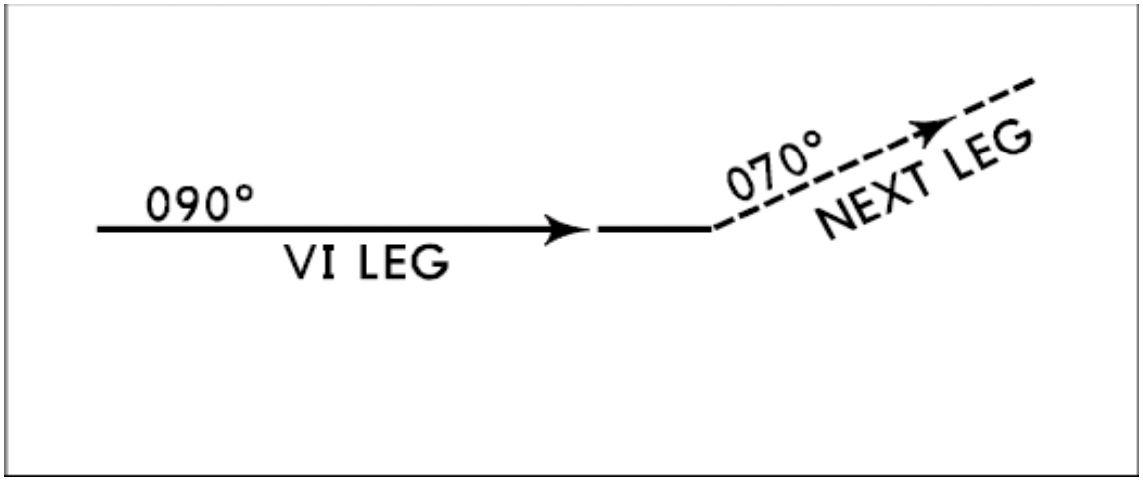
ICAO RNAV leg

Heading to a next-leg Intercept



Path: Heading 090°
Terminator: Intercept of the 070° course to the next fix

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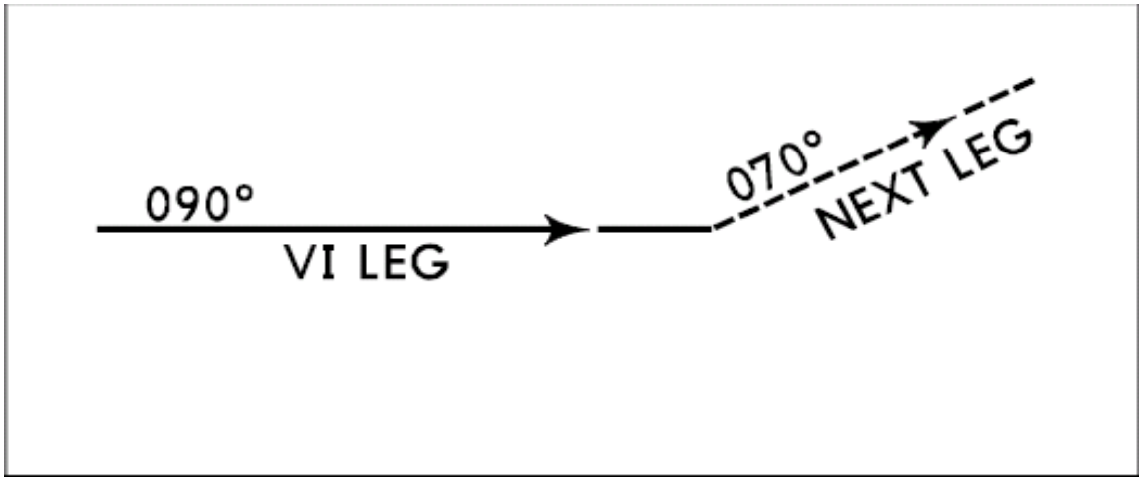
ICAO RNAV 航段

保持航向至切入下一航段（HI）



航径: 航向**090°**

终点: 切入航线角为 **070°** 的下一航段至下一定位点

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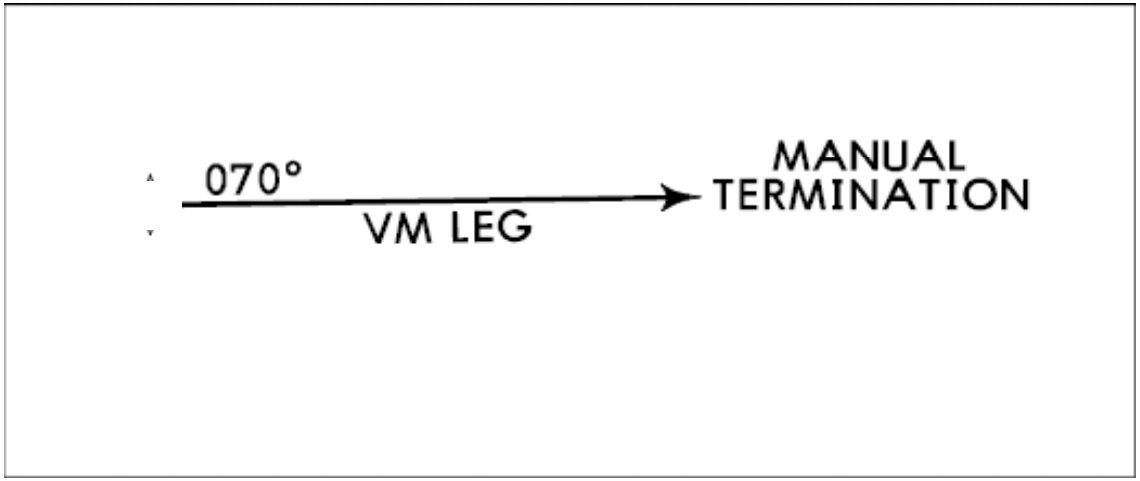
ICAO RNAV leg

Heading to a Manual Termination



Path: **Heading 070°**
Terminator: **Manual Termination**

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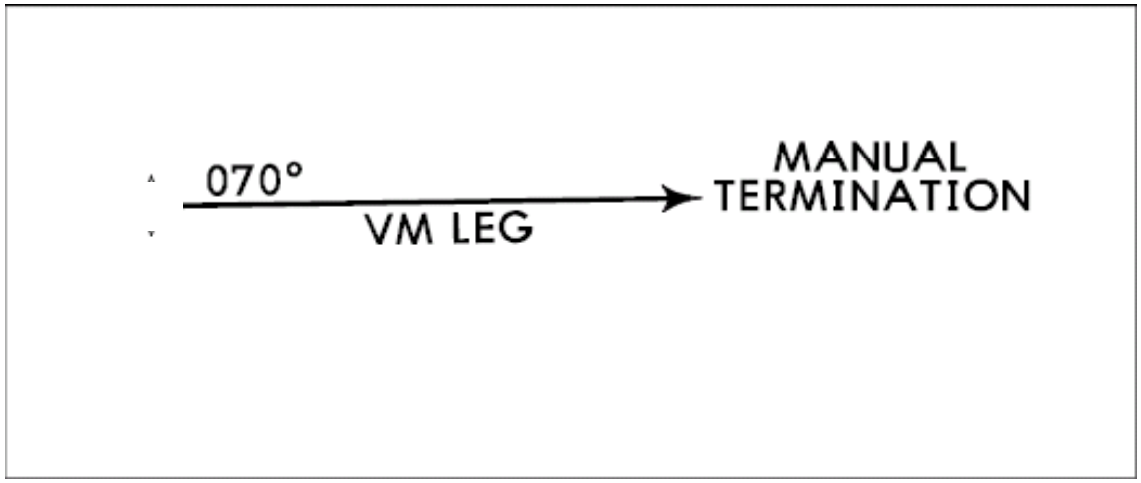
ICAO RNAV 航段

保持航向至人工终点（HM）



航径: 航向 **070°**
终点: 人工终止

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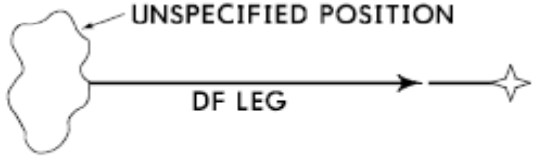
Summary
Path Terminators “To Fixes”

Leg Code	Example Path
IF	
TF	
CF	
DF	

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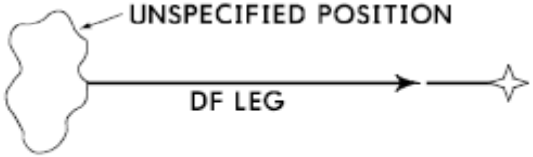
总结
航径终结码“至定位点”

Leg Code	Example Path
IF	
TF	
CF	
DF	

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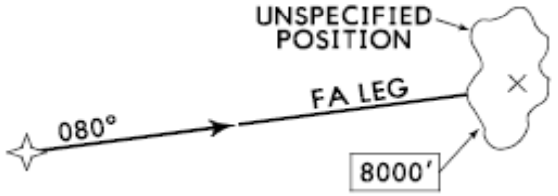
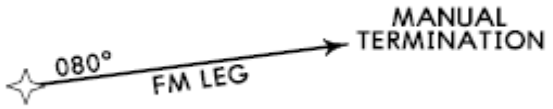
Summary:
Path Terminators “From Fixes”

Leg Code	Example Path
FA	
FC	
FD	
FM	

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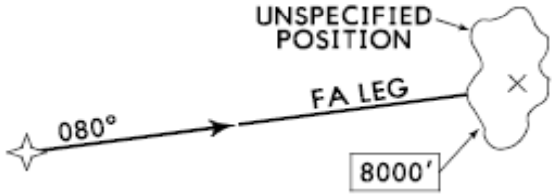
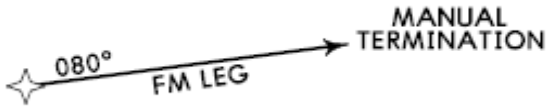
总结:
航径终结码 “从定位点”

Leg Code	Example Path
FA	
FC	
FD	
FM	

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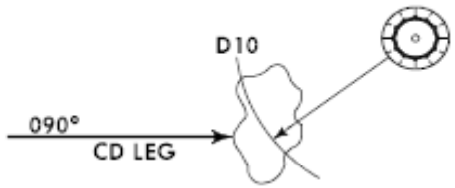
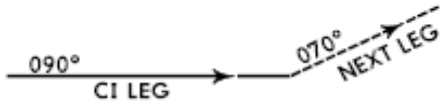
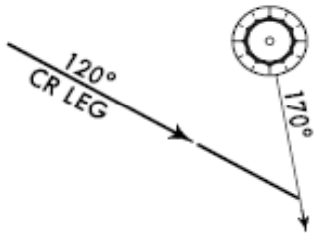
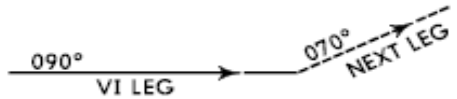
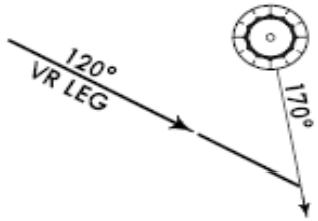
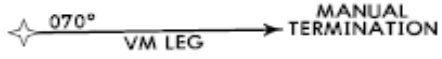
Summary: Path Terminators "Courses & Headings"

Leg Code	Example Path
CA	
CD	
CI	
CR	

Leg Code	Example Path
VA	
VD	
VI	
VR	
VM	

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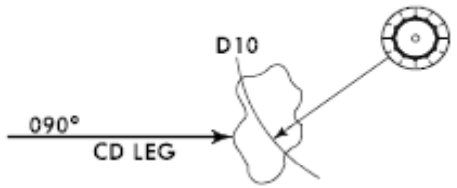
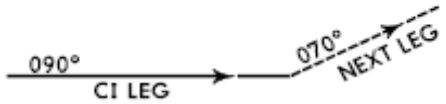
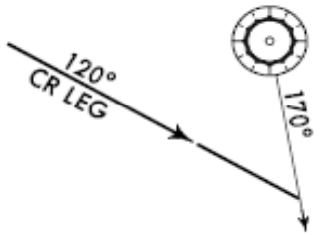
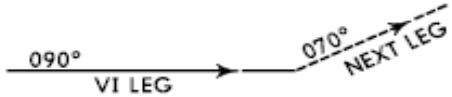
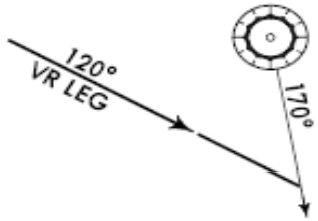
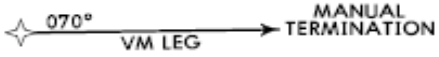
总结: 航径终结码
“航线角 & 航向”

Leg Code	Example Path
CA	
CD	
CI	
CR	

Leg Code	Example Path
VA	
VD	
VI	
VR	
VM	

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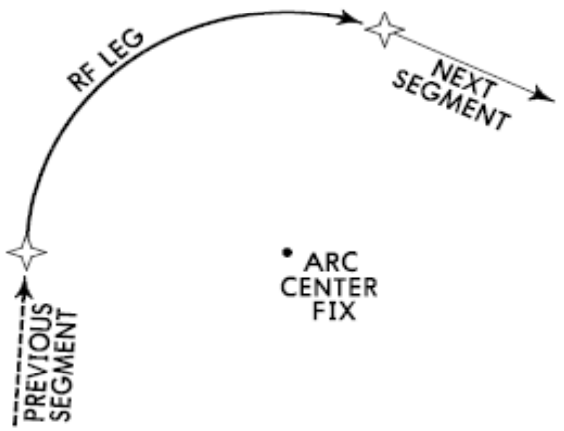
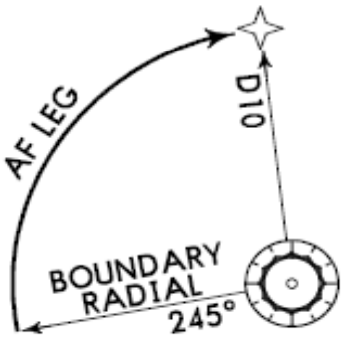
Summary:
Path Terminators “Arc Legs”

Leg Code	Example Path
RF	
AF	

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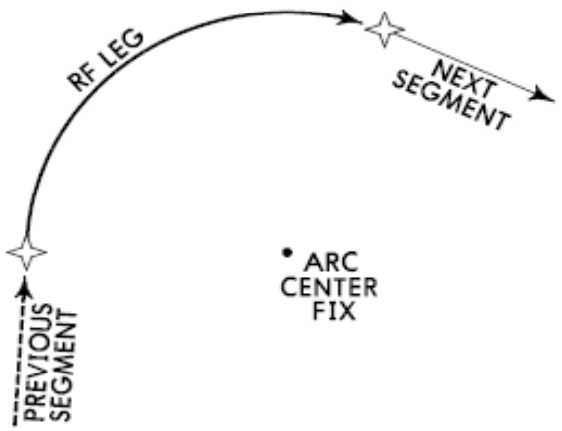
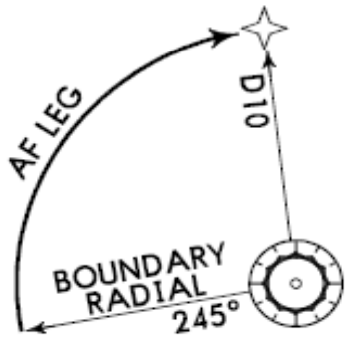
总结:
航迹终结码“弧线航段”

Leg Code	Example Path
RF	
AF	

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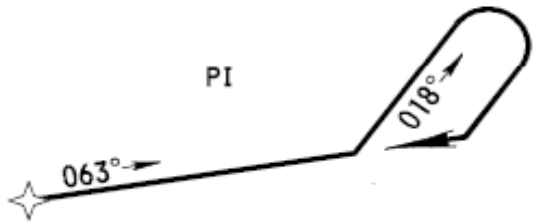
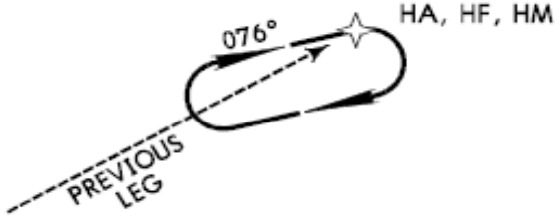
Summary: Path Terminators
“Procedure Turns & Holdings”

Leg Code	Example Path
PI	
HA, HF, HM	

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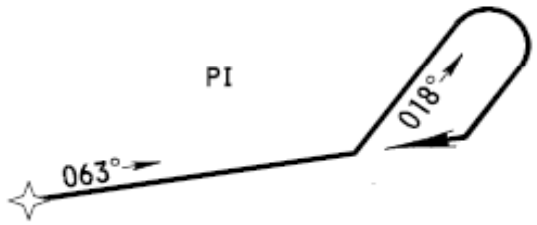
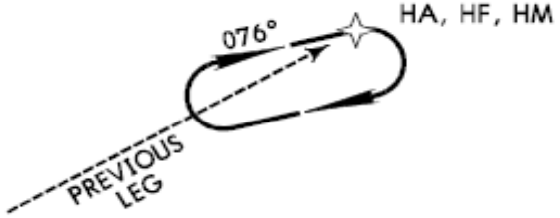
总结: 航径终结码
“程序转弯 & 等待”

Leg Code	Example Path
PI	
HA, HF, HM	

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Summary: 23 Types in Total

- Arc to a Fix - AF
- Course to an Altitude - CA
- Course to a DME Distance - CD
- Course to a Fix - CF
- Course to an Intercept - CI
- Course to a Radial Termination - CR
- Direct to a Fix - DF
- Fix to an Altitude - FA
- From a Fix for a Distance - FC
- From a Fix to a DME Distance - FD
- From a Fix to a Manual Termination - FM
- Racetrack Course Reversal (Alt Term) - HA
- Racetrack (Single Circuit - Fix Term) - HF
- Racetrack (Manual Termination) - HM
- Initial Fix - IF
- Track to a Fix - TF
- Procedure Turn - PI
- Constant Radius Arc - RF
- Heading to an Altitude - VA
- Heading to a DME Distance - VD
- Heading to an Intercept - VI
- Heading to a Manual Termination - VM
- Heading to a Radial Termination - VR

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总结: 共23种航径终结码

- Arc to a Fix - AF
- Course to an Altitude - CA
- Course to a DME Distance - CD
- Course to a Fix - CF
- Course to an Intercept - CI
- Course to a Radial Termination - CR
- Direct to a Fix - DF
- Fix to an Altitude - FA
- From a Fix for a Distance - FC
- From a Fix to a DME Distance - FD
- From a Fix to a Manual Termination - FM
- Racetrack Course Reversal (Alt Term) - HA
- Racetrack (Single Circuit - Fix Term) - HF
- Racetrack (Manual Termination) - HM

- Initial Fix - IF
- Track to a Fix - TF
- Procedure Turn - PI
- Constant Radius Arc - RF
- Heading to an Altitude - VA
- Heading to a DME Distance - VD
- Heading to an Intercept - VI
- Heading to a Manual Termination - VM
- Heading to a Radial Termination - VR

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Summary: 14 RNAV Types

- Course to an Altitude - CA
- Course to a Fix - CF
- Direct to a Fix - DF
- Fix to an Altitude - FA
- From a Fix to a Manual Termination - FM
- Racetrack Course Reversal (Alt Term) - HA
- Racetrack (Single Circuit - Fix Term) - HF
- Racetrack (Manual Termination) - HM
- Initial Fix - IF
- Track to a Fix - TF
- Constant Radius Arc - RF
- Heading to an Altitude - VA
- Heading to an Intercept - VI
- Heading to a Manual Termination - VM

- (Questionable value to RNAV applications)

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总结: 14种用于RNAV

- 保持航线角至某高度 - CA
- 保持航线角至某定位点 - CF
- 直飞某定位点 - DF
- 定位点至某高度 - FA
- 定位点至手动终结 - FM
- **Racetrack Course Reversal (Alt Term) - HA**
- **Racetrack (Single Circuit - Fix Term) - HF**
- 等待 (手动终结) - HM
- 起始定位点 - IF
- 保持航迹至某定位点 - TF
- 固定半径转弯至定位点 - RF
- 保持航向至某高度 - VA
- 保持航向至切入 - VI
- 保持航向至手动终结 - VM

- **(Questionable value to RNAV applications)**

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Summary: 9 RNP Types

- Course to a Fix - CF
- Direct to a Fix - DF
- Fix to an Altitude - FA
- Racetrack Course Reversal (Alt Term) - HA
- Racetrack (Single Circuit - Fix Term) - HF
- Racetrack (Manual Termination) - HM
- Initial Fix - IF
- Track to a Fix - TF
- Constant Radius Arc - RF

- (Preferred for RNP use)
- (Questionable value to RNP procedures)

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总结: 9 种用于RNP

- 保持航线角至某定位点 - CF
- 直飞某定位点 - DF
- 定位点至某高度 - FA
- **Racetrack Course Reversal (Alt Term) - HA**
- **Racetrack (Single Circuit - Fix Term) - HF**
- 等待 (手动终结) - HM
- 起始定位点 - IF
- 保持航迹至某定位点 - TF
- 固定半径转弯至某定位点 - RF

- **(RNP首选这些航迹终结码)**
- **(Questionable value to RNP procedures)**

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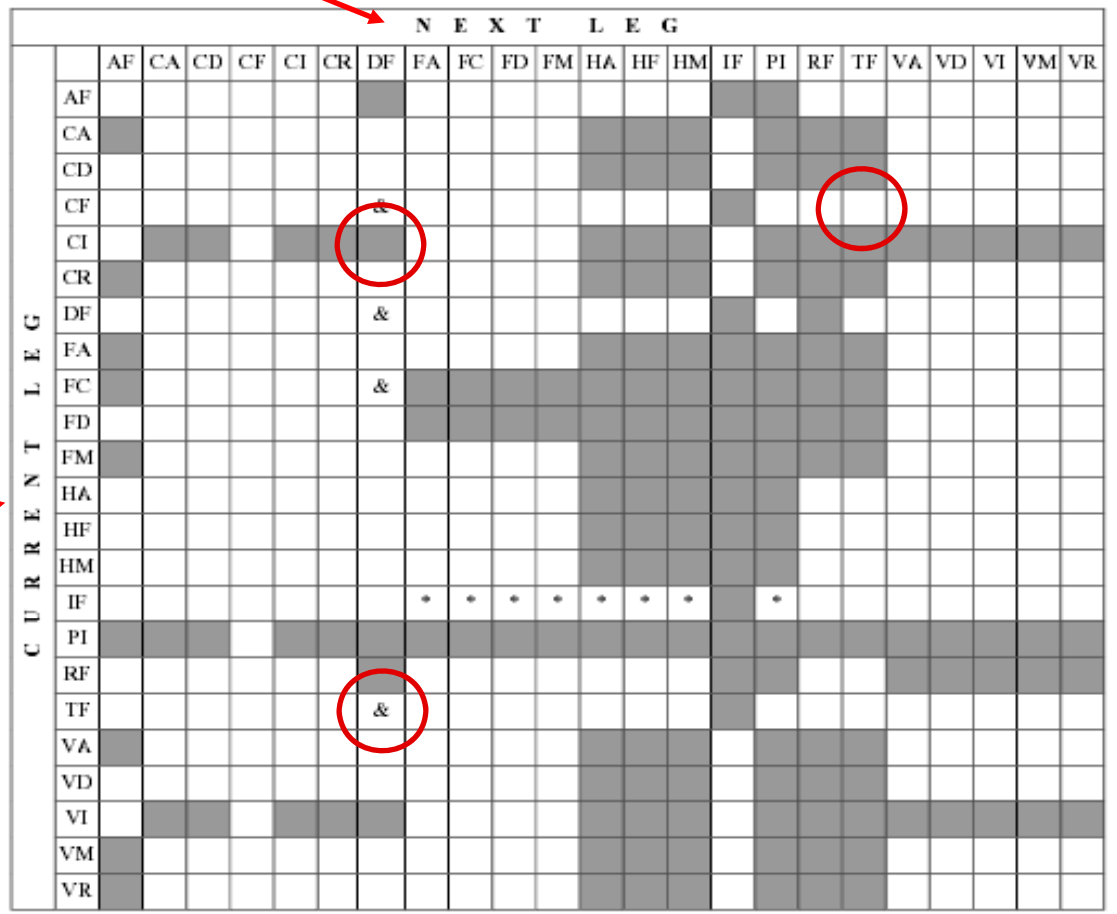
Leg Sequencing

Defines which PT can follow which:

... a DF cannot follow a CI...

... a DF can only follow a TF if the TF is flyover...

... CF then TF is no Problem



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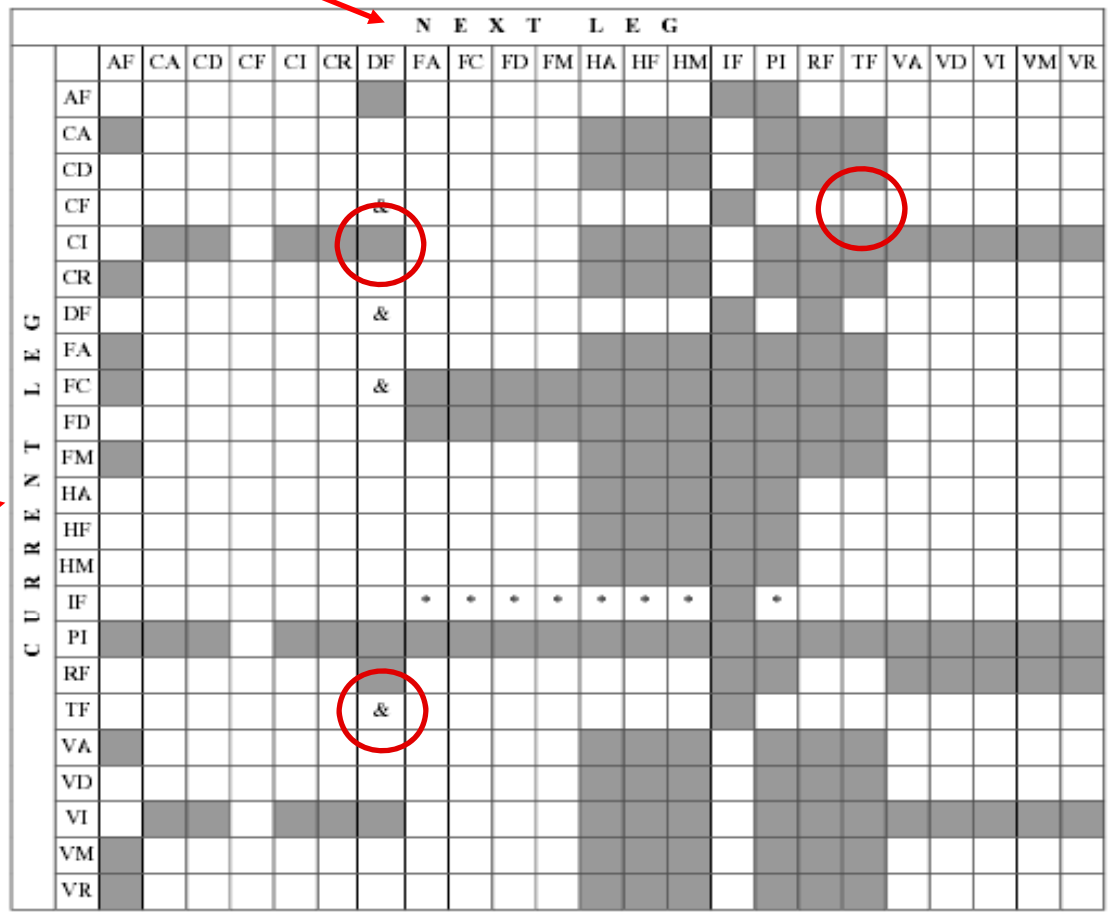
航段连接顺序

决定了航径终结码的先后连接顺序:

... 一个CI航段不能接 DF航段...

...如果TF航段的终点为飞越，则可以接DF航段...

... CF航段可以接 TF航段...



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Leg Data Requirements

1.5 Leg Data Fields

The following table proves detail on "Required" and "Optional" parameters used to define each leg type. An "O" in the table indicates that the parameter is considered optional and may be omitted as required in individual cases. All other entries indicate some type of a "required" situation for leg definition.

PT	W/P ID	OVR FLY	MAP	HLD	TD	TDV	RMD VHF	THETA	RHO	OBD MAG CRS	TM/ DST	ALT ONE	ALT TWO	SPD LMT	VRT ANG	ARC CTR	COMMENTS
AF	X	O			X		X	X	X	R		O	O	O			OB MAG CRS=BNDY RDL, THETA=FIX RDL
CA			O		O	O				C		+		O			ALT TERM WILL BE "AT OR ABOVE"
CD			O		O	O	X			C	D	O	O	O			
CF	X	B															
CI		O															
CR		O															
DF	X	B															
FA	X		O		O	O	X	X	X	C		+		O			"AT OR ABOVE"
FC	X	B	O		O	O	X	X	X	C	P	O	O	O			
FD	X	O	O		O	O	X	X	X	C	D	O	O	O			
FM	X		O		O	O	X	X	X	C		O		O			
HA	X			X	O		O	O	O	C	X	+		O			ALT TERM WILL BE "AT OR ABOVE"
HF	X			X	O		O	O	O	C	X	O		O			
HM	X			X	O		O	O	O	C	X	O		O			
IF	X						O	O	O			O	O	O			
PI	X				X		X	X	X	C	P	X		O			DIST IS EXCURSION DIST FROM FIX
RF	X	O			X		O	O		T	A	O	O	O	O	X	THETA IS INBD TANGENTIAL TRACK
TF	X	O			O	O	O	O	O	O	O	O	O	O	O		
VA			O		O	O				H		+		O			ALT TERM WILL BE "AT OR ABOVE"
VD			O		O	O	X			H	O	O	O	O			
VI		O	O		O	O	O			H		O	O	O			
VM	O		O		O	O				H		O		O			FOR W/P ID SEE STAR CODING RULES
VR		O	O		O	O	X	X		H		O	O	O			

PT	W/P ID	OVR FLY	MAP	HLD	TD	TDV	RMD VHF	THETA	RHO	OBD MAG CRS	TM/ DST	ALT ONE	ALT TWO	SPD LMT	VRT ANG	ARC CTR	COMMENTS
TF	X	O			O	O	O	O	O	O	O	O	O	O	O		

LEGEND:

X = REQUIRED FIELD
A = ALONG TRACK DISTANCE
O = OPTIONAL FIELD
P = PATH LENGTH
R = BOUNDARY RADIAL
C = COURSE
H = HEADING
T = OUTBOUND TANGENTIAL TRACK
D = DME DISTANCE
+ = "AT OR ABOVE" ONLY
SHADED = NOT APPLICABLE FIELD
B = "REQUIRED" FOR CF/DF, DF/DF OR FC/DF COMBINATIONS, OTHERWISE "OPTIONAL"

- **This table defines what details must be provided or may not be coded.**

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航段数据要求

1.5 Leg Data Fields

The following table proves detail on "Required" and "Optional" parameters used to define each leg type. An "O" in the table indicates that the parameter is considered optional and may be omitted as required in individual cases. All other entries indicate some type of a "required" situation for leg definition.

PT	W/P ID	OVR FLY	MAP	HLD	TD	TDV	RMD VHF	THETA	RHO	OBD MAG CRS	TM/ DST	ALT ONE	ALT TWO	SPD LMT	VRT ANG	ARC CTR	COMMENTS
AF	X	O			X		X	X	X	R		O	O	O			OB MAG CRS=BNDY RDL, THETA=FIX RDL
CA			O		O	O				C		+		O			ALT TERM WILL BE "AT OR ABOVE"
CD			O		O	O	X			C	D	O	O	O			
CF	X	B															
CI		O															
CR		O															
DF	X	B															
FA	X		O		O	O	X	X	X	C		+		O			"AT OR ABOVE"
FC	X	B	O		O	O	X	X	X	C	P	O	O	O			
FD	X	O	O		O	O	X	X	X	C	D	O	O	O			
FM	X		O		O	O	X	X	X	C		O		O			
HA	X			X	O		O	O	O	C	X	+		O			ALT TERM WILL BE "AT OR ABOVE"
HF	X			X	O		O	O	O	C	X	O		O			
HM	X			X	O		O	O	O	C	X	O		O			
IF	X						O	O	O			O	O	O			
PI	X				X		X	X	X	C	P	X		O			DIST IS EXCURSION DIST FROM FIX
RF	X	O			X		O	O		T	A	O	O	O	O	X	THETA IS INBD TANGENTIAL TRACK
TF	X	O			O	O	O	O	O	O	O	O	O	O	O		
VA			O		O	O				H		+		O			ALT TERM WILL BE "AT OR ABOVE"
VD			O		O	O	X			H	O	O	O	O			
VI		O	O		O	O	O			H		O	O	O			
VM	O		O		O	O				H		O		O			FOR W/P ID SEE STAR CODING RULES
VR		O	O		O	O	X	X		H		O	O	O			

PT	W/P ID	OVR FLY	MAP	HLD	TD	TDV	RMD VHF	THETA	RHO	OBD MAG CRS	TM/ DST	ALT ONE	ALT TWO	SPD LMT	VRT ANG	ARC CTR	COMMENTS
TF	X	O			O	O	O	O	O	O	O	O	O	O	O		

LEGEND:

X = REQUIRED FIELD
A = ALONG TRACK DISTANCE
O = OPTIONAL FIELD
P = PATH LENGTH
B = "REQUIRED" FOR CF/DF, DF/DF OR FC/DF COMBINATIONS, OTHERWISE "OPTIONAL"
R = BOUNDARY RADIAL
C = COURSE
H = HEADING
T = OUTBOUND TANGENTIAL TRACK
D = DME DISTANCE
+ = "AT OR ABOVE" ONLY
SHADED = NOT APPLICABLE FIELD

- 该表格给出了哪些信息必须详细提供，否则可能无法编码。

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Beginning and Ending Leg

Procedure	Beginning Leg	Ending Leg
SID Runway Transition	CA, CD, CF, CI, CR, DF, FA, FC, FD FM, IF[4], VA, VD, VI, VM[1], VR	AF, CF, DF, FM, HA, HM[2], IF[4], RF, TF, VM[1]
SID Common Route	CA[3], CD[3], CF[3], CI[3], CR[3], DF[3], FA, FC, FD, FM, IF, VA[3], VD[3], VI[3], VM [(1and 3) or 8], VR[3]	AF, CF, DF, FM, HA, IF[4], TF, RF, VM
SID Enroute Transition	FA, FC, FD, IF	AF, CF, DF, HA, RF, TF,
STAR Enroute Transition	FC, FD, IF	AF, CF, DF, HM, RF, TF
STAR Common Route	FC, FD, IF, FM	AF, CF, DF, FM, IF[4], RF, TF, VM
STAR Runway Transition	FC, FD, FM,HF, IF	AF, CF, FM, HF, HM, RF, TF, VM, IF[9]
Approach Transition	FC, FD, HF, IF, PI	AF, CF, CI[5], HF, HM, PI, RF, TF, VI[5]
Final Approach Coding	IF	CF, RF, TF[6],
Missed Approach	AF[7], CA, CD, CF, CI, CR DF, FA, FC, FD, FM, HA, HM, RF[7], TF, VA, VD, VI, VM, VR	AF, CA, CF, DF, FM, HM, RF, TF, VA, VM,

Explanation of Notes in Table

1. When followed by a CF or DF leg or when Route Type is T, Vector SID.
2. When Route Type is 0, Engine Out SID.
3. When SID Procedure has NO Runway Transitions
4. When IF leg is the one and only record in the SID/STAR route.
5. When Approach Transition is localizer based.

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开始和结束航段

Procedure	Beginning Leg	Ending Leg
SID Runway Transition	CA, CD, CF, CI, CR, DF, FA, FC, FD FM, IF[4], VA, VD, VI, VM[1], VR	AF, CF, DF, FM, HA, HM[2], IF[4], RF, TF, VM[1]
SID Common Route	CA[3], CD[3], CF[3], CI[3], CR[3], DF[3], FA, FC, FD, FM, IF, VA[3], VD[3], VI[3], VM [(1and 3) or 8], VR[3]	AF, CF, DF, FM, HA, IF[4], TF, RF, VM
SID Enroute Transition	FA, FC, FD, IF	AF, CF, DF, HA, RF, TF,
STAR Enroute Transition	FC, FD, IF	AF, CF, DF, HM, RF, TF
STAR Common Route	FC, FD, IF, FM	AF, CF, DF, FM, IF[4], RF, TF, VM
STAR Runway Transition	FC, FD, FM,HF, IF	AF, CF, FM, HF, HM, RF, TF, VM, IF[9]
Approach Transition	FC, FD, HF, IF, PI	AF, CF, CI[5], HF, HM, PI, RF, TF, VI[5]
Final Approach Coding	IF	CF, RF, TF[6],
Missed Approach	AF[7], CA, CD, CF, CI, CR DF, FA, FC, FD, FM, HA, HM, RF[7], TF, VA, VD, VI, VM, VR	AF, CA, CF, DF, FM, HM, RF, TF, VA, VM,

Explanation of Notes in Table

1. When followed by a CF or DF leg or when Route Type is T, Vector SID.
2. When Route Type is 0, Engine Out SID.
3. When SID Procedure has NO Runway Transitions
4. When IF leg is the one and only record in the SID/STAR route.
5. When Approach Transition is localizer based.

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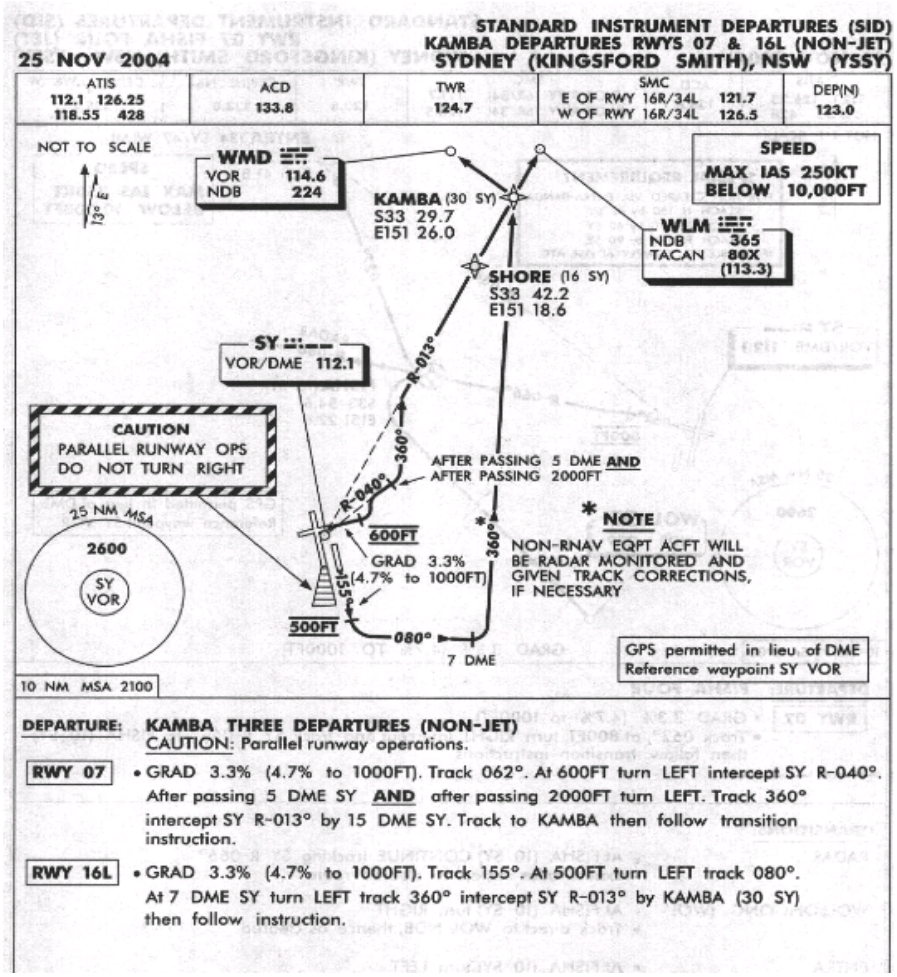
SID Coding Example



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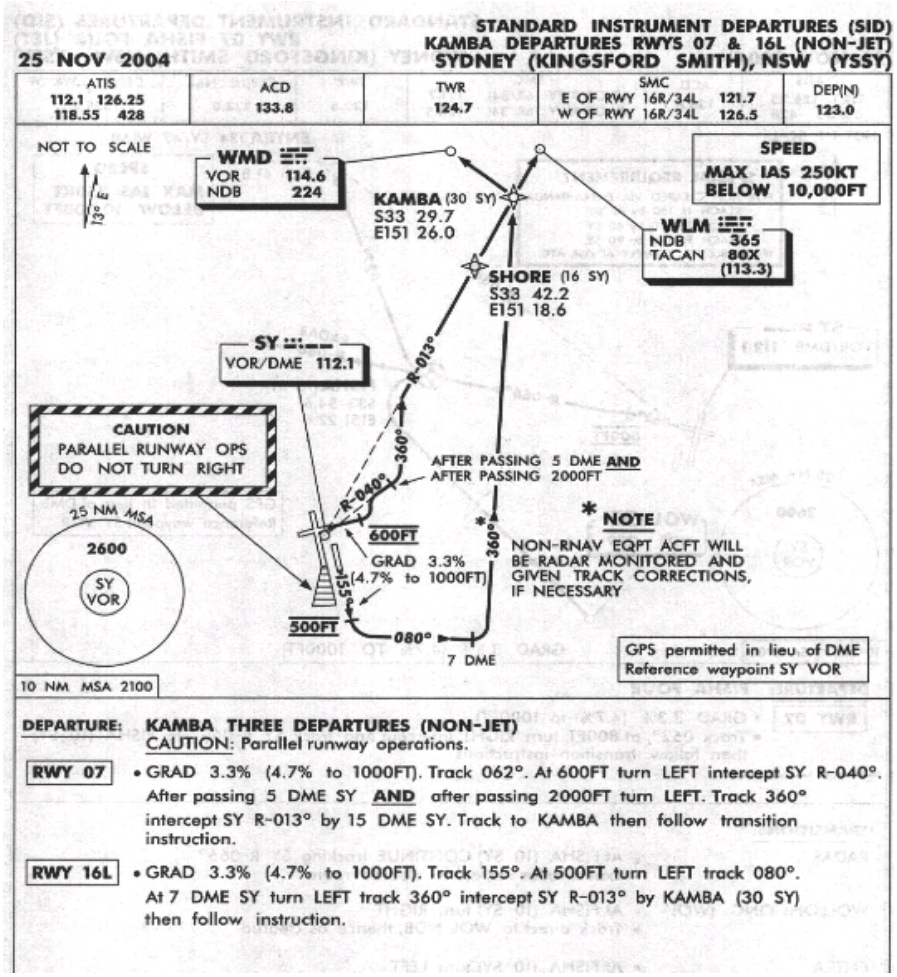
SID编码示例



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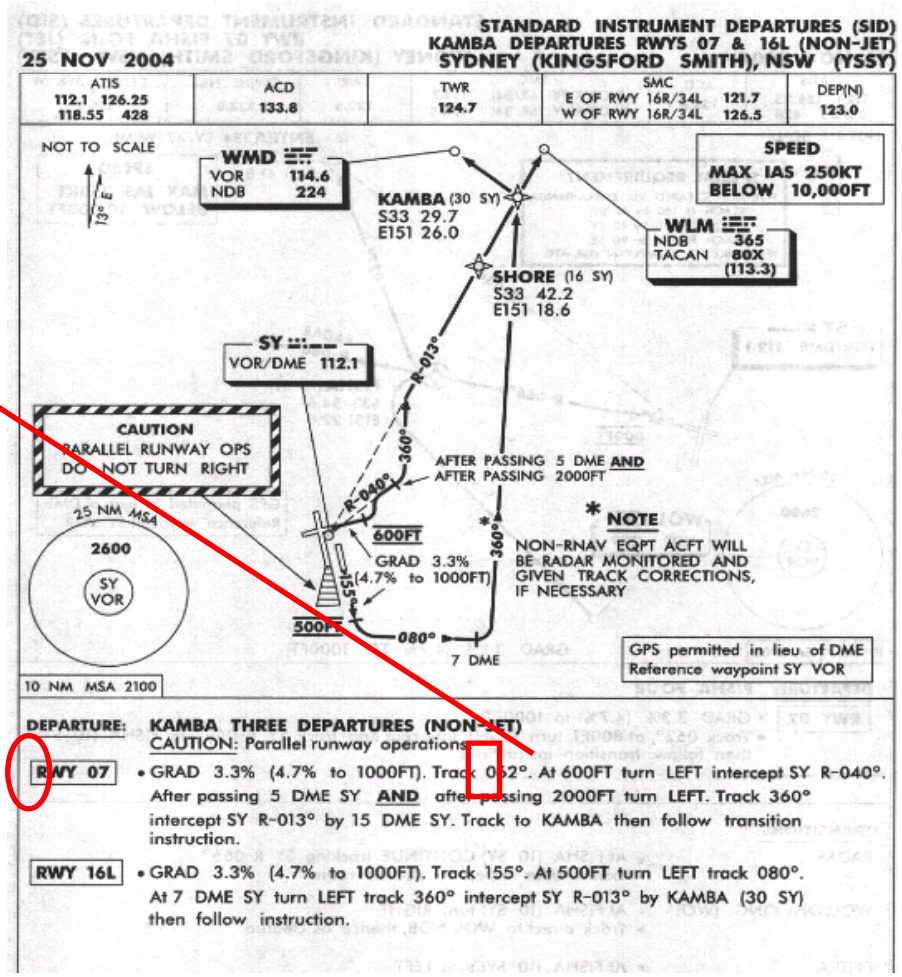
SID Coding Example

- Track 062° , At 600 ft….

- **CA Leg – Course to ALT**
- **Path: Course 062°**
- **Terminator: 600 ft MSL**



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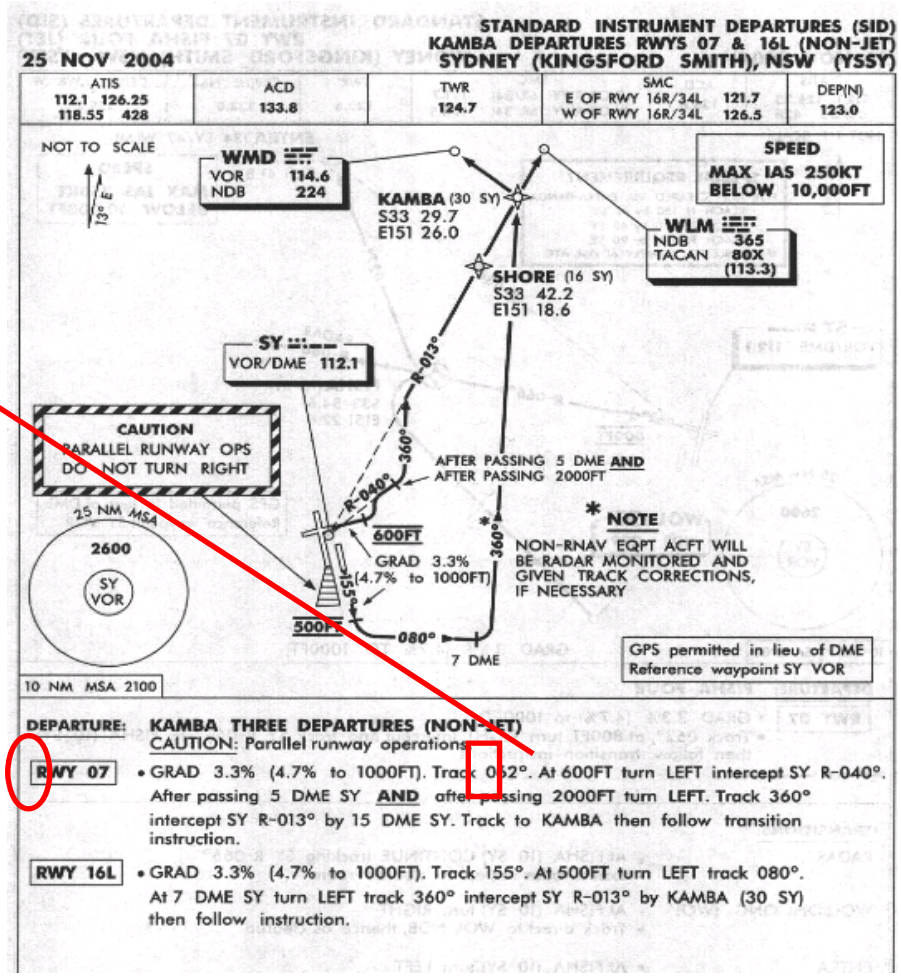
SID编码示例

- 航迹 062°，在高度 600 ft….

- **CA 航段– 保持航线角到高度**
- **路径: 航线角 062°**
- **终点: 600 ft （MSL）**



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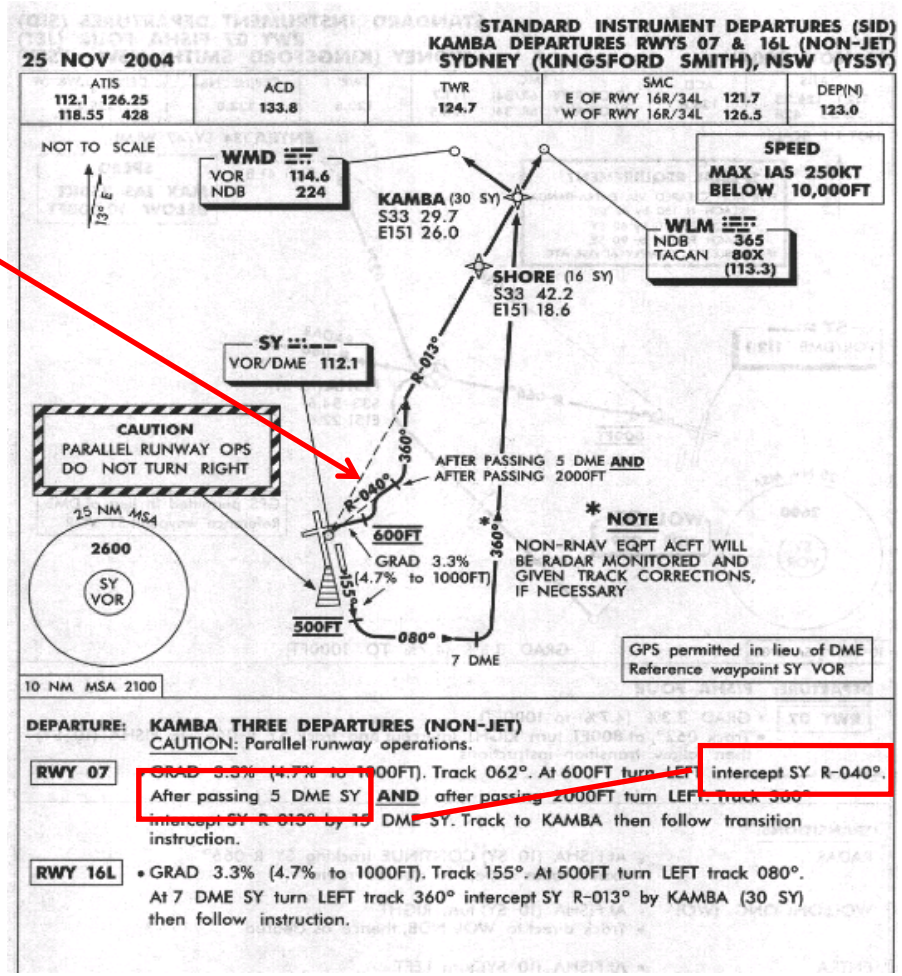
SID Coding Example

- Intercept radial 040° from SY, after passing D5 SY….

- **FD Leg – Course from a fix to a DME distance**
- **Path: Course 040°**
- **Terminator: SY DME 5**



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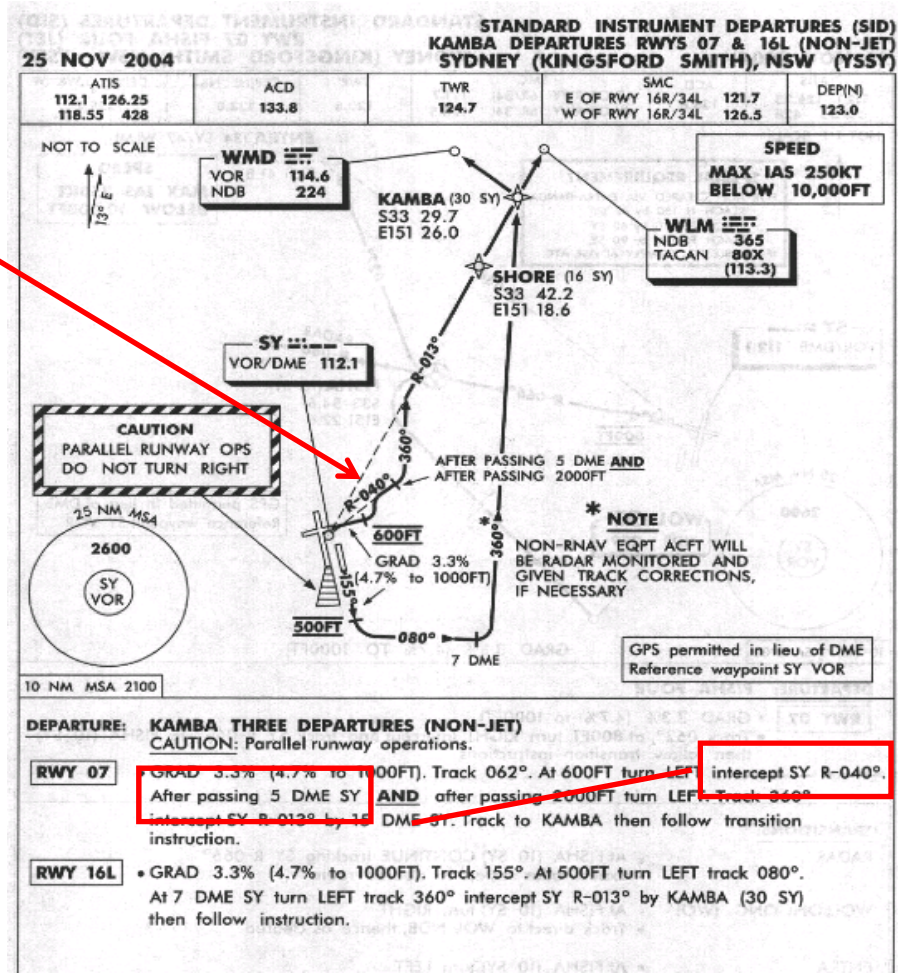
SID 编码示例

■切入SY台 R040° 径向线，过SY台DME 5NM ….

■ **FD Leg – 保持航线角从某定位点到某DME距离**

■ **航径: 航线角 040°**

■ **终点: SY台DME 5NM处**



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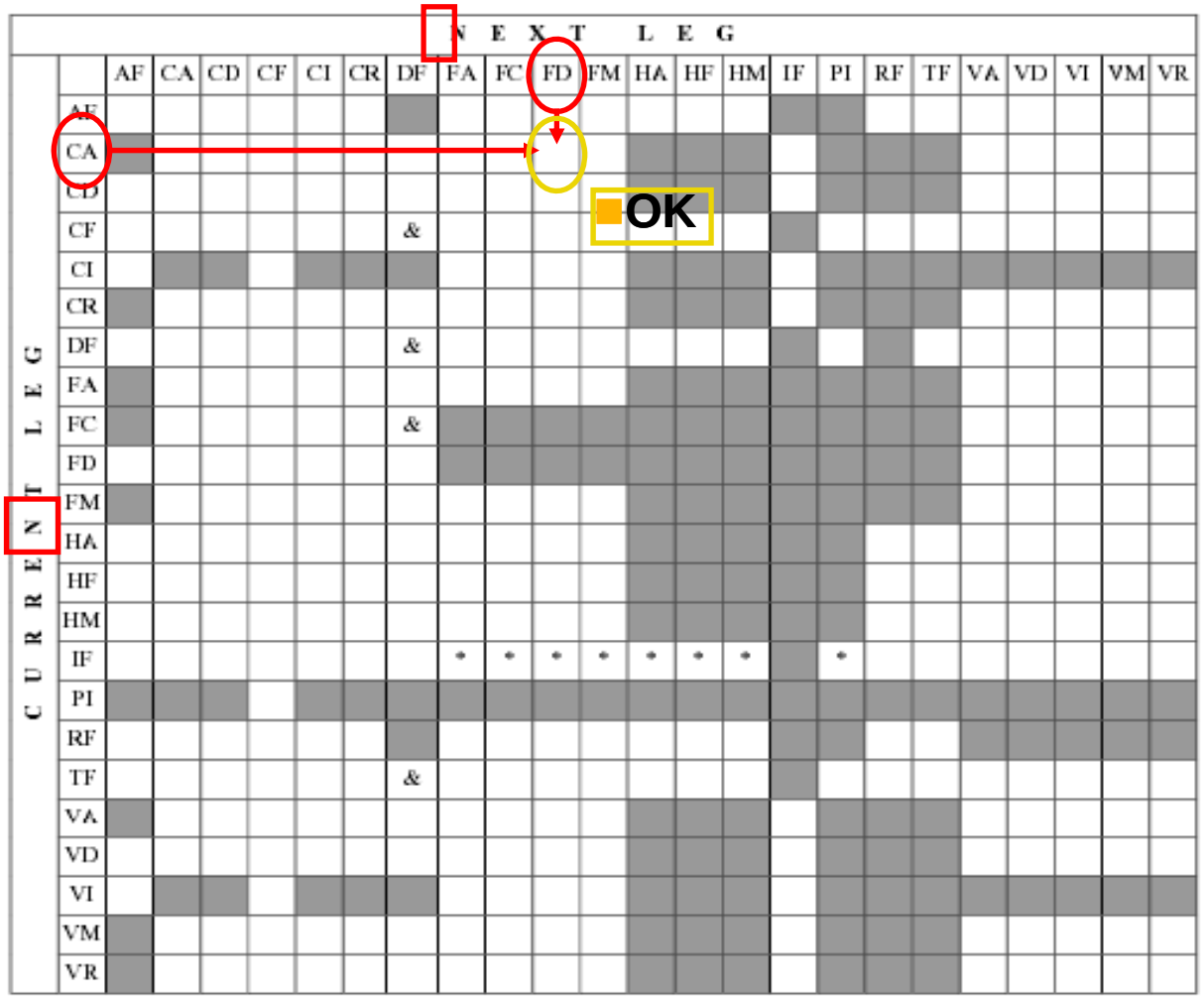
Check the leg sequencing table:



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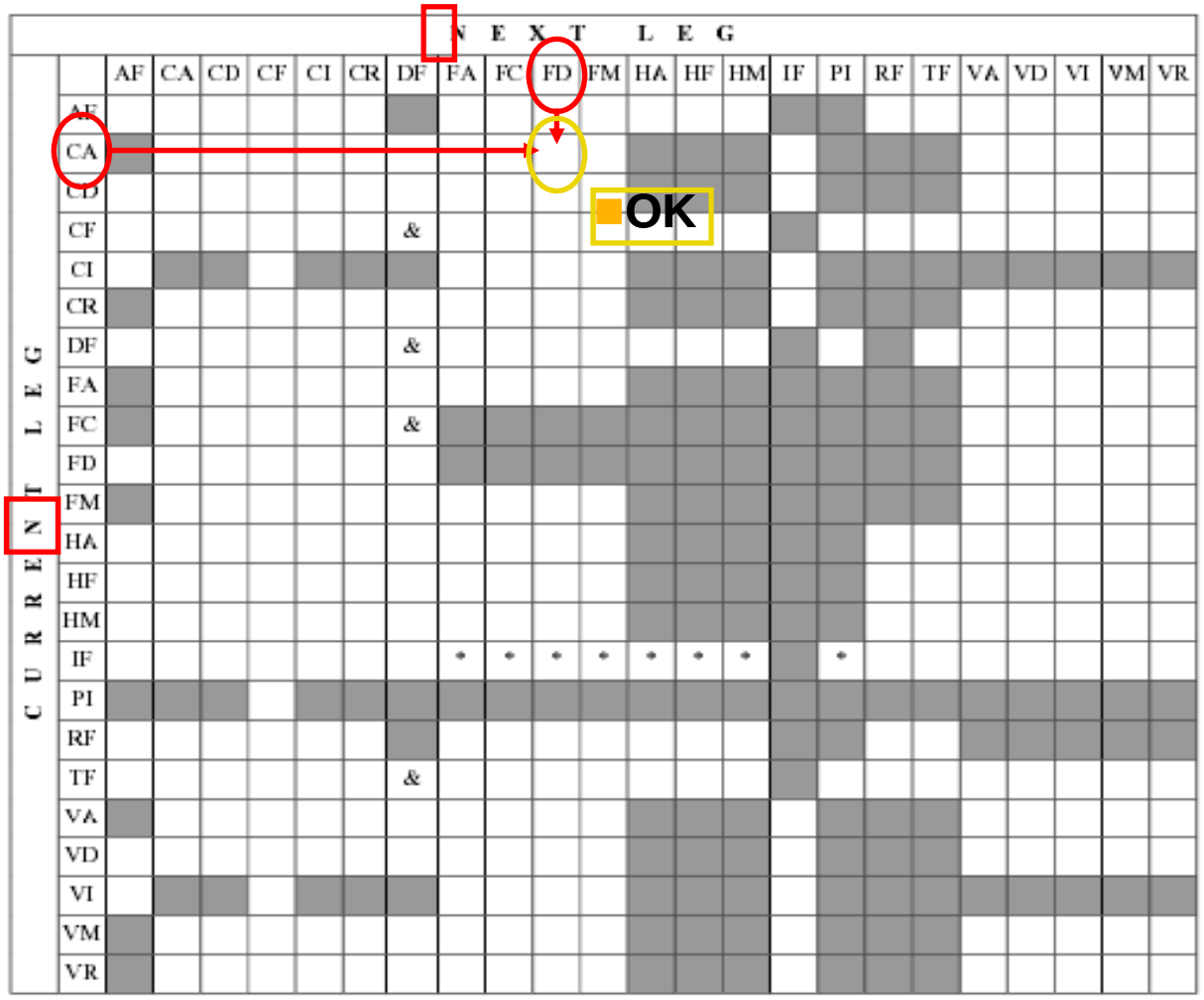
检查航段连接顺序表格:



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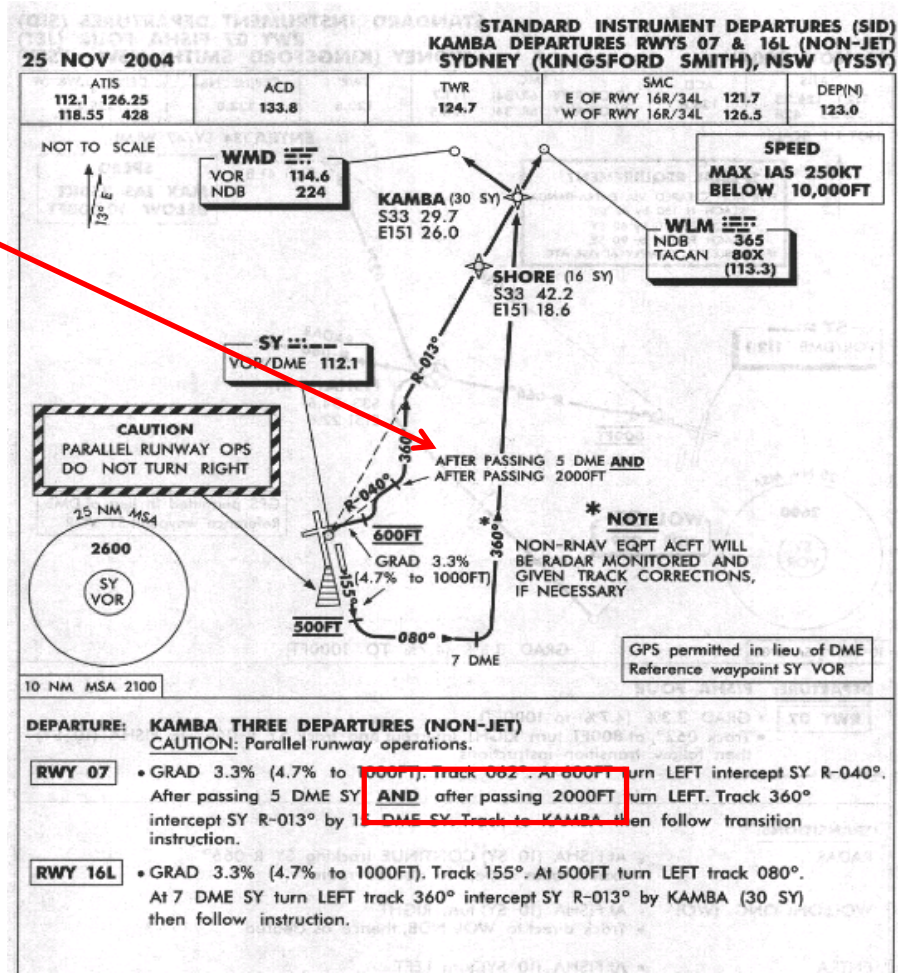
SID Coding Example

- AND! Passing 2000 ft ….

- **CA Leg – Course to ALT**
- **Path: Course 040°**
- **Terminator: 2’000 ft MSL**



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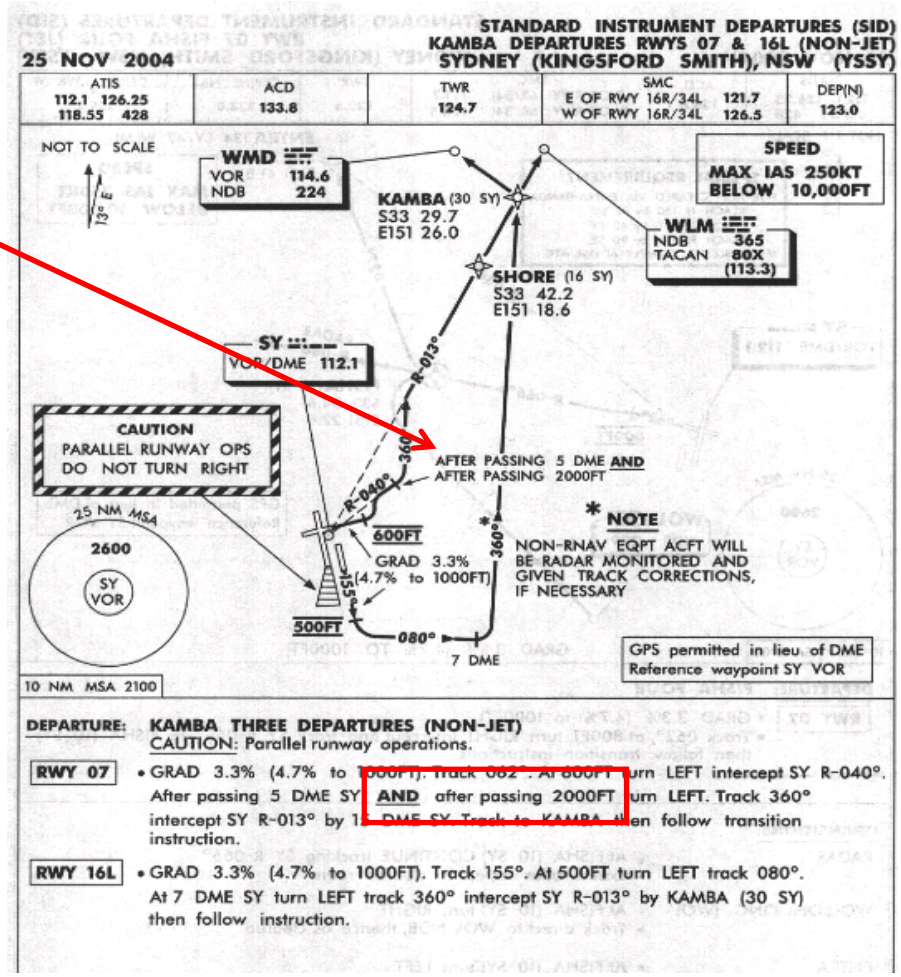
SID编码示例

- 过高度 2000 ft ….

- **CA 航段 – 保持航线角至高度**
- 航径: 航线角 **040°**
- 终点: **2’000 ft （MSL）**



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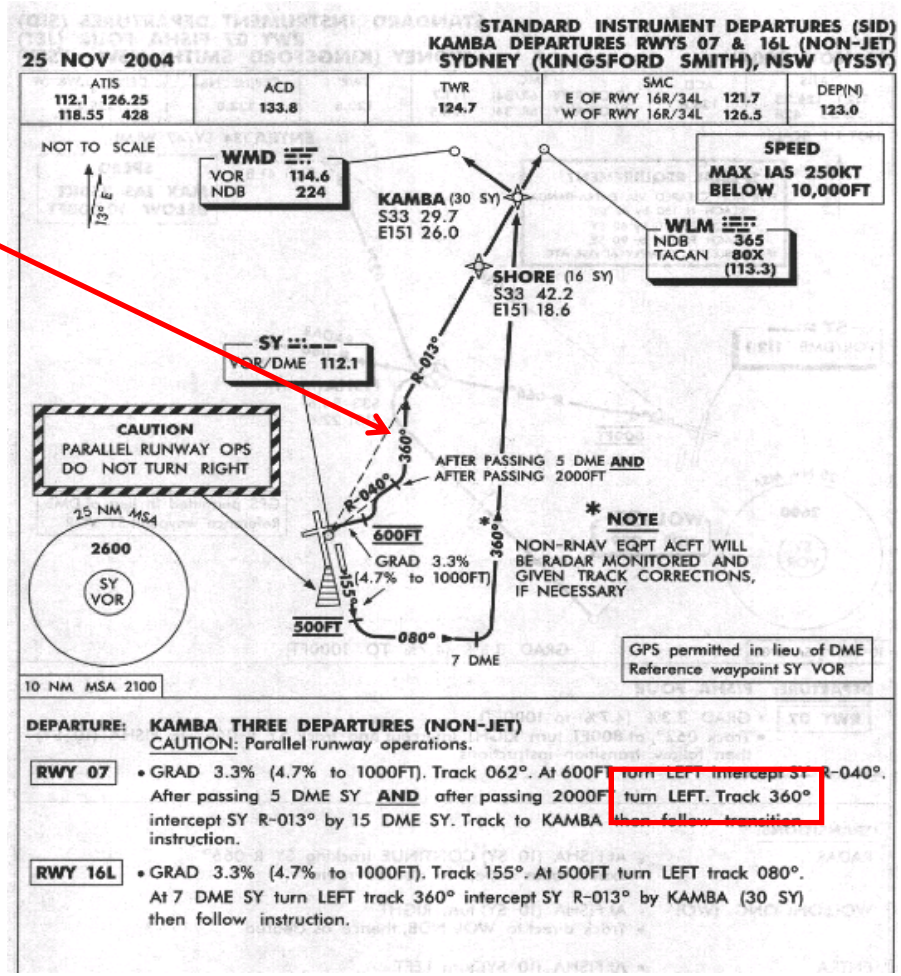
SID Coding Example

…turn left track 360° , intercept radial ….

- **CI Leg – Course to a next leg intercept**
- **Path: Course 360°**
- **Terminator: Course 013° to “SHORE”**



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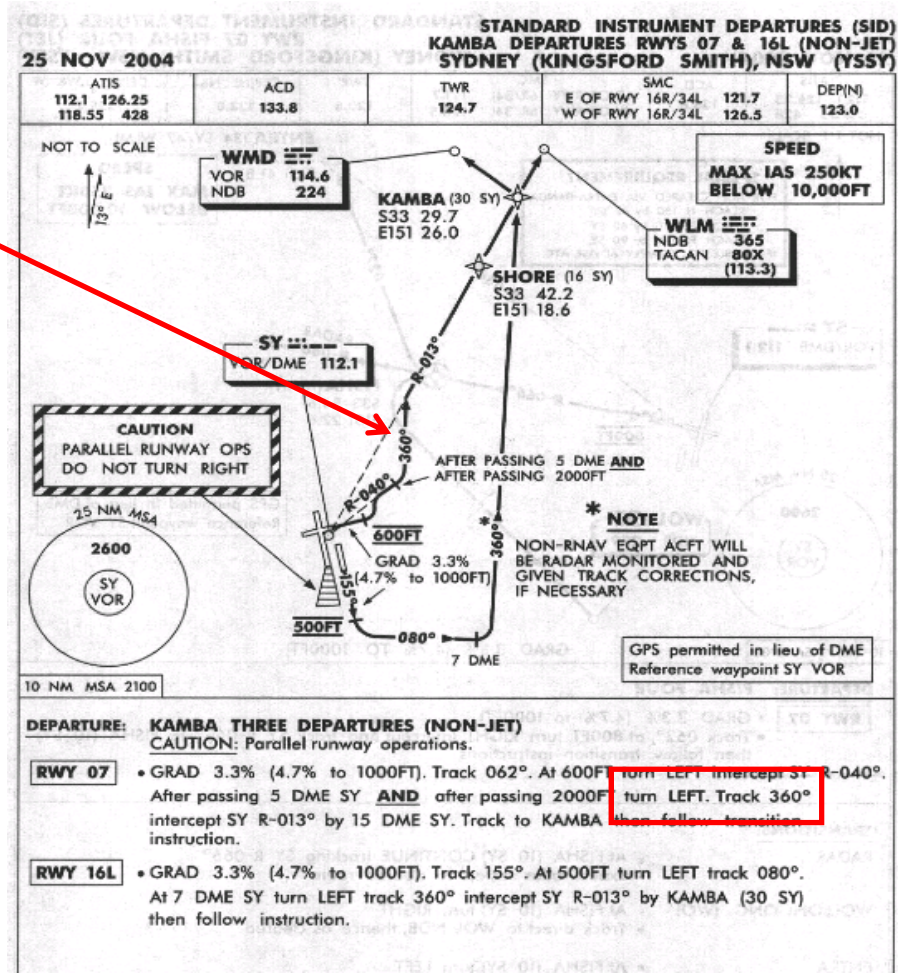
SID编码示例

- …左转保持航迹 360°，切入径向线 ….

- CI 航段 – 保持航线角切入下一航段
- 航径: 航线角 360°
- 终结: 保持航线角 013° 至SHORE点



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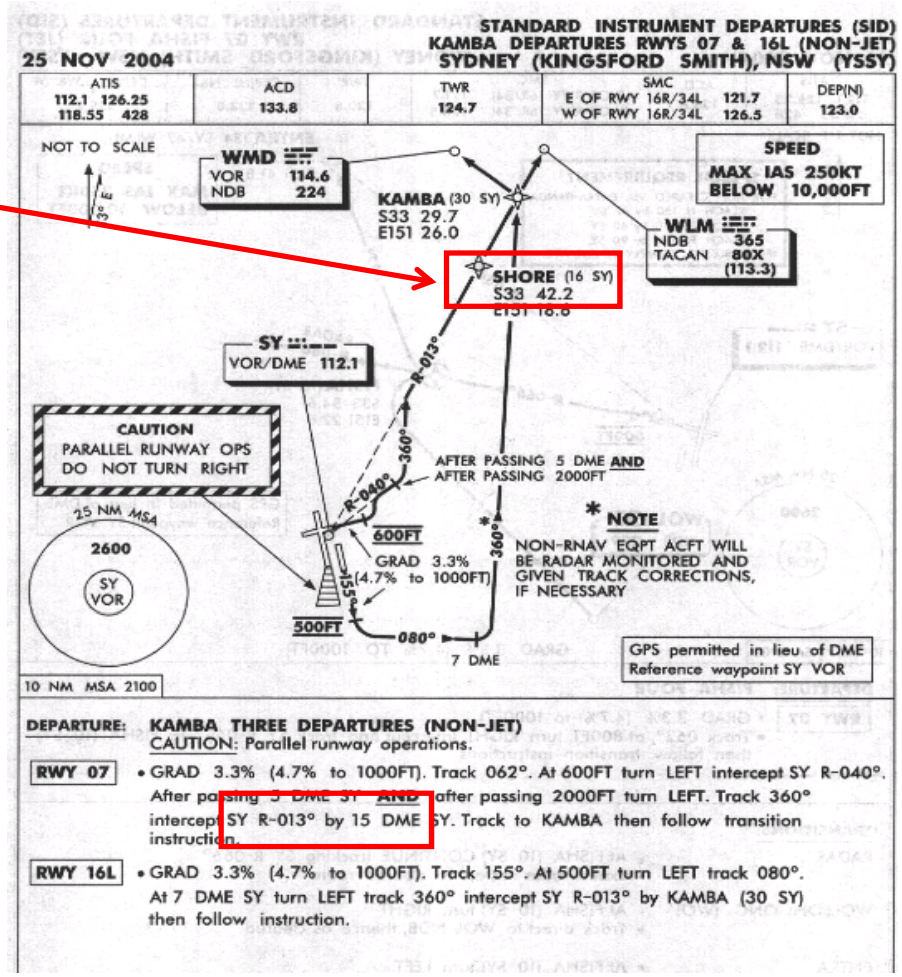
SID Coding Example

…radial 013° from SY by 15 DME …..

- CF Leg – Course to a fix
- Path: Course 013°
- Terminator: “SHORE”



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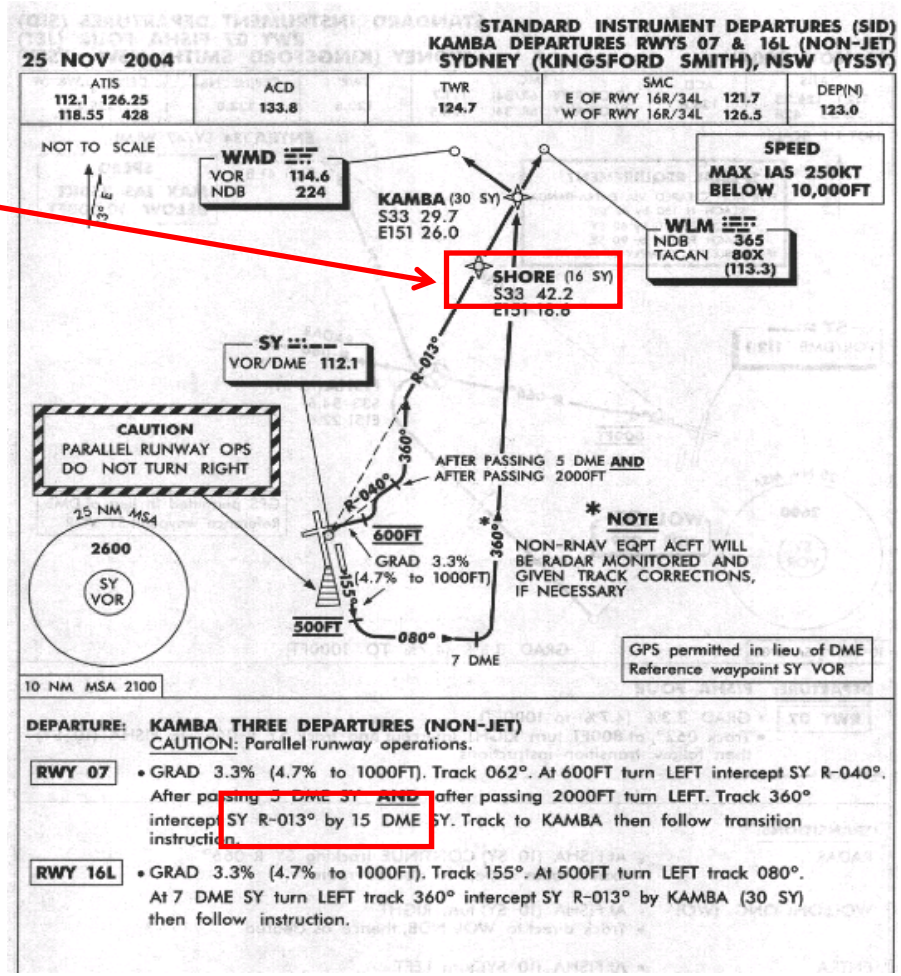
SID 编码示例

- …沿SY R 013° 径向线至15DME …..

- **CF 航段 – 保持航线角至定位点**
- 航径: 航线角 **013°**
- 终点: **“SHORE”**



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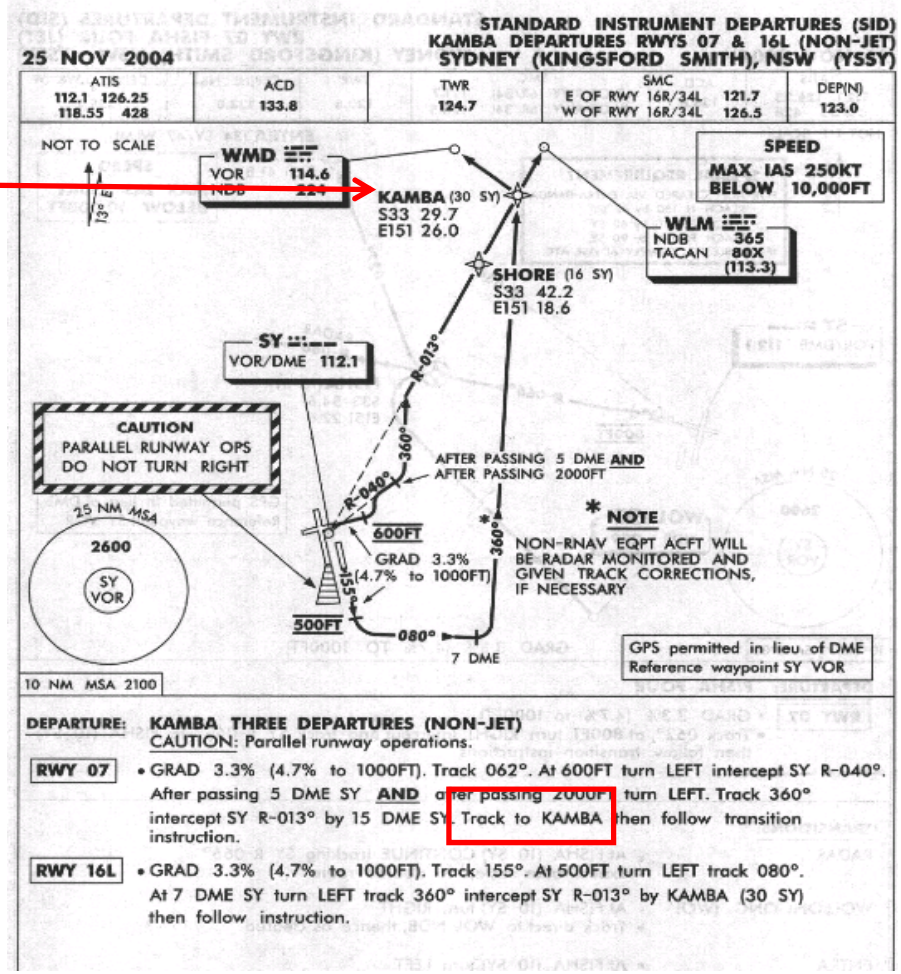
SID Coding Example

- …track to “KAMBA”…..



- TF Leg – Track to a fix
- Path: GC from “SHORE”
- Terminator: “KAMBA”

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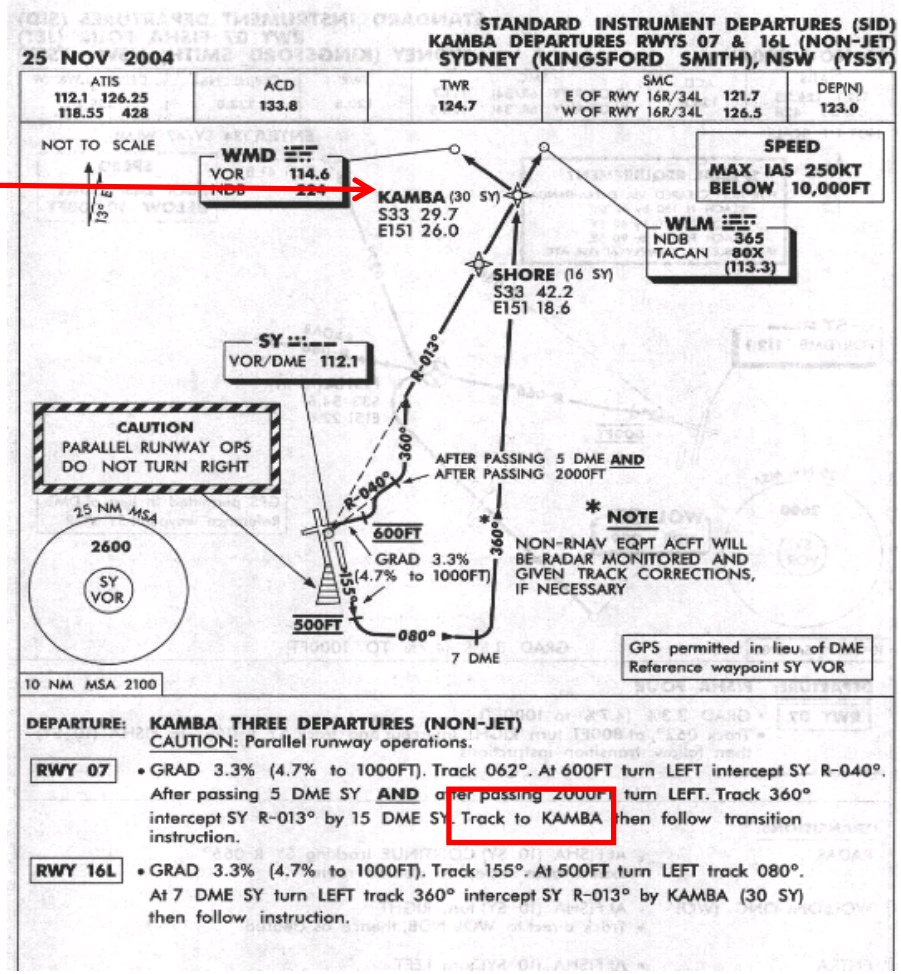
SID 编码示例

…保持航迹至 “KAMBA”…..



- TF航段 – 保持航迹至定位点
- 航径: 始于SHORE的大圆航线
- 终点: KAMBA

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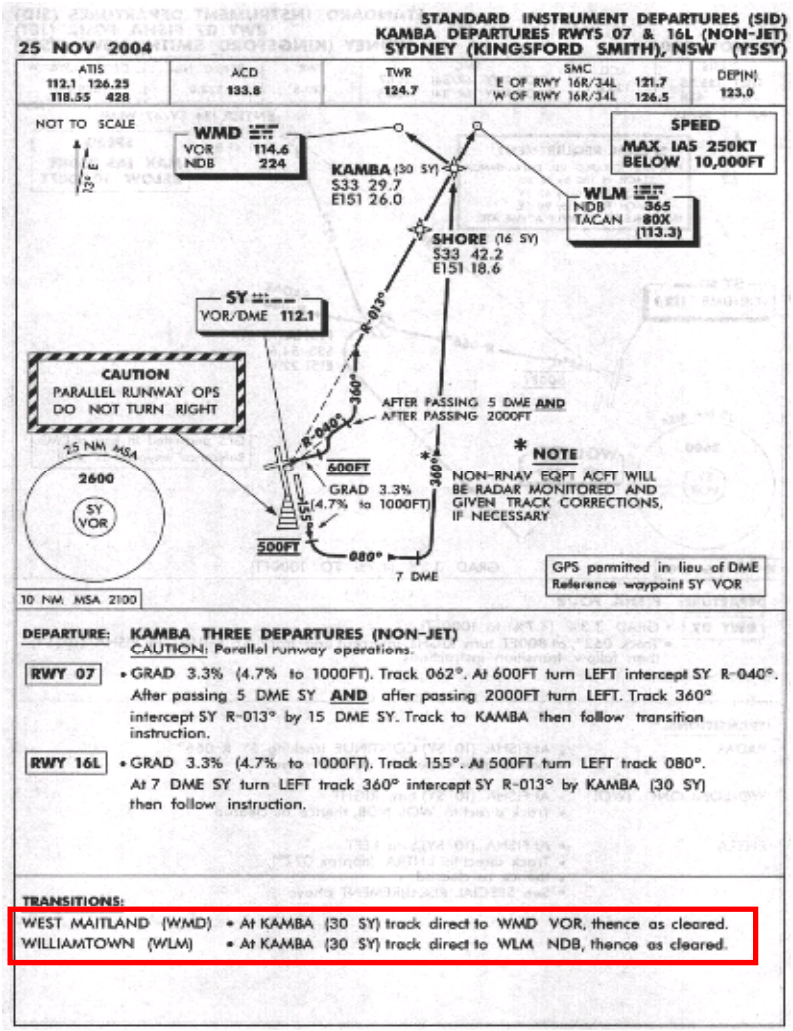
SID Coding Example

- 2 Transitions…..

- **IF Leg – Initial Fix**
- **Path: Start of transition**
- **Terminator: N/A**



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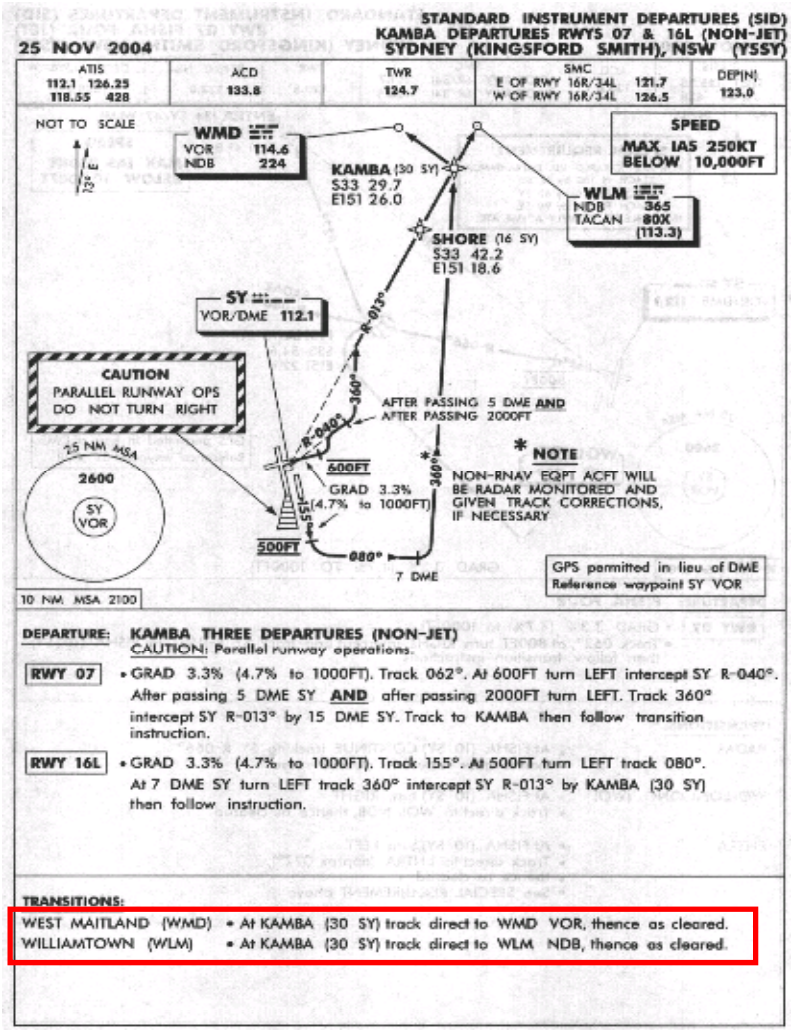
SID 编码示例

- 2个过渡点.....

- IF 航段 – 起始定位点
- 航径: 从过渡点开始
- 终点: N/A



STANDARD INSTRUMENT DEPARTURES (SID)
KAMBA DEPARTURES RWYS 07 & 16L (NON-JET)
SYDNEY (KINGSFORD SMITH), NSW (YSSY)
25 NOV 2004

ATIS 112.1 126.25 118.55 428 | ACD 133.8 | TWR 124.7 | SMC E OF RWY 16R/34L 121.7, W OF RWY 16R/34L 126.5 | DEP(N) 123.0

NOT TO SCALE

WMD VOR 114.6 NDB 224

KAMBA (30 SY) S33 29.7 E151 26.0

SHORE (16 SY) S33 42.2 E151 18.6

WLM NDB 365 TACAN 80X (113.3)

SPEED MAX IAS 250KT BELOW 10,000FT

SY VOR/DME 112.1

CAUTION PARALLEL RUNWAY OPS DO NOT TURN RIGHT

AFTER PASSING 5 DME AND AFTER PASSING 2000FT

* NOTE NON-RNAV EQPT ACFT WILL BE RADAR MONITORED AND GIVEN TRACK CORRECTIONS, IF NECESSARY

25 NM MSA 2600 SY VOR

600FT GRAD 3.3% (4.7% to 1000FT)

500FT

7 DME

GPS permitted in lieu of DME Reference waypoint SY VOR

10 NM MSA 2100

DEPARTURE: KAMBA THREE DEPARTURES (NON-JET)
CAUTION: Parallel runway operations.

RWY 07 • GRAD 3.3% (4.7% to 1000FT). Track 062°. At 600FT turn LEFT intercept SY R-040°. After passing 5 DME SY AND after passing 2000FT turn LEFT. Track 360° intercept SY R-013° by 15 DME SY. Track to KAMBA then follow transition instruction.

RWY 16L • GRAD 3.3% (4.7% to 1000FT). Track 155°. At 500FT turn LEFT track 080°. At 7 DME SY turn LEFT track 360° intercept SY R-013° by KAMBA (30 SY) then follow instruction.

TRANSITIONS:
WEST MAITLAND (WMD) • At KAMBA (30 SY) track direct to WMD VOR, thence as cleared.
WILLIAMTOWN (WLM) • At KAMBA (30 SY) track direct to WLM NDB, thence as cleared.

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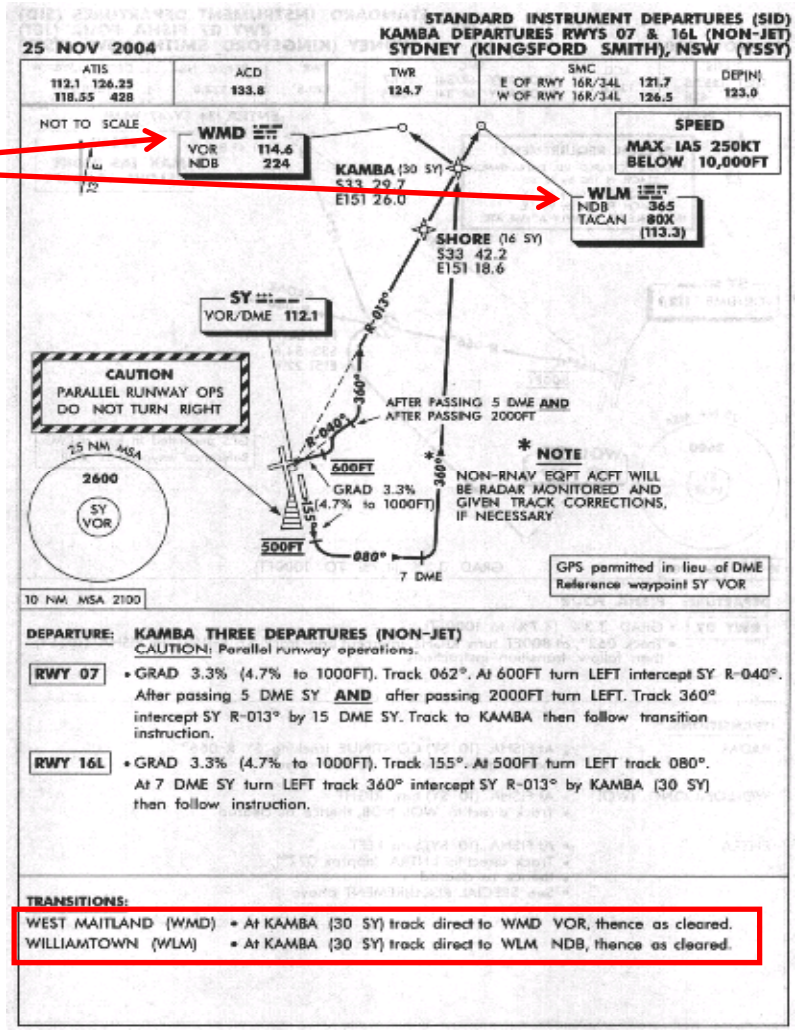
SID Coding Example

- Transitions:
“WMD” and “WLM”



- **TF Leg – Track to a fix**
- **Path: GC from “KAMBA”**
- **Terminator: “WMD” or “WLM”**

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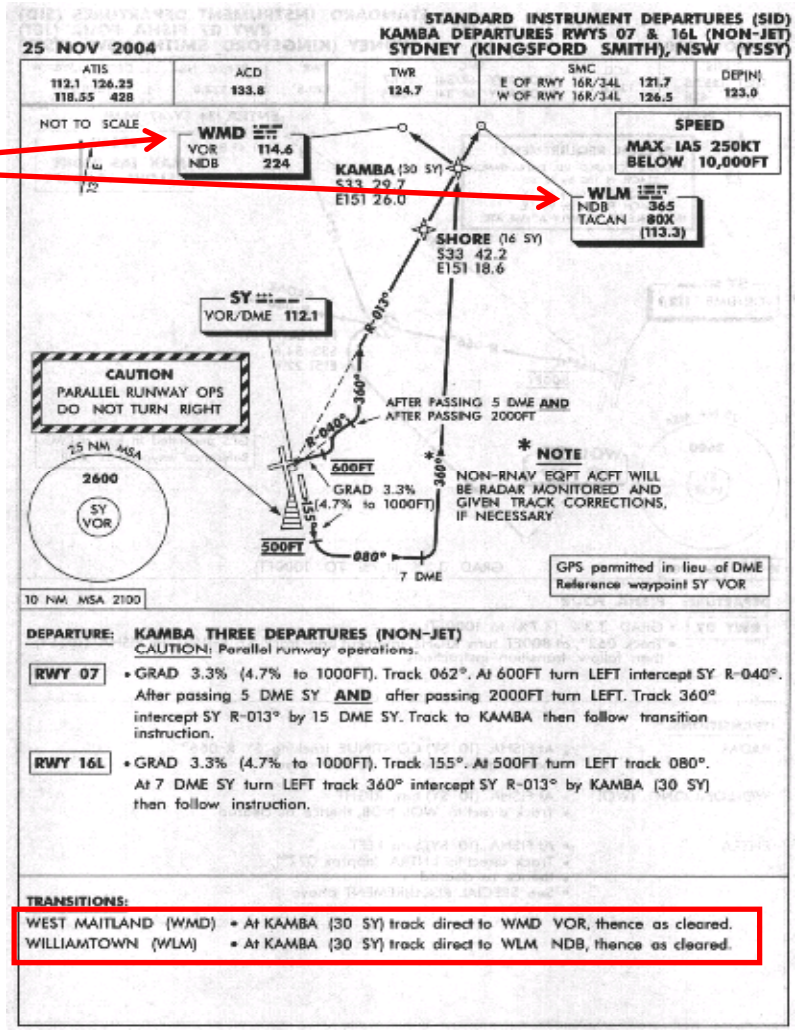
SID 编码示例

- 过渡点:
“WMD” 和 “WLM”



- **TF 航段 – 保持航迹至定位点**
- **航径: 始于KAMBA的大圆航线**
- **终点: “WMD” 或 “WLM”**

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Path Terminators Examples (1)

LEG	DESCRIPTION	EXAMPLE	ICAO RNAV	RNP
AF	Arc to a Fix	Fly FFM 10 DME Arc to CARLO Int.		
CA	Course to an Altitude	Climb 292 to 1’000’.	X	
CD	Course to a DME distance	Climb 292 to 10 DME FFM.		
CF	Course to a Fix	Intercept FFM R-030 to PAVEL Int.	X	X
CI	Course to Intercept next leg	Turn right track 292 course to intercept FFM R-030.		
CR	Course to a Radial termination	Track 250, upon crossing FFM R-030 turn right direct COL VOR/DME.		

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航径终结码示例 (1)

航段	描述	示例	ICAO RNAV	RNP
AF	沿弧至定位点	沿 **FFM DME 10NM** 弧至定位点 **CARLO .**		
CA	保持航线角至某高度	保持 **292°** 爬升至 **1'000'.**	**X**	
CD	保持航线角至某**DME**距离	保持 **292°** 爬升至**FFM DME 10NM.**		
CF	保持航线角至定位点	切入 **FFM R-030**径向线至**PAVEL.**	**X**	**X**
CI	保持航线角切入下一航段	右转保持航迹**292°** 切入**FFM R-030°**径向线**.**		
CR	保持航线角至某径向线	保持航迹 **250°**， 进入**FFM R-030 °**径向方位右转直飞 **COL VOR/DME**台**.**		

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Path Terminators Examples (2)

LEG	DESCRIPTION	EXAMPLE	ICAO RNAV	RNP
DF	Direct to a fix	Turn right, direct to RENNO Int.	X	X
FA	Course from a fix to an Altitude	Climb on FRA R-292 to 1’000’.	X	X
FD	Course from a fix to a DME distance	From FELIX Int. track 292 to 10 DME FFM.		
FC	From a fix to a distance	Start turn after 1 min (FMS coding 3.5 NM)		
FM	Course from a fix to a Manual Termination	From PIRET Int. track 292. Expect radar vectors to final APCH.	x	
IF	Initial Fix	Used to identify a starting fix.	X	X

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航径终结码示例 (2)

航段	描述	示例	ICAO RNAV	RNP
DF	直飞某定位点	右转，直飞至定位点**RENNO.**	**X**	**X**
FA	从某定位点至某高度	沿 **FRA R-292°** 径向线爬升至 **1’000’.**	**X**	**X**
FD	从某定位点保持航线角至某**DME**距离	从定位点**FELIX**沿航迹 **292°** 至**FFM DME 10NM.**		
FC	从某定位点至一距离点	**1**分钟后开始转弯 **(FMS** 编码 **3.5 NM)**		
FM	从某定位点保持航线角至人工终点	从定位点 **PIRET**沿航迹**292°** 飞行，直至雷达引导至最后进近。	**x**	
IF	起始定位点	用于识别一个开始点。	**X**	**X**

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Path Terminators Examples (3)

LEG	DESCRIPTION	EXAMPLE	ICAO RNAV	RNP
HF	Hold and terminate when crossing fix second time	Course reversal procedures	X	X
HA	Climb in Holding Pattern to ALT	Climb in FFM holding pattern to 3’000 ft before continuing on course to ERTLR.	X	X
HM	Hold with Manual Termination	Direct to FFM and hold.	X	X
PI	Procedure Turn to intercept inbound leg	045/180 Course Reversal to inbound leg.		
RF	Constant Radius to a fix (Arc Center is a fix)	Maintain a fixed radius around a fix.	X	X
TF	Track to fix / Track between two fixes	From HOLTM Int. track 250 to VORSM Int.	X	X

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Path Terminators Examples (3)

航段	描述	示例	ICAO RNAV	RNP
HF	等待，二次过定位点时结束	反向程序	**X**	**X**
HA	在等待中爬升至 某高度	保持航迹飞向**ERTLR**前，在**FFM**点做等待爬升至**3’000** 英尺.	**X**	**X**
HM	人工结束等待	直飞 **FFM** 并等待.	**X**	**X**
PI	程序转弯切入入航边	**045**° **/180**° 程序转弯至入航边		
RF	固定转弯半径至定位点 (圆弧中心为一个定位点)	保持固定半径绕定点飞行.	**X**	**X**
TF	保持航迹至定位点 / 两定位点之间的航迹	从定位点**HOLTM** 沿航迹 **250**° 至定位点 **VORSM** .	**X**	**X**

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A few Fly-by vs Fly-Over Rules

- Fixes on straight lines are fly-by fixes.
- MAPt are fly-over fixes on RNAV, but fly-by fixes on RNP for straight missed approaches.
- Ending fixes on all xR legs are considered flyover fixes.
- Ending fixes on all xD legs are considered flyover fixes.
- Beginning and ending fixes on RF legs must be fly-by fixes.

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一些旁切 与飞越的规则

- 直线上的定位点为旁切定位点。
- **RNAV**中复飞点为飞越定位点，但在**RNP**中，如果是直线复飞，则复飞点为旁切定位点。
- 所有**xR**航段的终点，应考虑设置为飞越定位点。
- 所有**xD**航段的终点，应考虑设置为飞越定位点。
- **RF**航段的起始点和终点，必须为旁切定位点。

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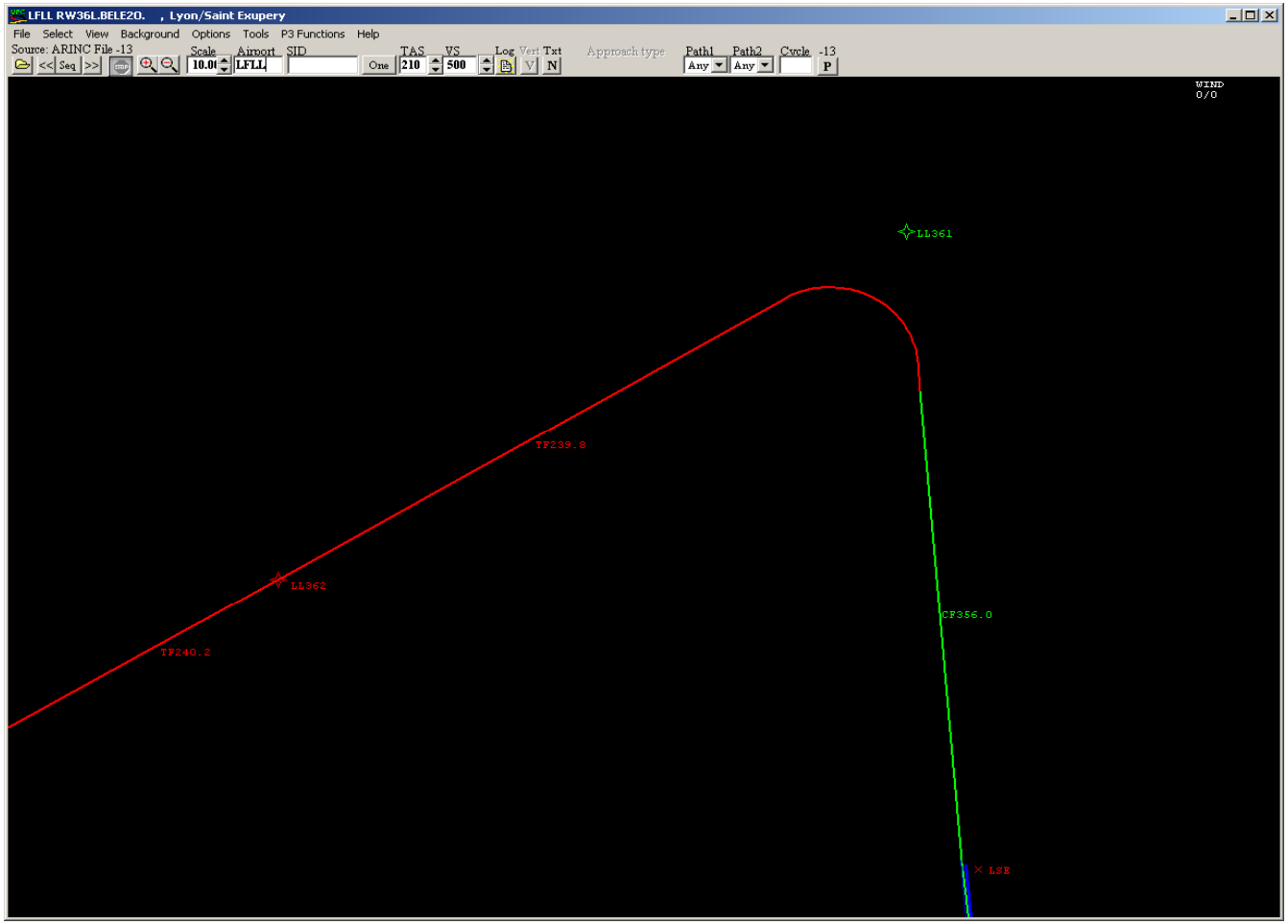
Example of CF - TF Coding “flyby”



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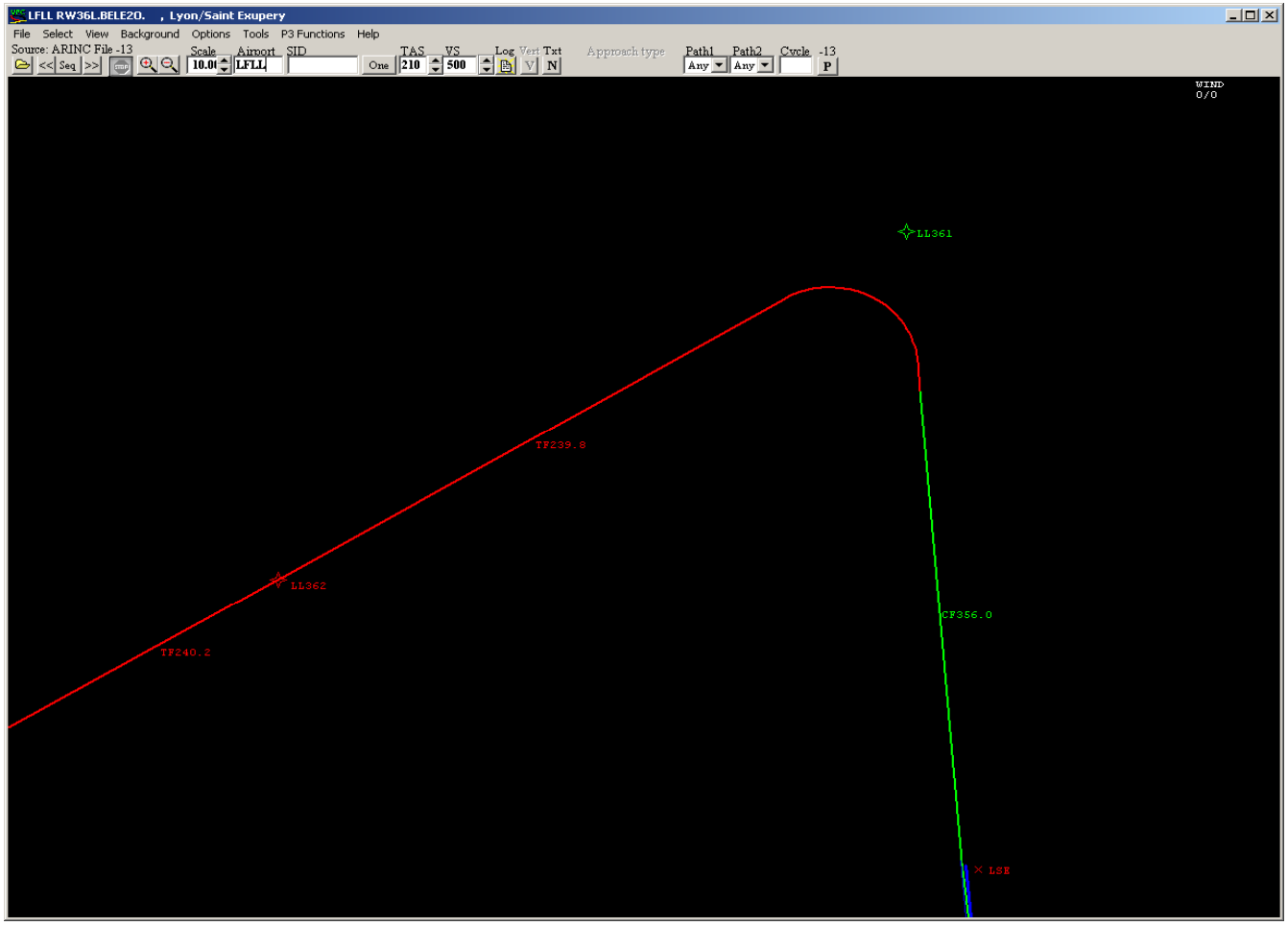
示例：CF-TF编码“旁切”



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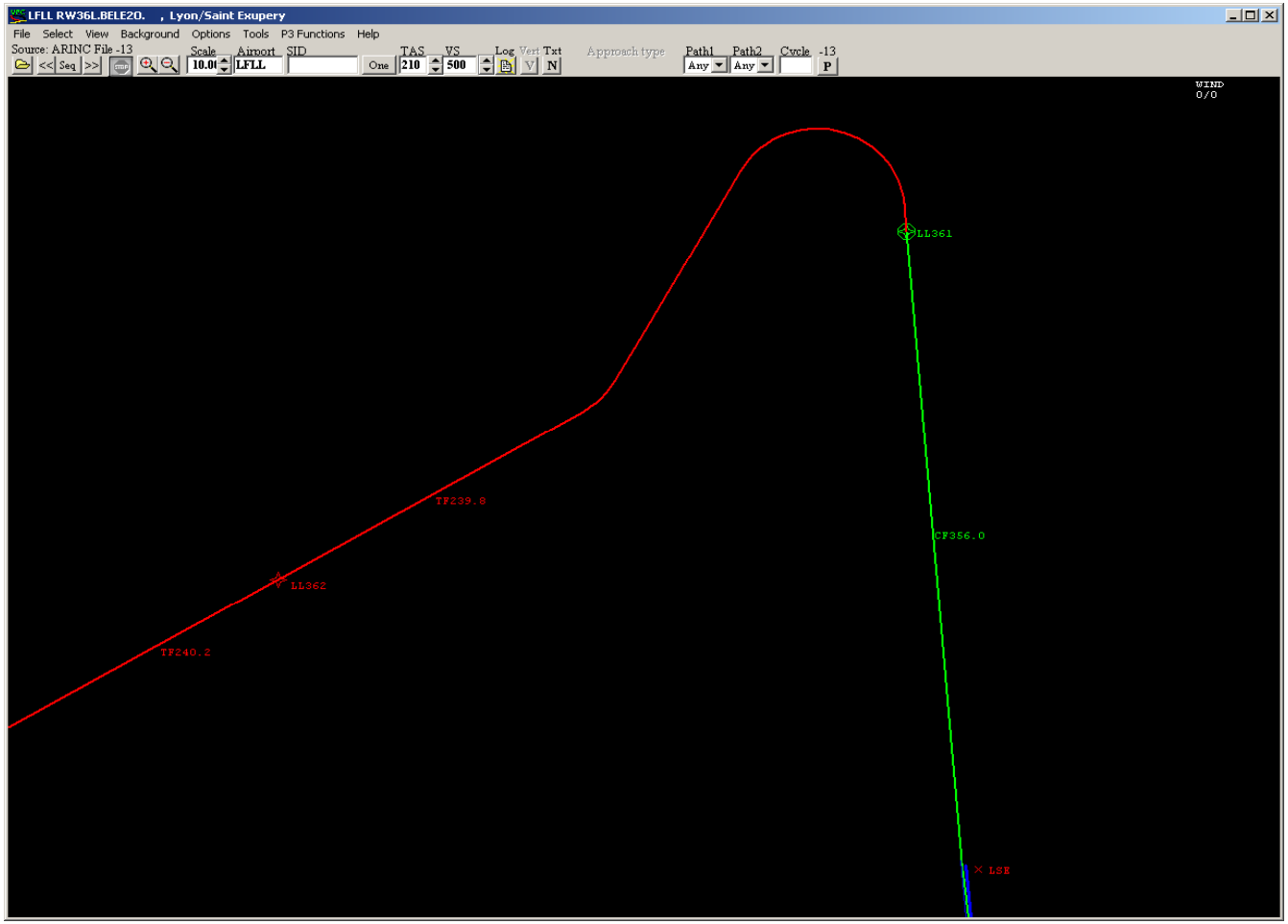
Example of CF - TF Coding “flyover”



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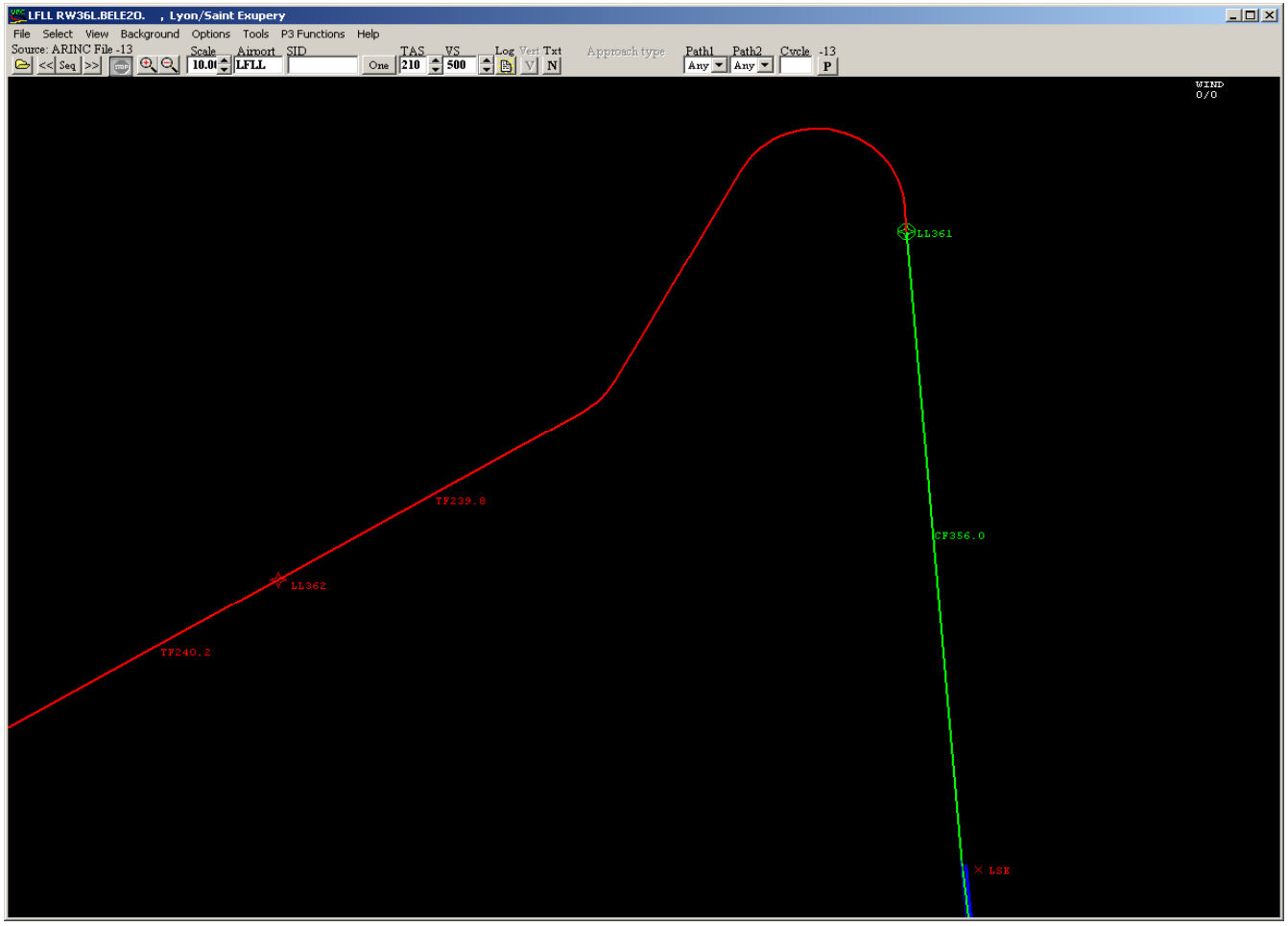
示例： CF - TF 编码“飞越”



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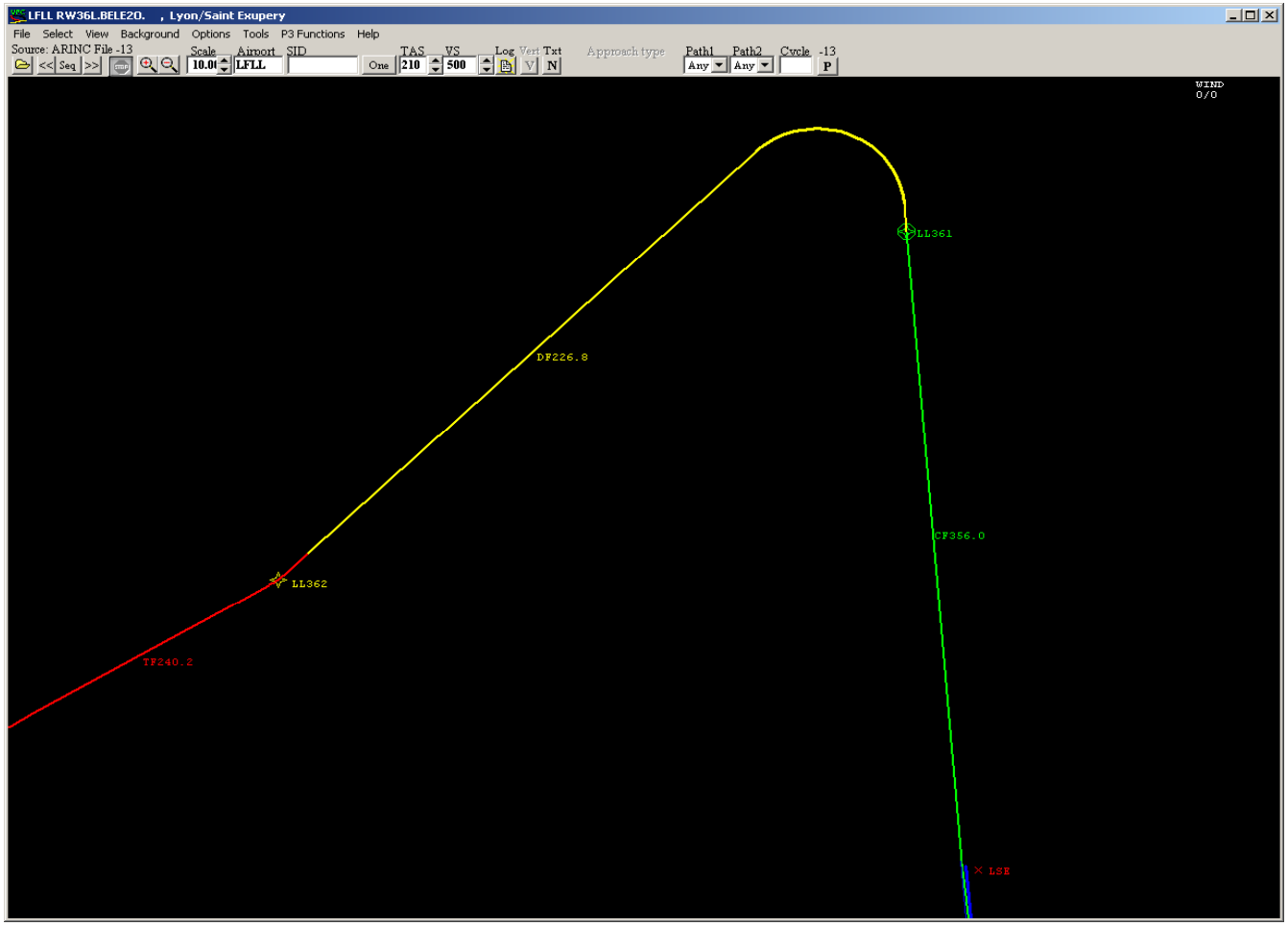
Example of CF - DF Coding



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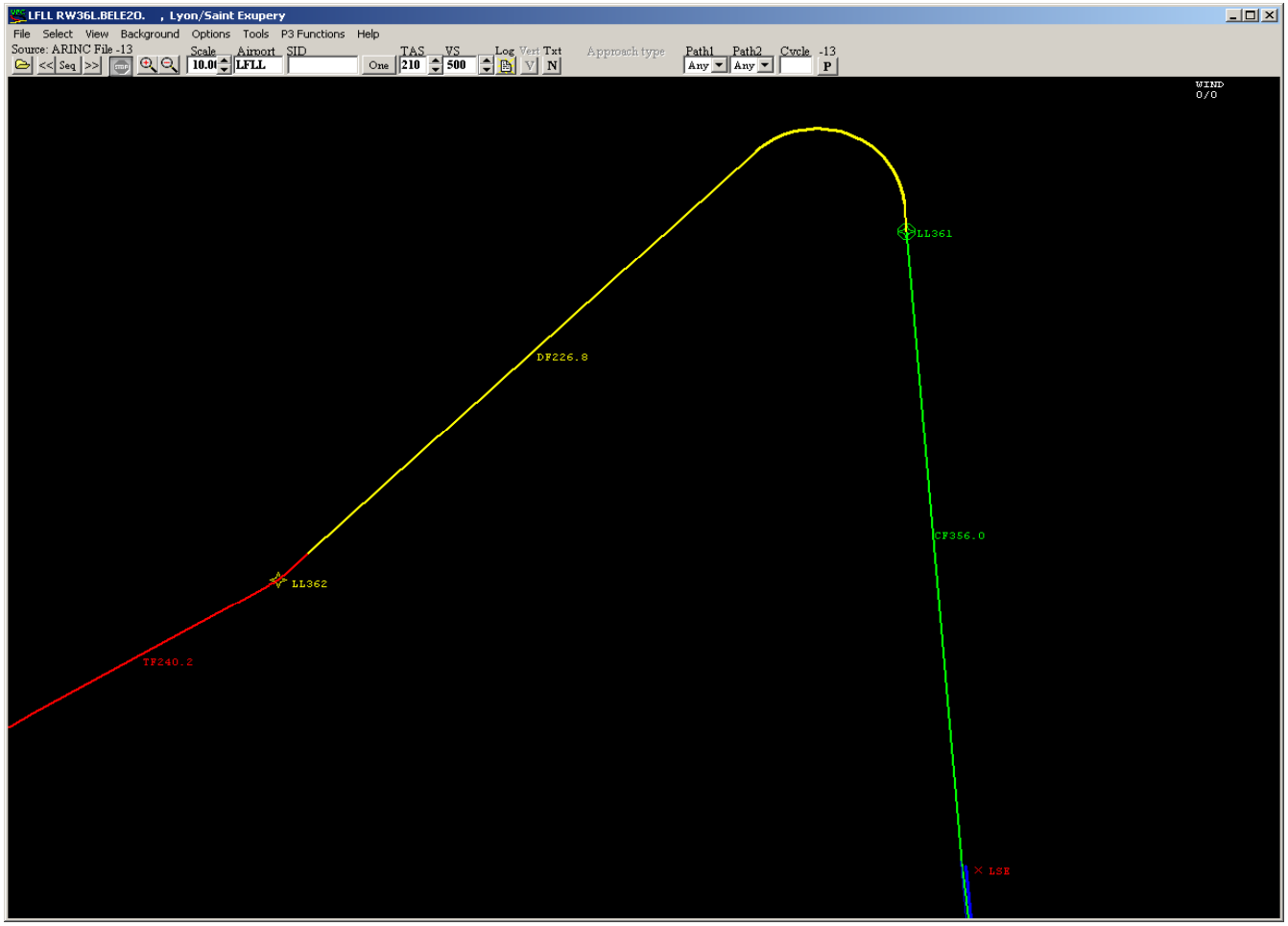
示例：CF - DF 编码



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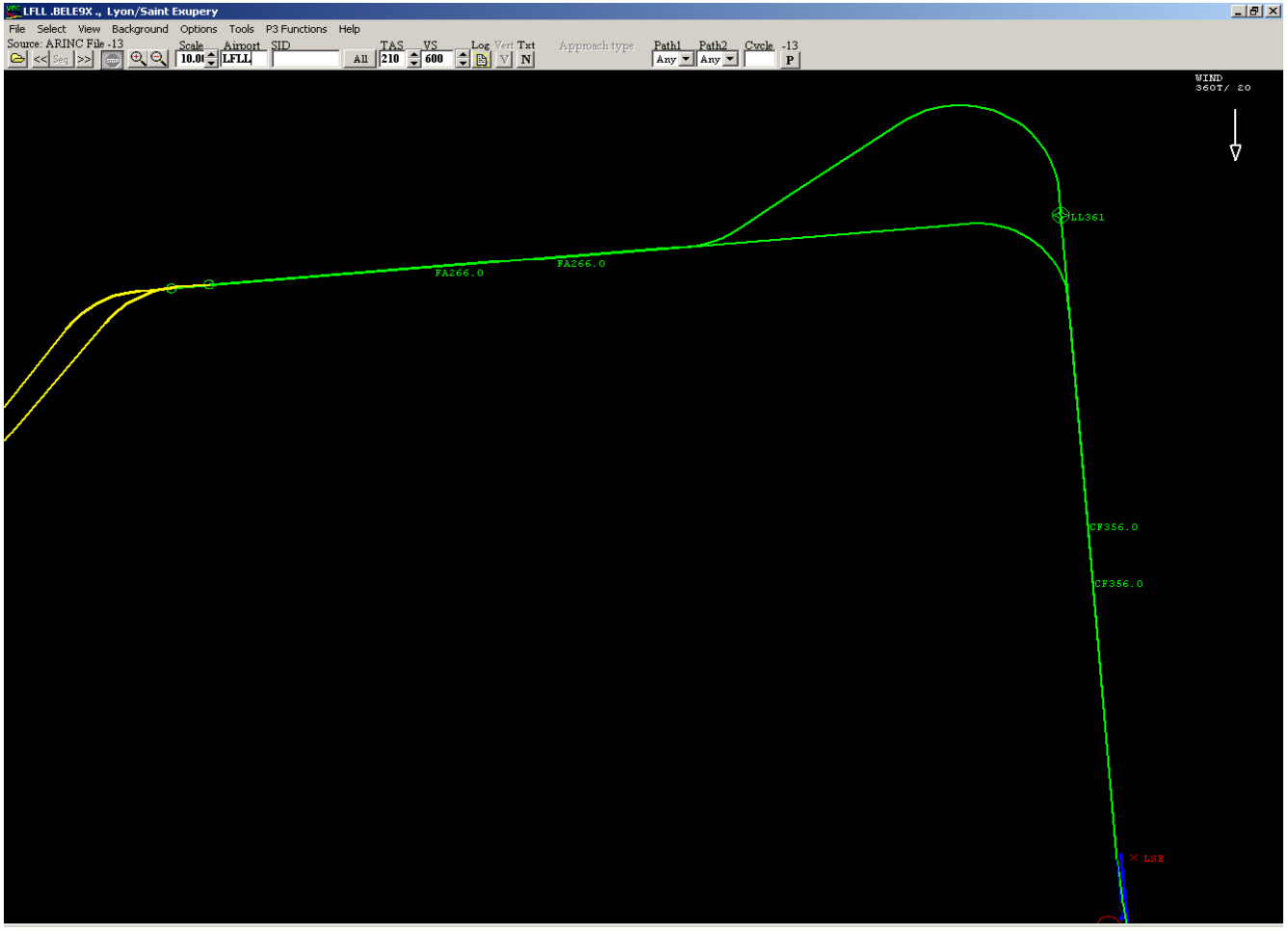
FA Legs “flyover vs. flyby”



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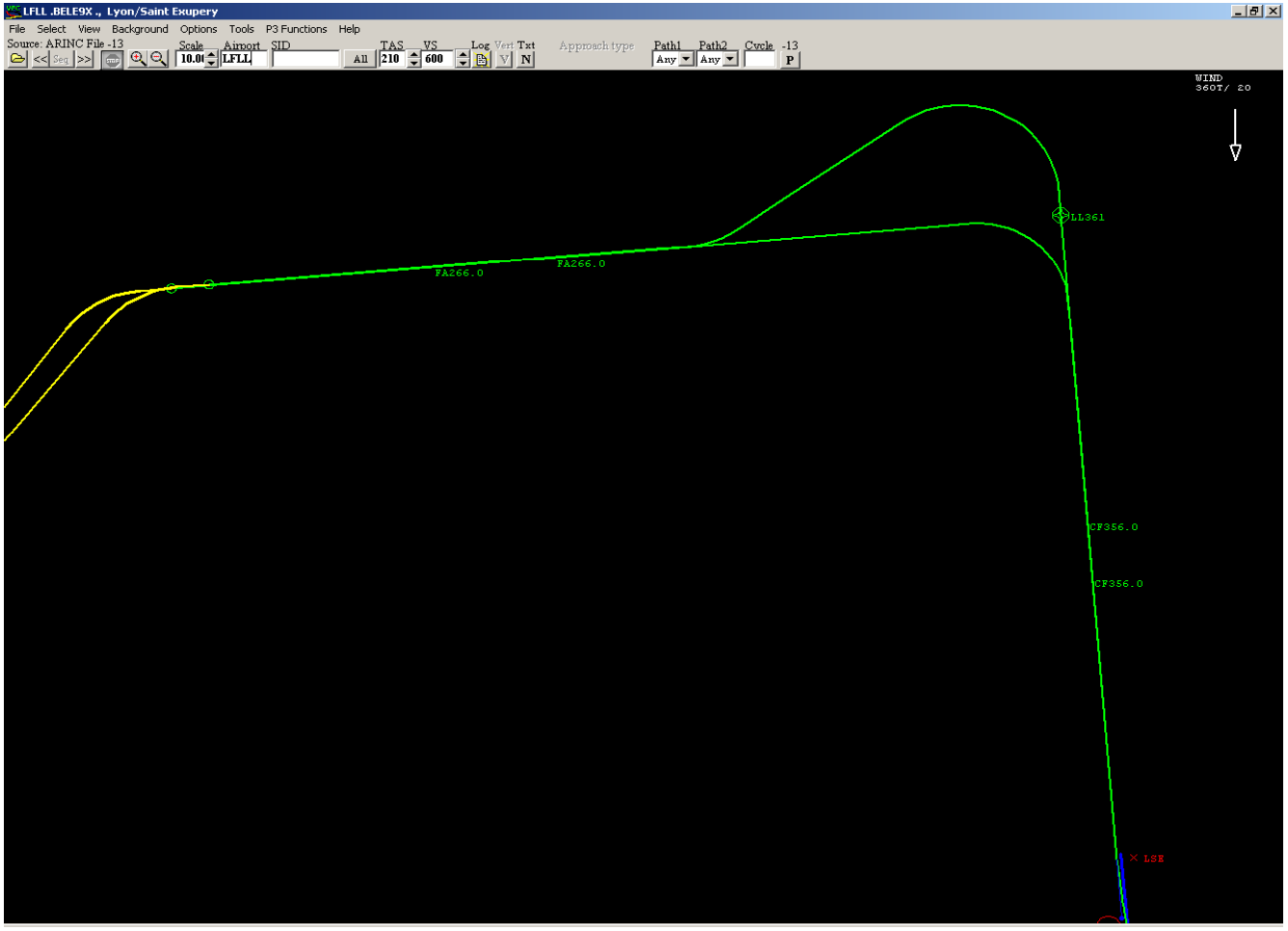
FA 航段 “飞越”与“旁切”对比图



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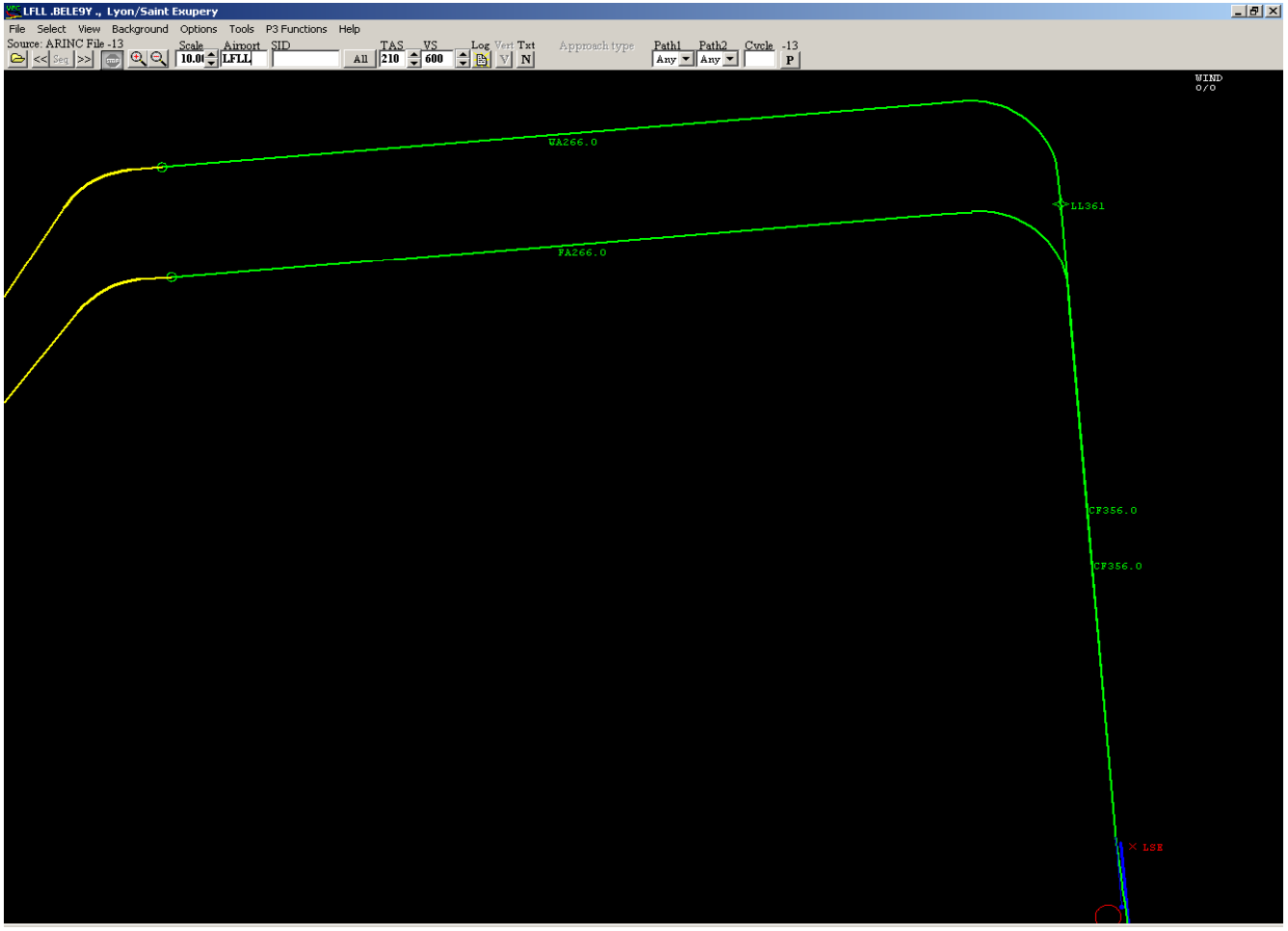
FA vs. CA vs. VA Legs
“no” Wind



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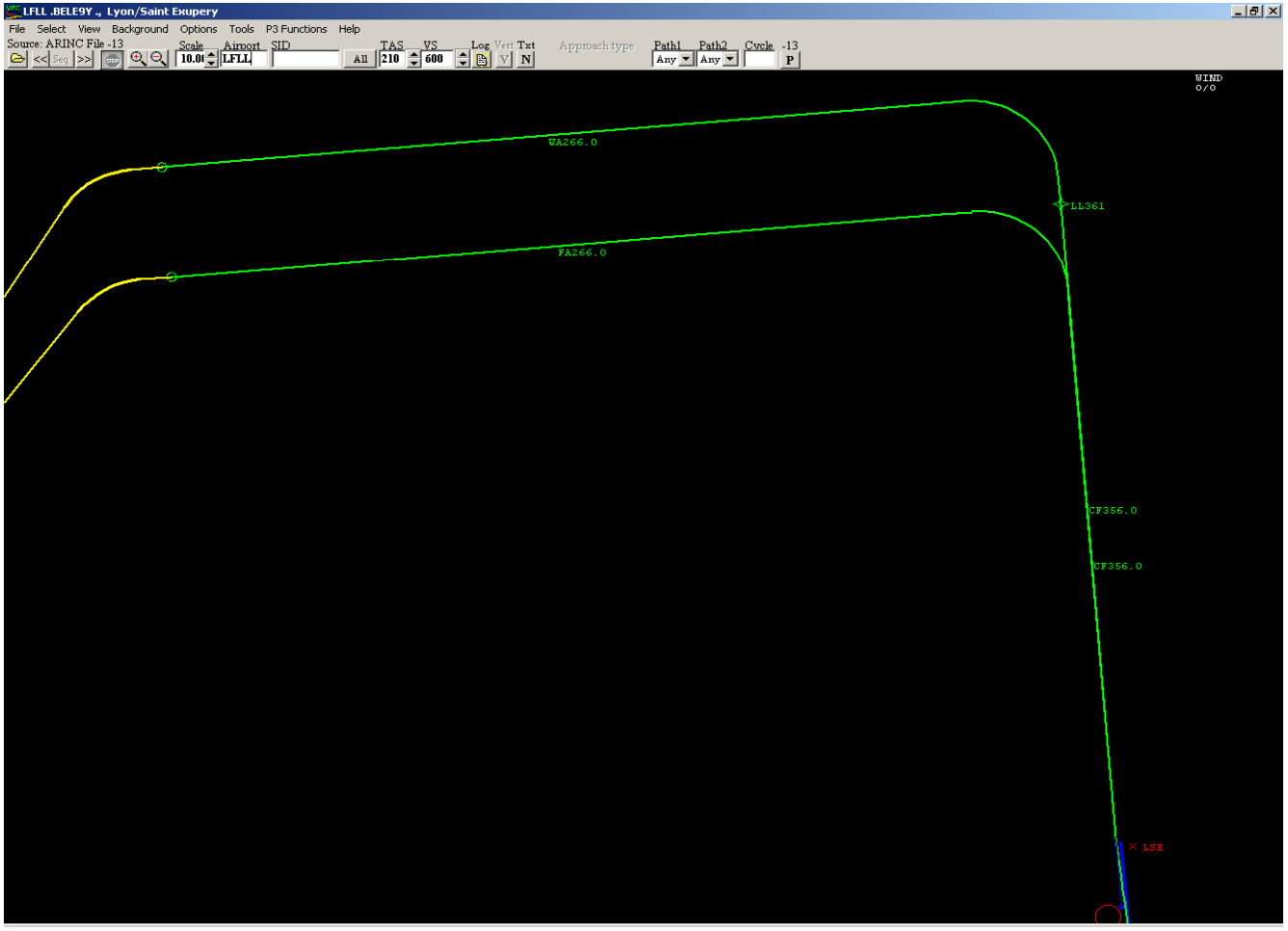
FA 、 CA 、 VA比较
无风情况



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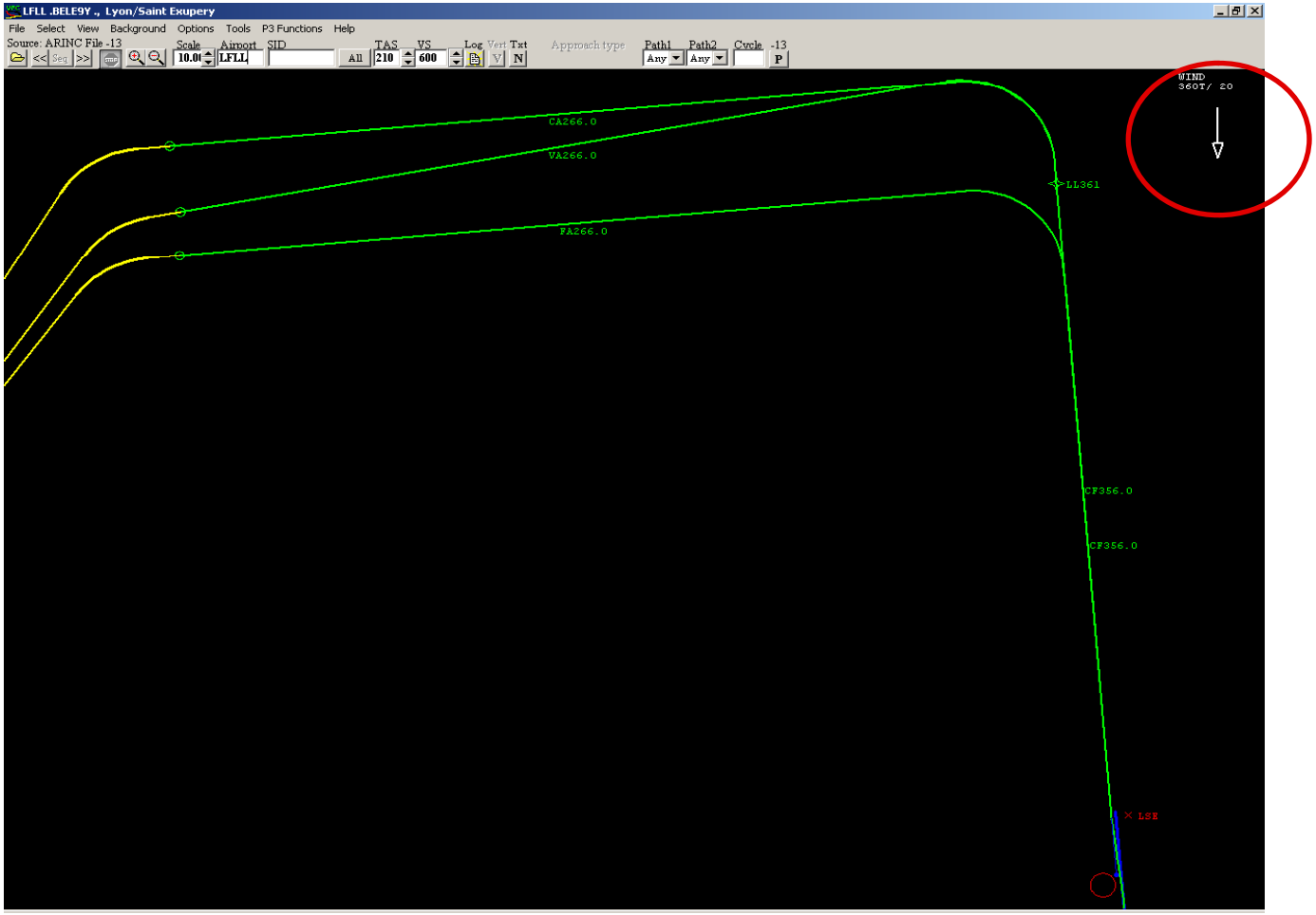
FA vs. CA vs. VA Legs
Wind from north 20kts



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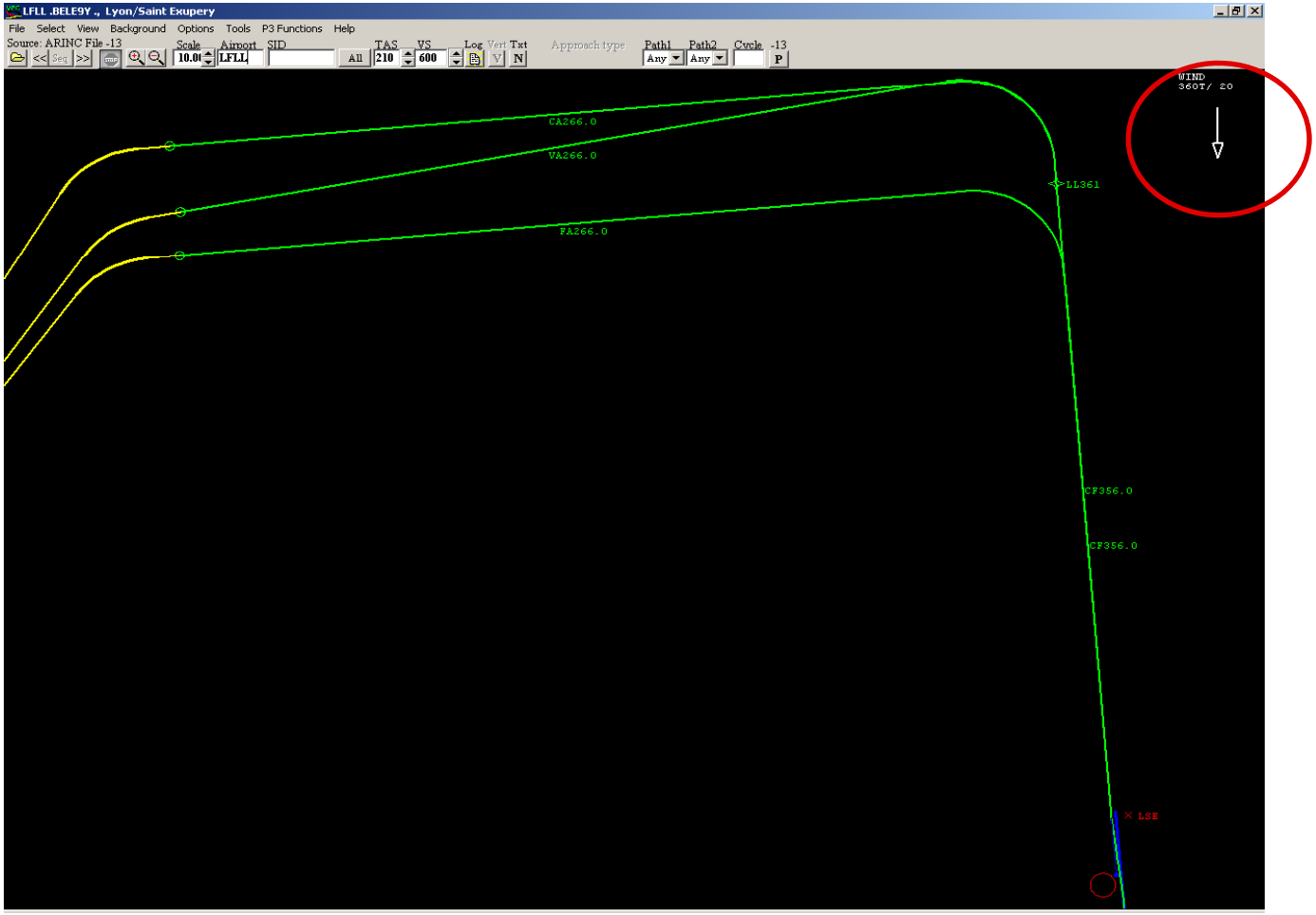
FA 、 CA 、 VA航段比较
北风**20kt**



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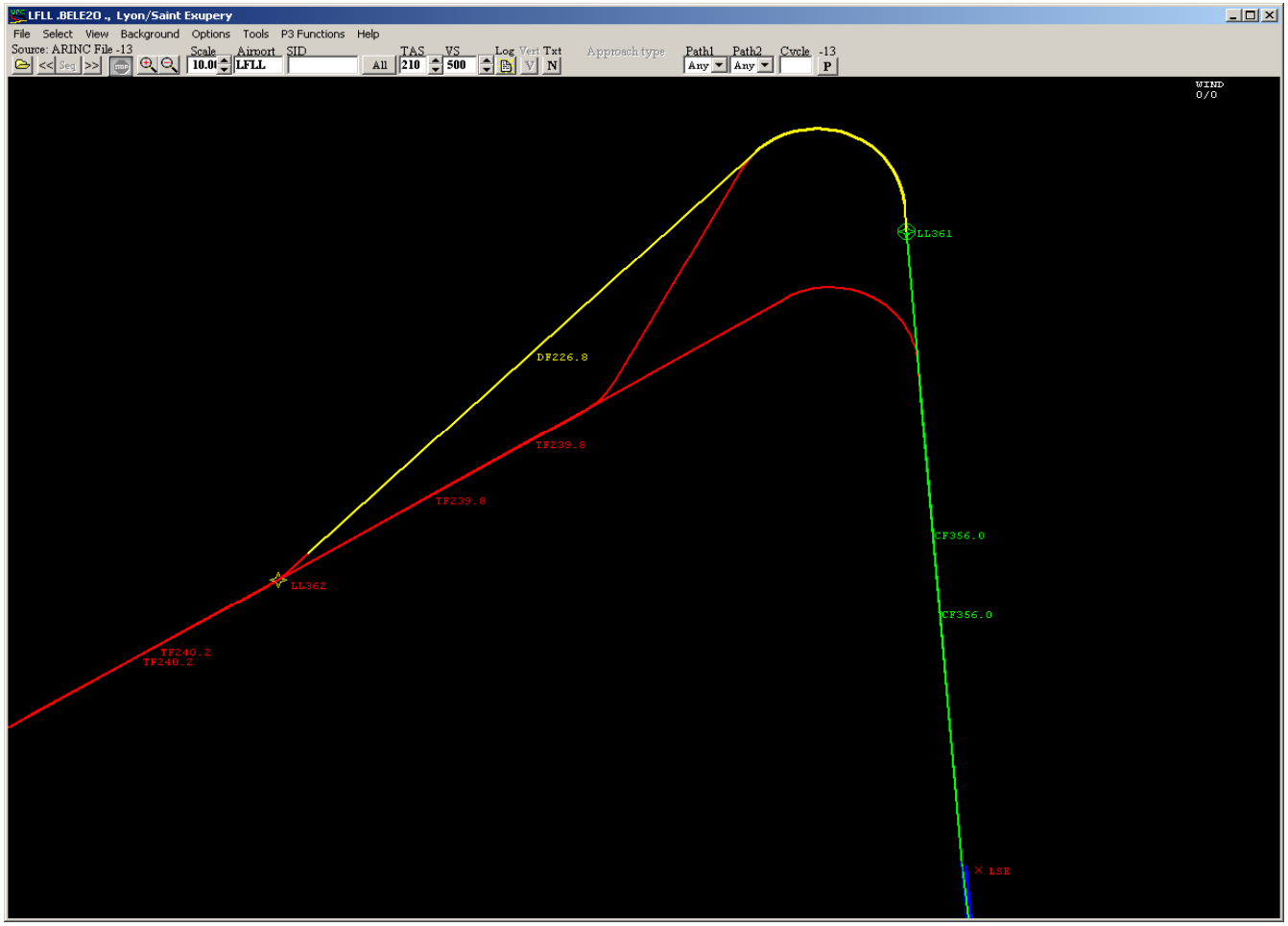
Example of CF - xF Coding



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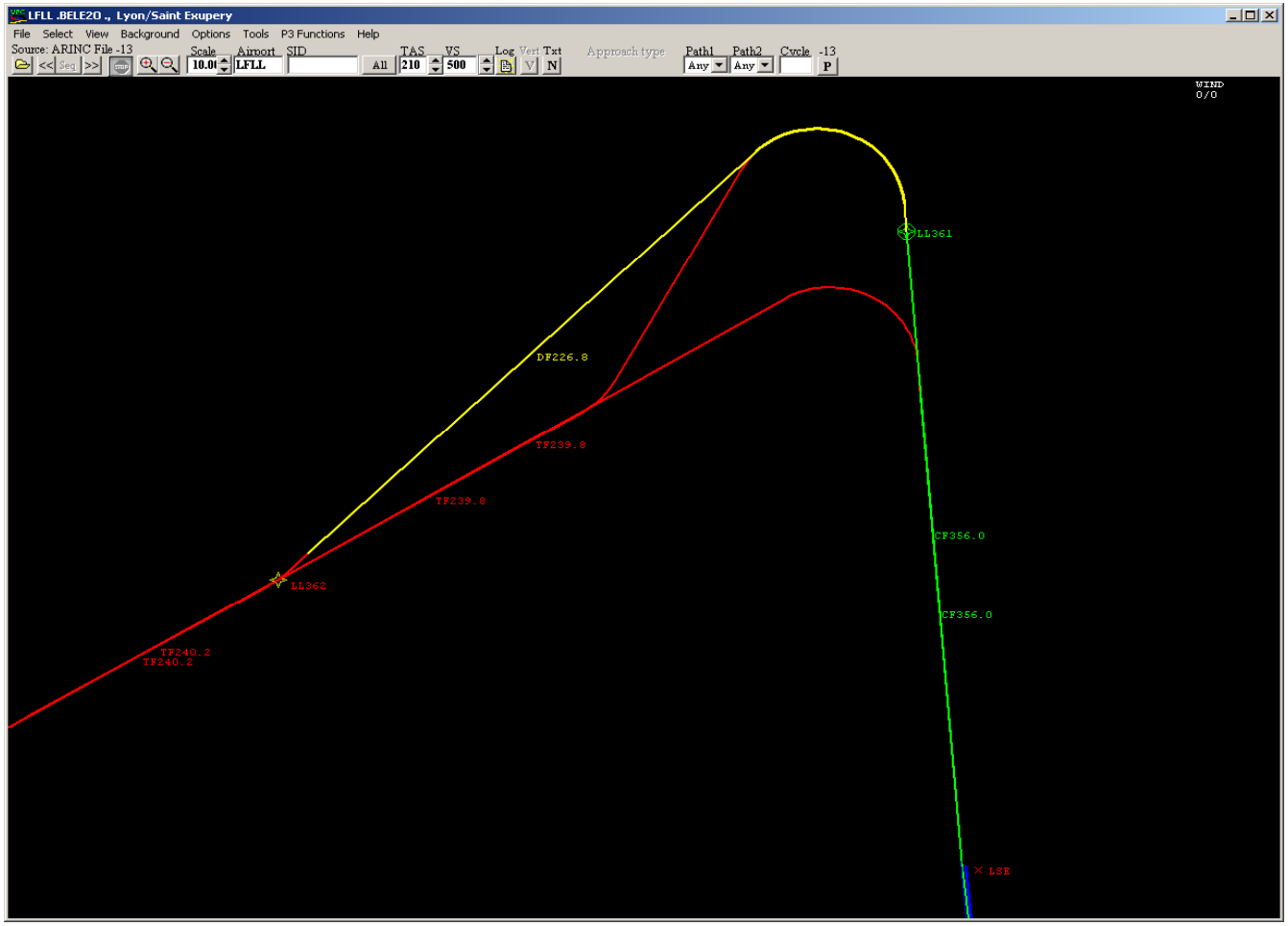
CF - xF 编码示例



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Review and Discussion

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复习与讨论

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Agenda

ARINC 424

- History & Purpose
- File Structure and Record Layout
- Path Terminator
- **Route Types**
- Coding Demonstration

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议题

ARINC 424

- 历史 & 目的
- 文件结构与记录格式
- 航径终结码
- **航路类型**
- 编码演示

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Route Type Concept

What are Route Types?

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航路类型概念

什么是航路类型？

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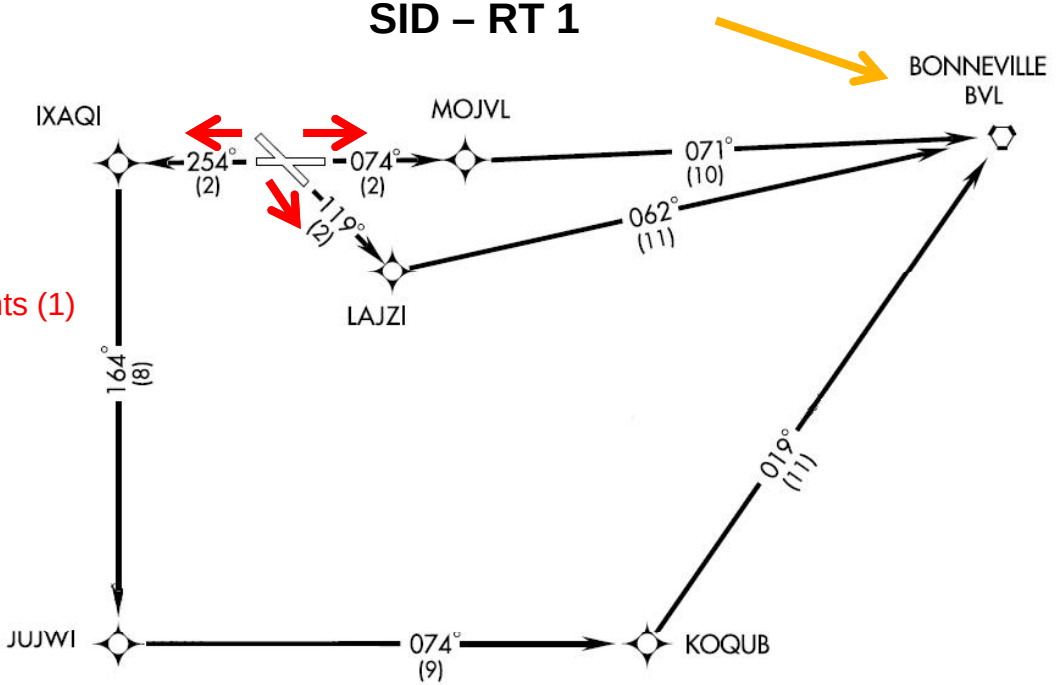
Route Type Concept

- multiple runway segments (1)
- same/single end fix
- no common segment

SID – RT 1

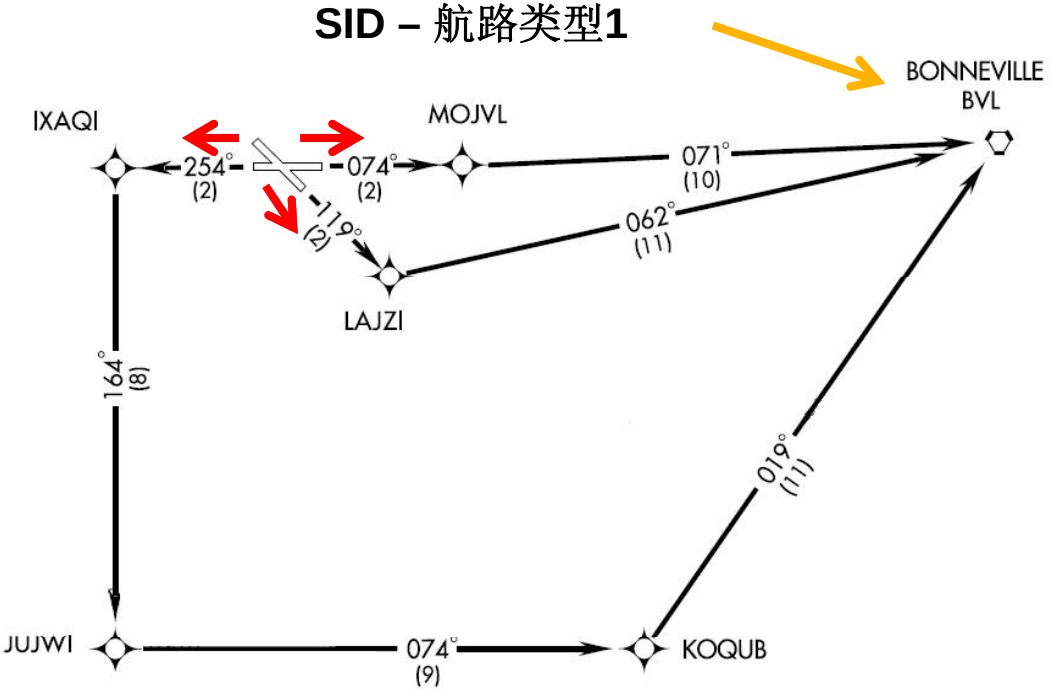


SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
ENV1	1	RW08	010	MOJVL	K2 EA	E _ _ _	CF
ENV1	1	RW08	020	BVL	K2 D	V E _ _	TF
ENV1	1	RW12	010	LAJZI	K2 EA	E _ _ _	CF
ENV1	1	RW12	020	BVL	K2 D	V E _ _	TF
ENV1	1	RW26	010	IXAQI	K2 EA	E _ _ _	CF
ENV1	1	RW26	020	JUJWI	K2 EA	E _ _ _	TF
ENV1	1	RW26	030	KOQUB	K2 EA	E _ _ _	TF
ENV1	1	RW26	040	BVL	K2 D	V E _ _	TF

航路类型基本概念

SID – 航路类型1

- 多跑道航段 (1)
- 相同/单一终止点
- 没有共用航段



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
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ENV1	1	RW08	020	BVL	K2 D	V E _ _	TF
ENV1	1	RW12	010	LAJZI	K2 EA	E _ _ _	CF
ENV1	1	RW12	020	BVL	K2 D	V E _ _	TF
ENV1	1	RW26	010	IXAQI	K2 EA	E _ _ _	CF
ENV1	1	RW26	020	JUJWI	K2 EA	E _ _ _	TF
ENV1	1	RW26	030	KOQUB	K2 EA	E _ _ _	TF
ENV1	1	RW26	040	BVL	K2 D	V E _ _	TF

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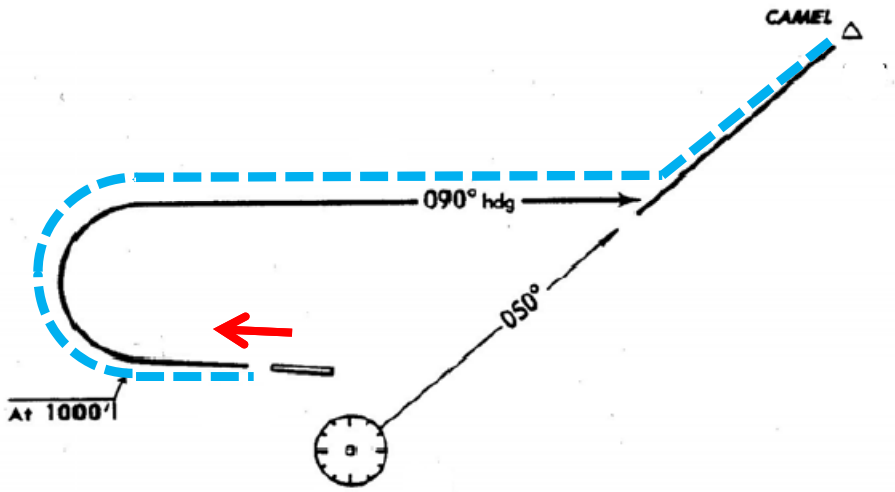
Route Type Concept

SID – RT 2

- 1 runway end
- 1 common route (2)



SID IDENT	ROUTE TYPE	TRANS IDENT	WAYPOINT IDENT	DESC CODE	PATH TERM
SID 1	2	RW29			VA
SID 1	2	RW29			VI
SID 1	2	RW29	CAMEL	EE	CF

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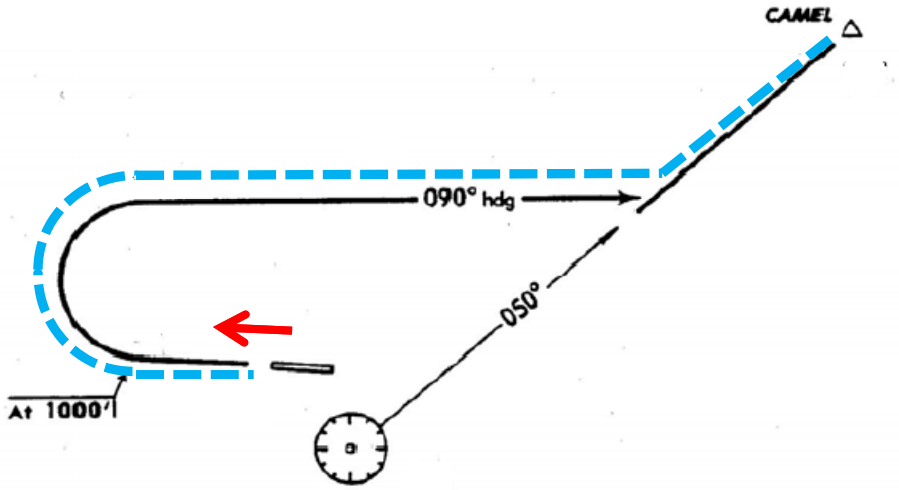
航路类型概念

SID – 航路类型 2

- 单一跑道末端
- 1 条共用航段(2)



SID IDENT	ROUTE TYPE	TRANS IDENT	WAYPOINT IDENT	DESC CODE	PATH TERM
SID 1	2	RW29			VA
SID 1	2	RW29			VI
SID 1	2	RW29	CAMEL	EE	CF

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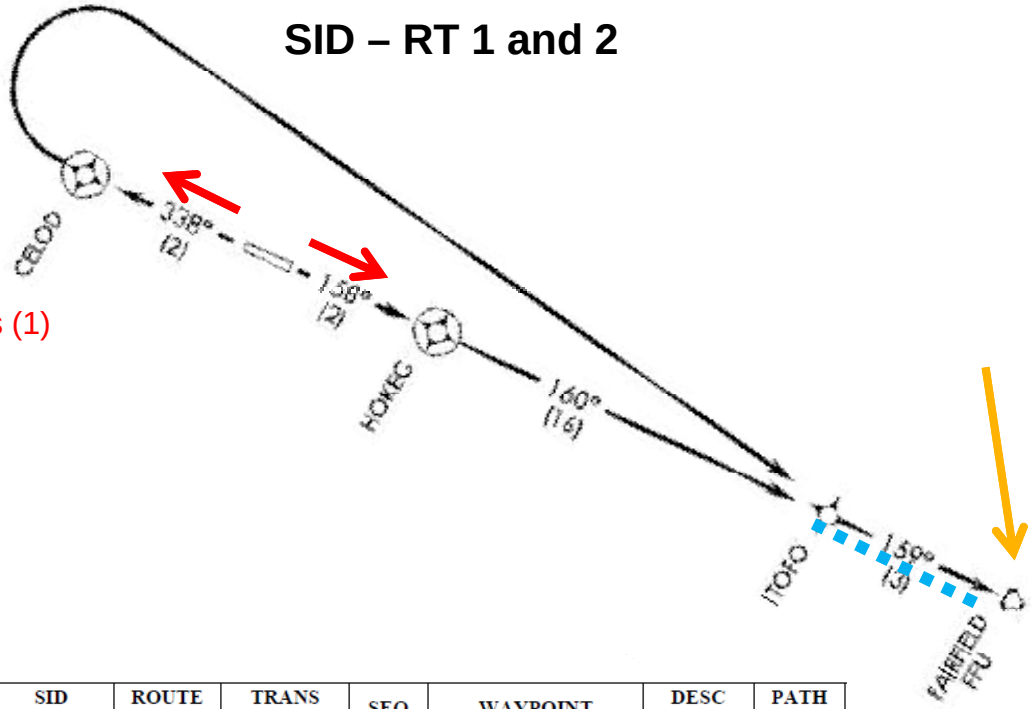
Route Type Concept

SID – RT 1 and 2

- multiple runway segments (1)
- same/single end fix
- common segment (2)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
ITOFO1	1	RW16	010	HOKEG	K2 EA	E Y _ _	CF
ITOFO1	1	RW16	020	ITOFO	K2 EA	E E _ _	TF
ITOFO1	1	RW34	010	CELOD	K2 EA	E Y _ _	CF
ITOFO1	1	RW34	020	ITOFO	K2 EA	E E _ _	DF
ITOFO1	2		010	ITOFO	K2 EA	E _ _ _	IF
ITOFO1	2		020	FFU	K2 D	V E _ _	TF

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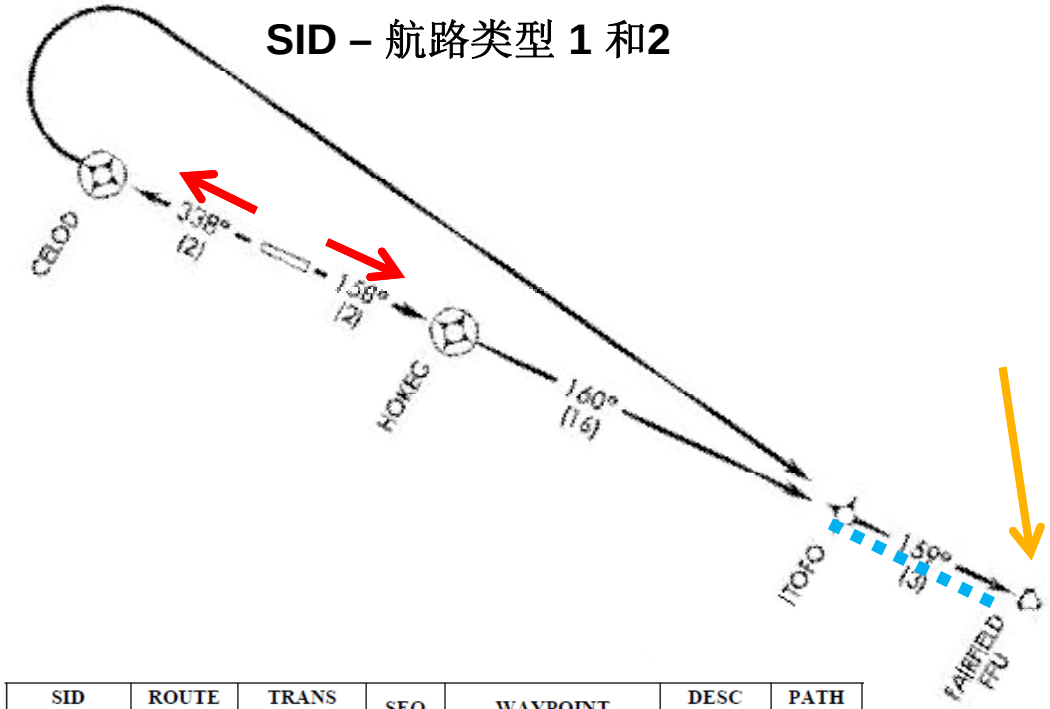
航路类型概念

SID – 航路类型 1 和2

- 多跑道航段 (1)
- 同一个终点
- 共用航段(2)



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ITOFO1	1	RW16	020	ITOFO	K2 EA	E E _ _	TF
ITOFO1	1	RW34	010	CELOD	K2 EA	E Y _ _	CF
ITOFO1	1	RW34	020	ITOFO	K2 EA	E E _ _	DF
ITOFO1	2		010	ITOFO	K2 EA	E _ _ _	IF
ITOFO1	2		020	FFU	K2 D	V E _ _	TF

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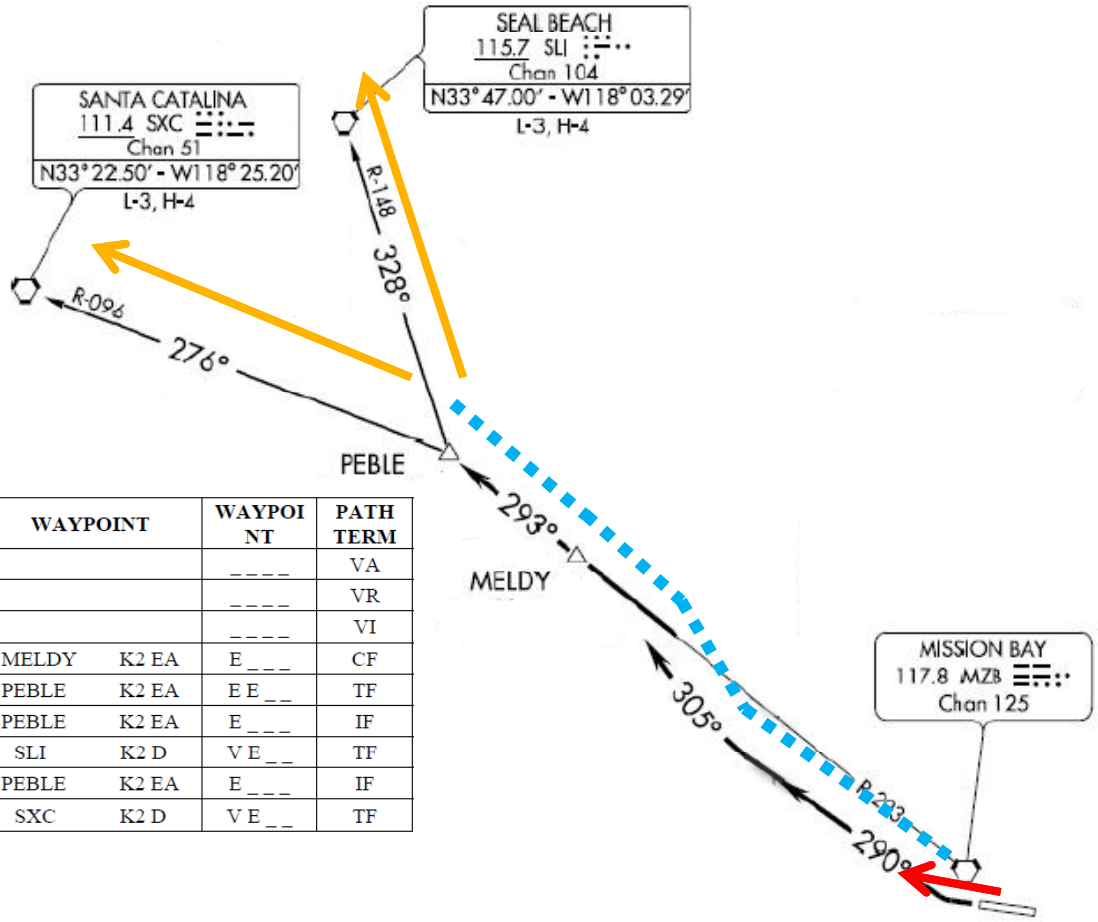
Route Type Concept

SID – RT 2 and 3

- single runway end
- common segment (2)
- multiple enroute segments (3)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		WAYPOINT	PATH TERM
PEBLE3	2	RW27	010			_ _ _ _	VA
PEBLE3	2	RW27	020			_ _ _ _	VR
PEBLE3	2	RW27	030			_ _ _ _	VI
PEBLE3	2	RW27	040	MELDY	K2 EA	E _ _ _	CF
PEBLE3	2	RW27	050	PEBLE	K2 EA	E E _ _	TF
PEBLE3	3	SLI	010	PEBLE	K2 EA	E _ _ _	IF
PEBLE3	3	SLI	020	SLI	K2 D	V E _ _	TF
PEBLE3	3	SXC	010	PEBLE	K2 EA	E _ _ _	IF
PEBLE3	3	SXC	020	SXC	K2 D	V E _ _	TF

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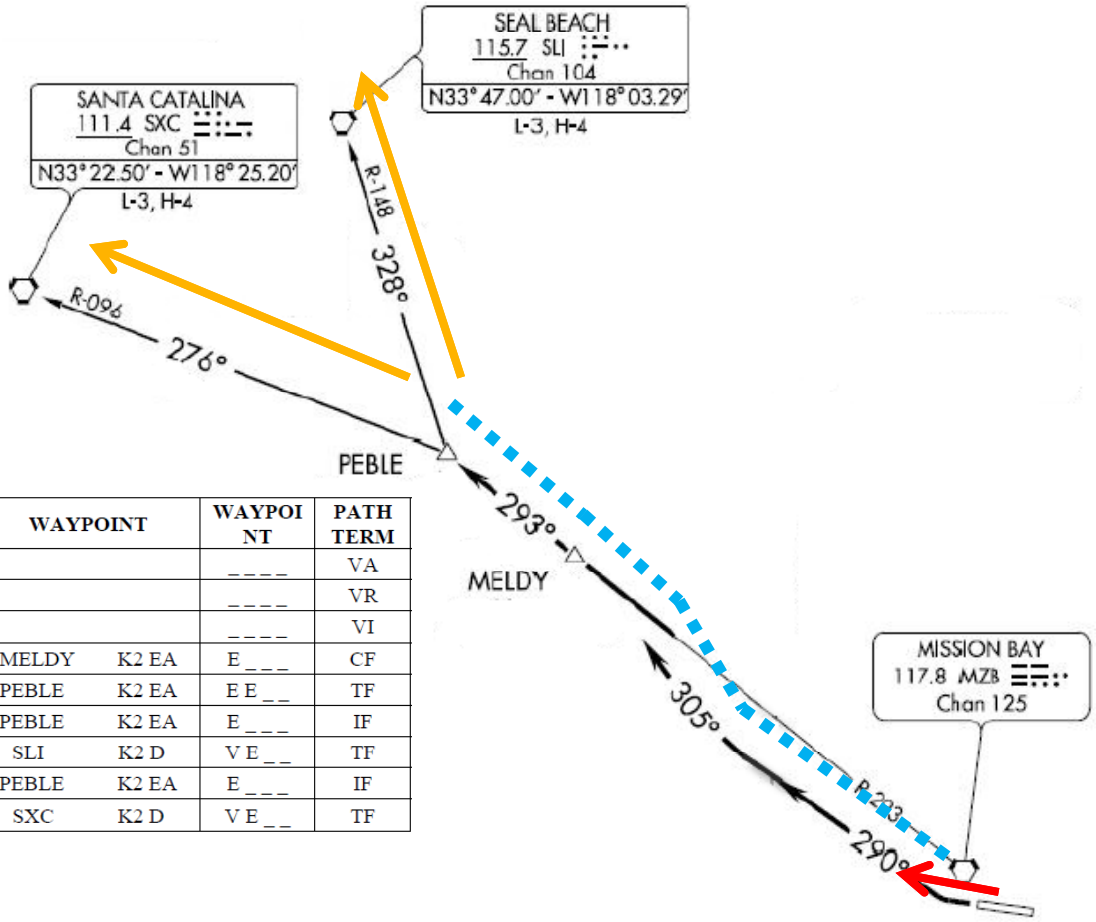
航路类型基本概念

SID – 航路类型2 和 3

- 单一跑道末端
- 共用航段 (2)
- 多条不同航路段 (3)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		WAYPOINT	PATH TERM
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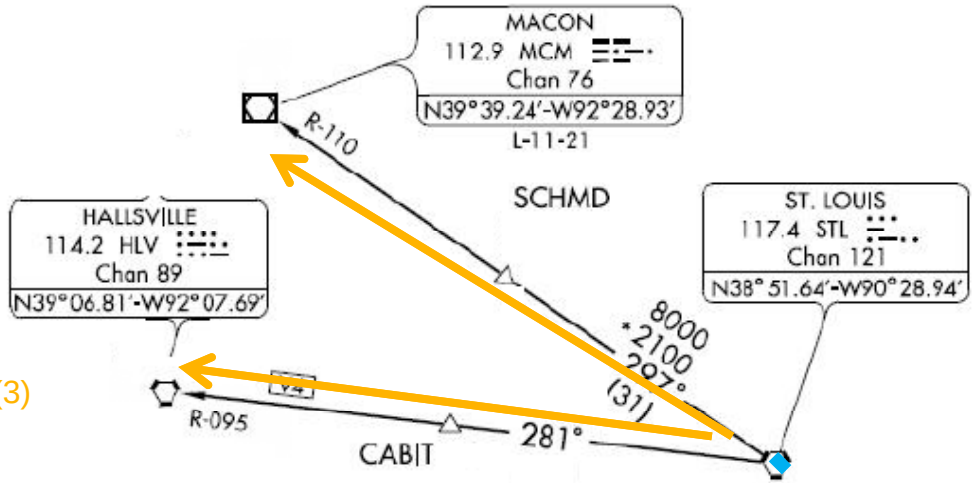
PEBLE3	2	RW27	020			_ _ _ _	VR
PEBLE3	2	RW27	030			_ _ _ _	VI
PEBLE3	2	RW27	040	MELDY	K2 EA	E _ _ _	CF
PEBLE3	2	RW27	050	PEBLE	K2 EA	E E _ _	TF
PEBLE3	3	SLI	010	PEBLE	K2 EA	E _ _ _	IF
PEBLE3	3	SLI	020	SLI	K2 D	V E _ _	TF
PEBLE3	3	SXC	010	PEBLE	K2 EA	E _ _ _	IF
PEBLE3	3	SXC	020	SXC	K2 D	V E _ _	TF

Route Type Concept

SID – RT 2 and 3

- common segment (2)
- multiple enroute segments (3)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
SNOOZ2	2	ALL	010	STL	K2 D	V E _ _	IF
SNOOZ2	3	HLV	010	STL	K2 D	V _ _ _	IF
SNOOZ2	3	HLV	020	CABIT	K2 EA	E _ _ _	TF
SNOOZ2	3	HLV	020	HLV	K2 D	V E _ _	TF
SNOOZ2	3	MCM	010	STL	K2 D	V _ _ _	IF
SNOOZ2	3	MCM	020	SCHMD	K2 EA	E _ _ _	TF
SNOOZ2	3	MCM	030	MCM	K2 D	V E _ _	TF

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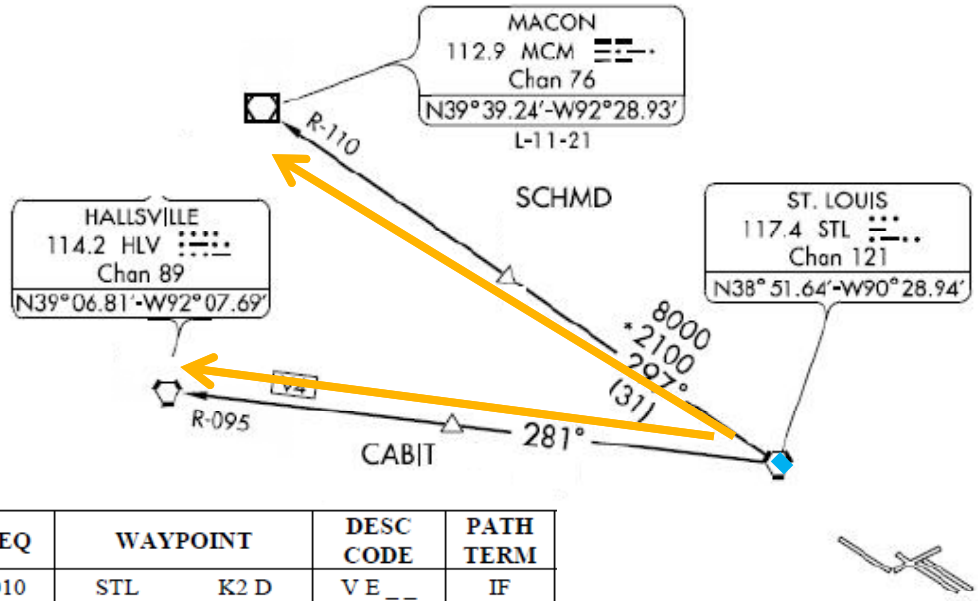
航路类型概念

SID –航路类型2 和3

- 共用航段 (2)
- 多条不同航路段 (3)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
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SNOOZ2	3	HLV	010	STL	K2 D	V _ _ _	IF
SNOOZ2	3	HLV	020	CABIT	K2 EA	E _ _ _	TF
SNOOZ2	3	HLV	020	HLV	K2 D	V E _ _	TF
SNOOZ2	3	MCM	010	STL	K2 D	V _ _ _	IF
SNOOZ2	3	MCM	020	SCHMD	K2 EA	E _ _ _	TF
SNOOZ2	3	MCM	030	MCM	K2 D	V E _ _	TF

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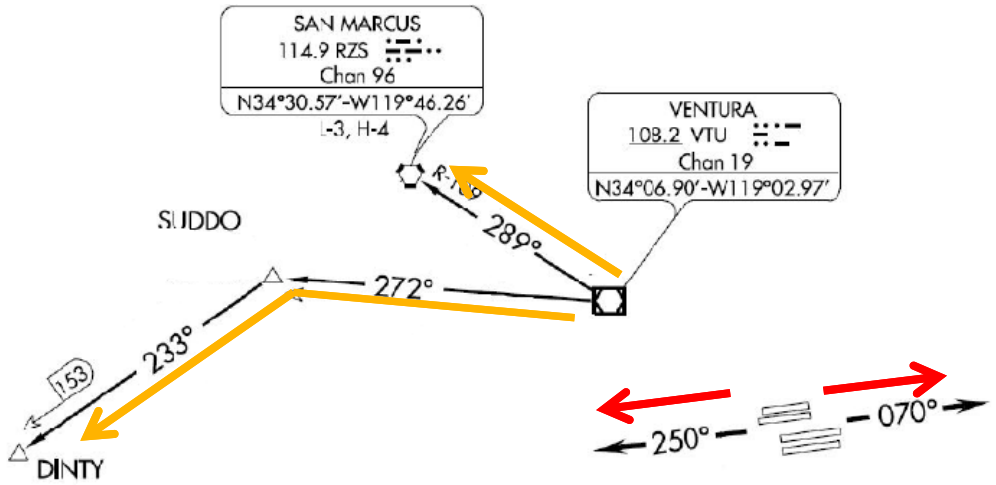
Route Type Concept

SID – RT 1 and 3

- multiple runway segments (1)
- no common segment
- multiple enroute segments (3)



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VTU5	1	RW06B	020	VTU	K2 D	V E _ _	DF
VTU5	1	RW24B	010			_ _ _ _	VM
VTU5	1	RW24B	020	VTU	K2 D	V E _ _	DF
VTU5	3	RZS	010	VTU	K2 D	V _ _ _	IF
VTU5	3	RSZ	020	RZS	K2 D	V E _ _	TF
VTU5	3	DINTY	010	VTU	K2 D	V _ _ _	IF
VTU5	3	DINTY	020	SUDDO	K2 EA	E _ _ _	TF
VTU5	3	DINTY	030	DINTY	K2 EA	E E _ _	TF

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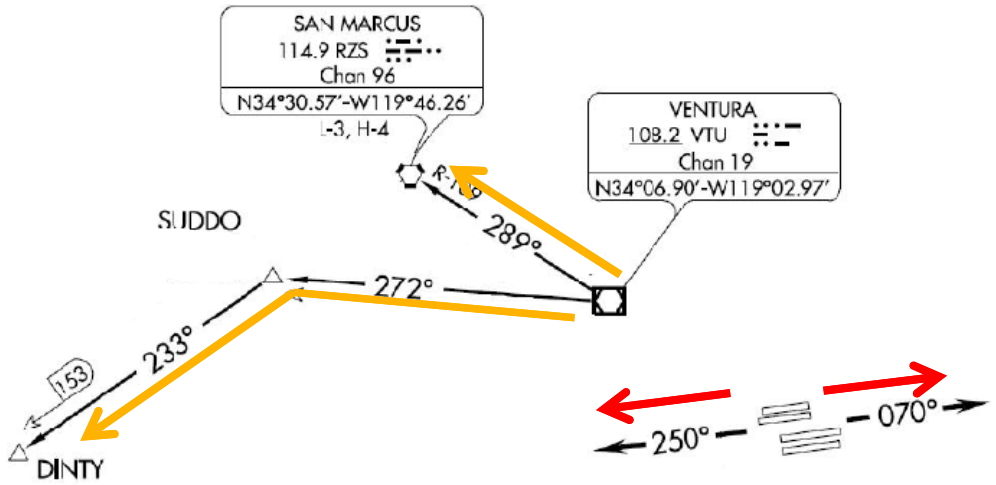
航路类型概念

SID – RT 1 and 3

- 多跑道航段 (1)
- 无共用航段
- 多条航路段 (3)



SID IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
VTU5	1	RW06B	010				VM
VTU5	1	RW06B	020	VTU	K2 D	V E	DF
VTU5	1	RW24B	010				VM
VTU5	1	RW24B	020	VTU	K2 D	V E	DF
VTU5	3	RZS	010	VTU	K2 D	V	IF
VTU5	3	RSZ	020	RZS	K2 D	V E	TF
VTU5	3	DINTY	010	VTU	K2 D	V	IF
VTU5	3	DINTY	020	SUDDO	K2 EA	E	TF
VTU5	3	DINTY	030	DINTY	K2 EA	E E	TF

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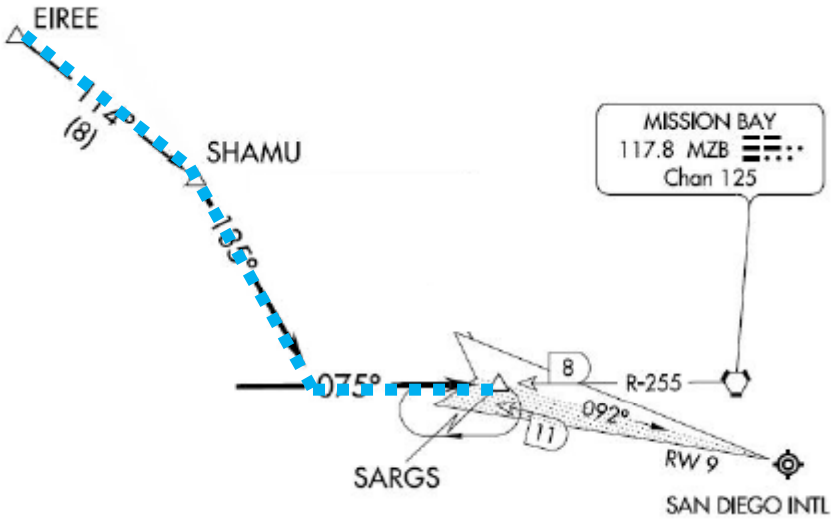
Route Type Concept

STAR – RT 2

- common route (2)

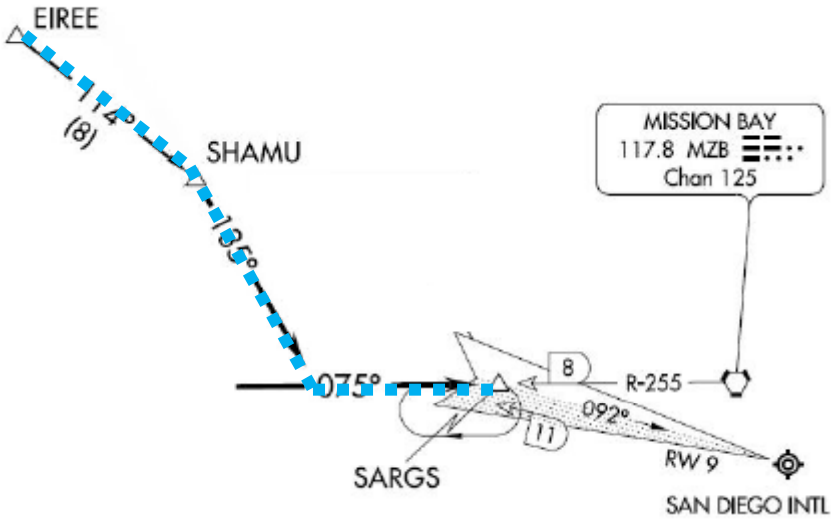


STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
SHAMU1	2	RW09	010	EIREE	K2 EA	E _ _ _	IF
SHAMU1	2	RW09	020	SHAMU	K2 EA	E _ _ _	TF
SHAMU1	2	RW09	030			_ _ _ _	VI
SHAMU1	2	RW09	040	SARGS	K2 EA	E E _ _	CF

航路类型概念

STAR – 航路类型 2

- 共用航路 (2)



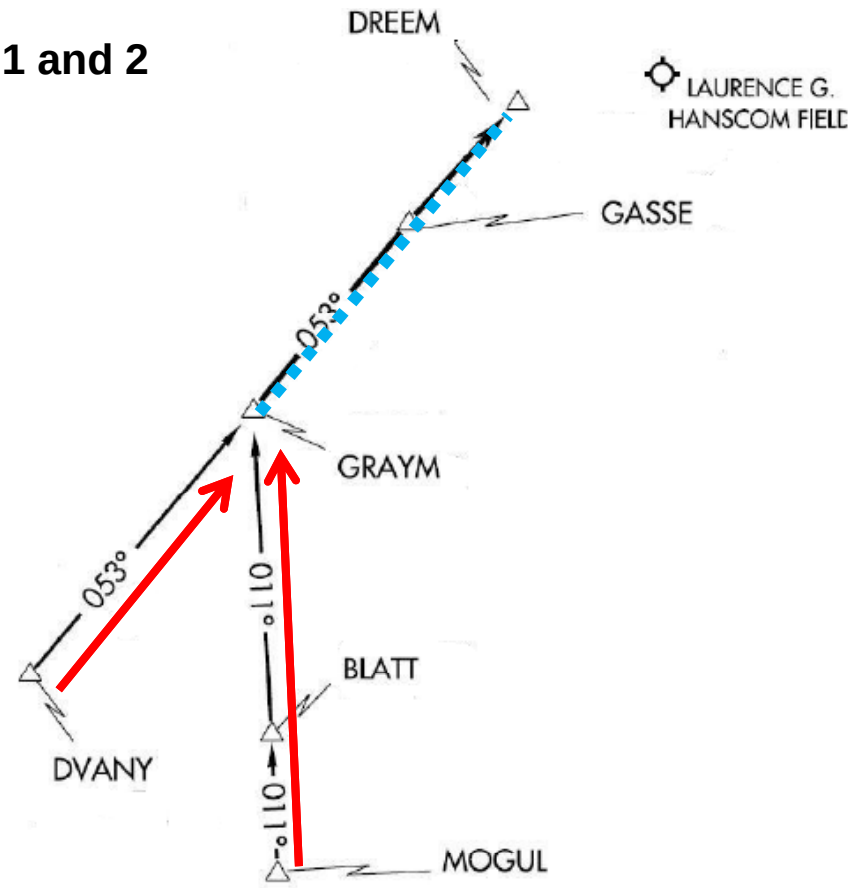
STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT	DESC CODE	PATH TERM
SHAMU1	2	RW09	010	EIREE K2 EA	E _ _ _	IF
SHAMU1	2	RW09	020	SHAMU K2 EA	E _ _ _	TF
SHAMU1	2	RW09	030		_ _ _ _	VI
SHAMU1	2	RW09	040	SARGS K2 EA	E E _ _	CF

Route Type Concept

STAR – RT 1 and 2

- multiple enroute segments (1)
  - common segment (2)

STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT	DESC CODE	PATH TERM
GRAYM2	1	DVANY	010	DVANY K6 EA	E _ _ _	IF
GRAYM2	1	DVANY	020	GRAYM K6 EA	E E _ _	TF
GRAYM2	1	MOGUL	010	MOGUL K6 EA	E _ _ _	IF
GRAYM2	1	MOGUL	020	BLATT K6 EA	E _ _ _	TF
GRAYM2	1	MOGUL	030	GRAYM K6 EA	E E _ _	TF
GRAYM2	2	ALL	010	GRAYM K6 EA	E _ _ _	IF
GRAYM2	2	ALL	020	GASSE K6 EA	E _ _ _	TF
GRAYM2	2	ALL	030	DREEM K6 EA	E E _ _	TF



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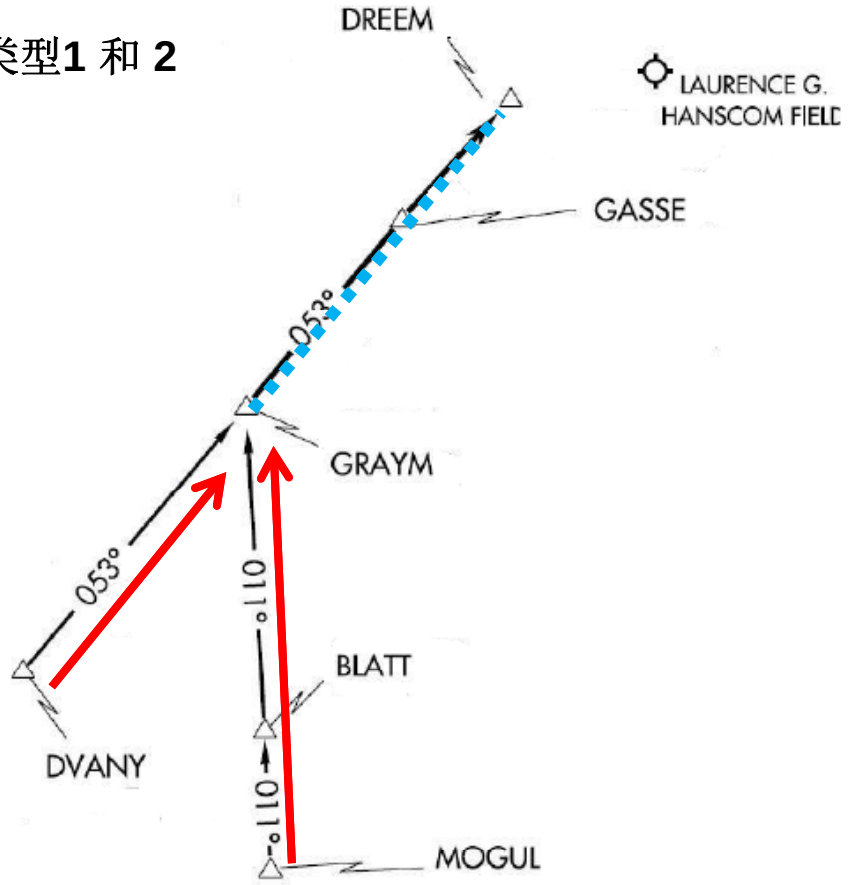
航路类型概念

STAR – 航路类型1 和 2

- 多条不同航路段 (1)
- 共用航段 (2)

STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
GRAYM2	1	DVANY	010	DVANY	K6 EA	E _ _ _	IF
GRAYM2	1	DVANY	020	GRAYM	K6 EA	E E _ _	TF
GRAYM2	1	MOGUL	010	MOGUL	K6 EA	E _ _ _	IF
GRAYM2	1	MOGUL	020	BLATT	K6 EA	E _ _ _	TF
GRAYM2	1	MOGUL	030	GRAYM	K6 EA	E E _ _	TF
GRAYM2	2	ALL	010	GRAYM	K6 EA	E _ _ _	IF
GRAYM2	2	ALL	020	GASSE	K6 EA	E _ _ _	TF
GRAYM2	2	ALL	030	DREEM	K6 EA	E E _ _	TF



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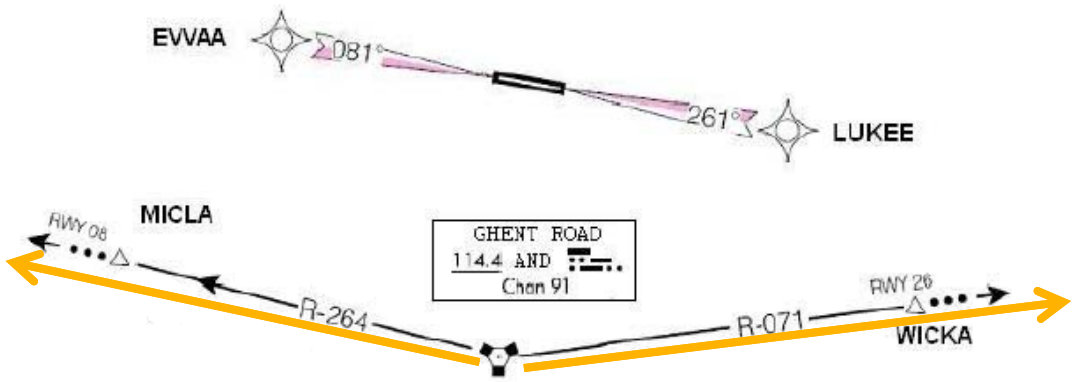
Route Type Concept

STAR – RT 3



- multiple runway segments (3)
  - no common segment

STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
GHENT1	3	RW08	010	AND	K3 D	V _ _ _	IF
GHENT1	3	RW08	020	MICLA	K3 EA	E _ _ _	TF
GHENT1	3	RW08	030	MICLA	K3 EA	E _ _ _	FM
GHENT1	3	RW08	040	EVVAA	K3 EA	E E _ _	CF
GHENT1	3	RW26	010	AND	K3 D	V _ _ _	IF
GHENT1	3	RW26	020	WICKA	K3 EA	E _ _ _	TF
GHENT1	3	RW26	030	WICKA	K3 EA	E _ _ _	FM
GHENT1	3	RW26	040	LUKEE	K3 EA	E E _ _	CF

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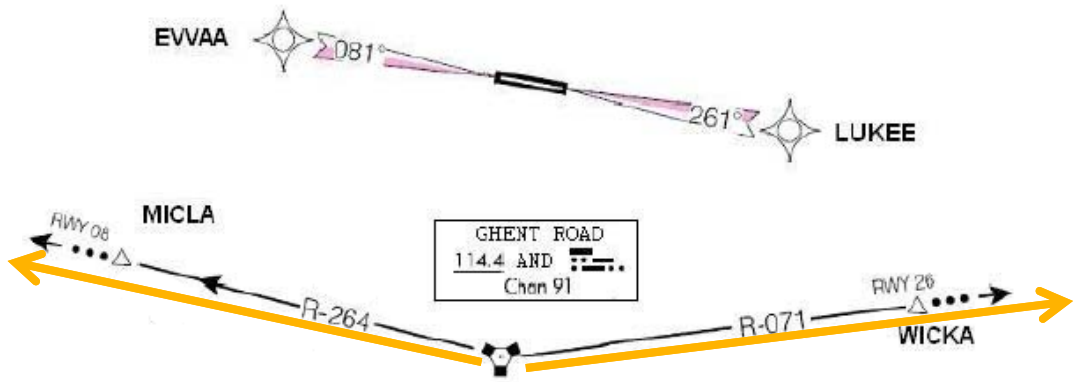
航路类型概念

STAR – 航路类型 3



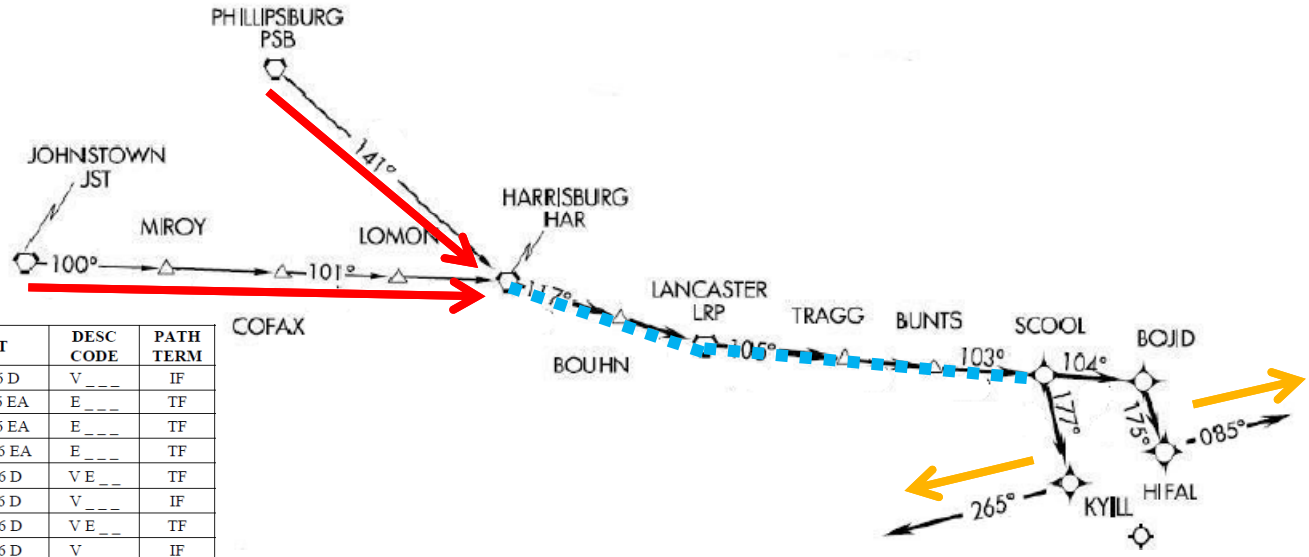
- 多跑道航段 (3)
- 无共用航段

STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
GHENT1	3	RW08	010	AND	K3 D	V _ _ _	IF
GHENT1	3	RW08	020	MICLA	K3 EA	E _ _ _	TF
GHENT1	3	RW08	030	MICLA	K3 EA	E _ _ _	FM
GHENT1	3	RW08	040	EVVAA	K3 EA	E E _ _	CF
GHENT1	3	RW26	010	AND	K3 D	V _ _ _	IF
GHENT1	3	RW26	020	WICKA	K3 EA	E _ _ _	TF
GHENT1	3	RW26	030	WICKA	K3 EA	E _ _ _	FM
GHENT1	3	RW26	040	LUKEE	K3 EA	E E _ _	CF

Route Type Concept

STAR – RT 1, 2 and 3

- multiple enroute segments (1)
- common segment (2)
- multiple enroute segments (3)



STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
BOJID1	1	JST	010	JST	K6 D	V _ _ _	IF
BOJID1	1	JST	020	MIROY	K6 EA	E _ _ _	TF
BOJID1	1	JST	030	COFAX	K6 EA	E _ _ _	TF
BOJID1	1	JST	040	LOMON	K6 EA	E _ _ _	TF
BOJID1	1	JST	050	HAR	K6 D	V E _ _	TF
BOJID1	1	PSB	010	PSB	K6 D	V _ _ _	IF
BOJID1	1	PSB	020	HAR	K6 D	V E _ _	TF
BOJID1	2		010	HAR	K6 D	V _ _ _	IF
BOJID1	2		020	BOUHN	K6 EA	E _ _ _	TF
BOJID1	2		030	LRP	K6 D	V _ _ _	TF
BOJID1	2		040	TRAGG	K6 EA	E _ _ _	TF
BOJID1	2		050	BUNTS	K6 EA	E _ _ _	TF
BOJID1	2		060	SCOOL	K6 EA	E E _ _	TF
BOJID1	3	RW09B	010	SCOOL	K6 EA	E _ _ _	IF
BOJID1	3	RW09B	020	KYILL	K6 EA	E _ _ _	TF
BOJID1	3	RW09B	030	KPHL	K6 PA	A E _ _	VM
BOJID1	3	RW27B	010	SCOOL	K6 EA	E _ _ _	IF
BOJID1	3	RW27B	020	BOJID	K6 EA	E _ _ _	TF
BOJID1	3	RW27B	030	HIFAL	K6 EA	E _ _ _	TF
BOJID1	3	RW27B	040	KPHL	K6 PA	A E _ _	VM

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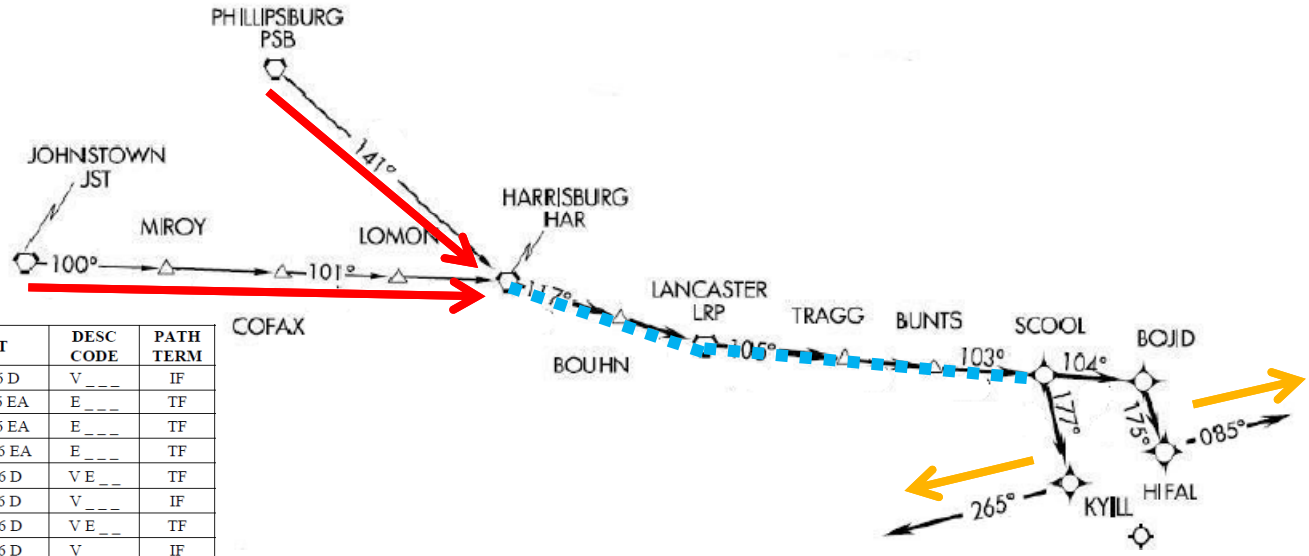
航路类型概念

STAR – 航路类型1, 2 和 3

- 多条不同航路段 (1)
- 共用航段 (2)
- 多航路航段 (3)



STAR IDENT	ROUTE TYPE	TRANS IDENT	SEQ	WAYPOINT		DESC CODE	PATH TERM
BOJID1	1	JST	010	JST	K6 D	V _ _ _	IF
BOJID1	1	JST	020	MIROY	K6 EA	E _ _ _	TF
BOJID1	1	JST	030	COFAX	K6 EA	E _ _ _	TF
BOJID1	1	JST	040	LOMON	K6 EA	E _ _ _	TF
BOJID1	1	JST	050	HAR	K6 D	V E _ _	TF
BOJID1	1	PSB	010	PSB	K6 D	V _ _ _	IF
BOJID1	1	PSB	020	HAR	K6 D	V E _ _	TF
BOJID1	2		010	HAR	K6 D	V _ _ _	IF
BOJID1	2		020	BOUHN	K6 EA	E _ _ _	TF
BOJID1	2		030	LRP	K6 D	V _ _ _	TF
BOJID1	2		040	TRAGG	K6 EA	E _ _ _	TF
BOJID1	2		050	BUNTS	K6 EA	E _ _ _	TF
BOJID1	2		060	SCOOL	K6 EA	E E _ _	TF
BOJID1	3	RW09B	010	SCOOL	K6 EA	E _ _ _	IF
BOJID1	3	RW09B	020	KYILL	K6 EA	E _ _ _	TF
BOJID1	3	RW09B	030	KPHL	K6 PA	A E _ _	VM
BOJID1	3	RW27B	010	SCOOL	K6 EA	E _ _ _	IF
BOJID1	3	RW27B	020	BOJID	K6 EA	E _ _ _	TF
BOJID1	3	RW27B	030	HIFAL	K6 EA	E _ _ _	TF
BOJID1	3	RW27B	040	KPHL	K6 PA	A E _ _	VM

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Agenda

ARINC 424

- History & Purpose
- File Structure and Record Layout
- Path Terminator
- Route Types

Coding Demonstration

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议题

ARINC 424

- 历史 & 目的
- 文件结构与记录格式
- 航径终结码
- 航路类型
- 编码演示

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