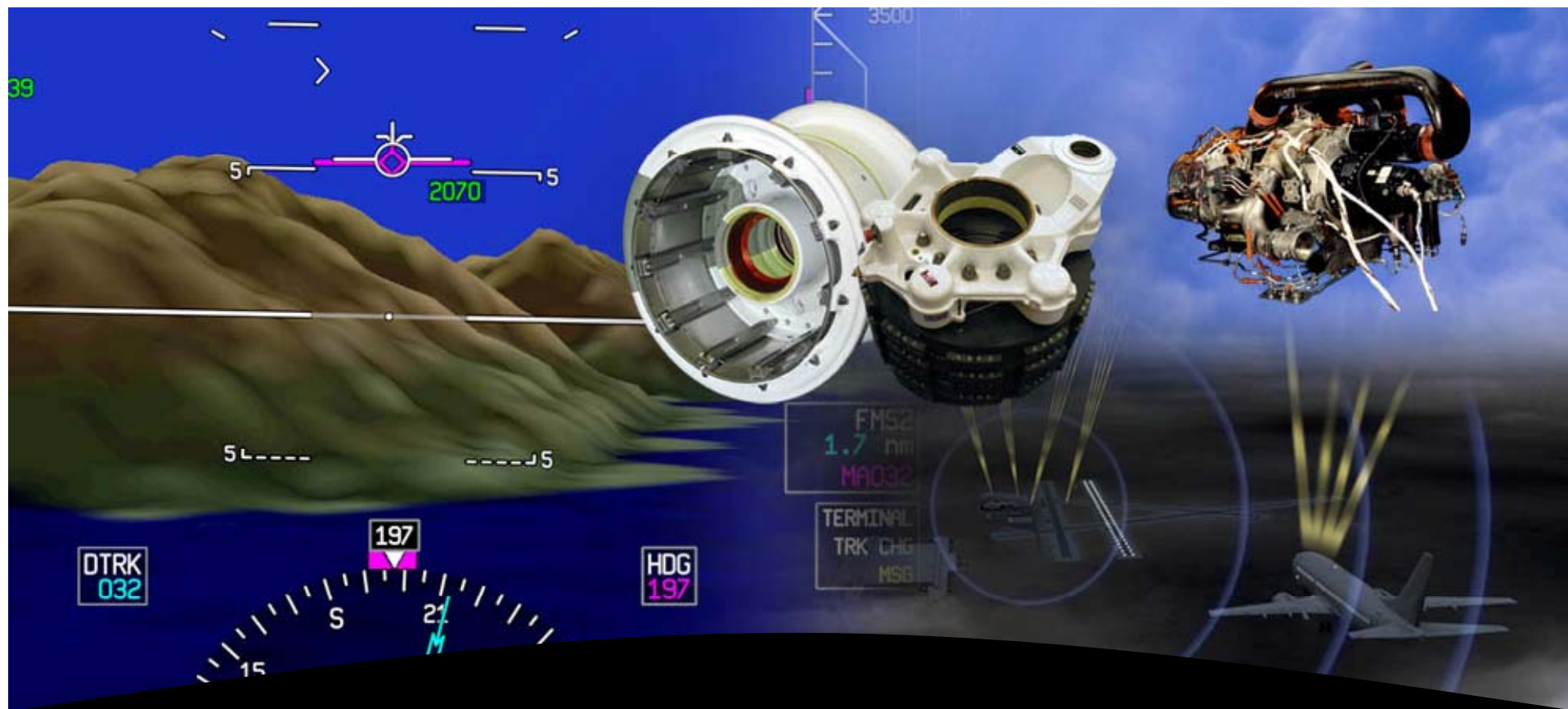
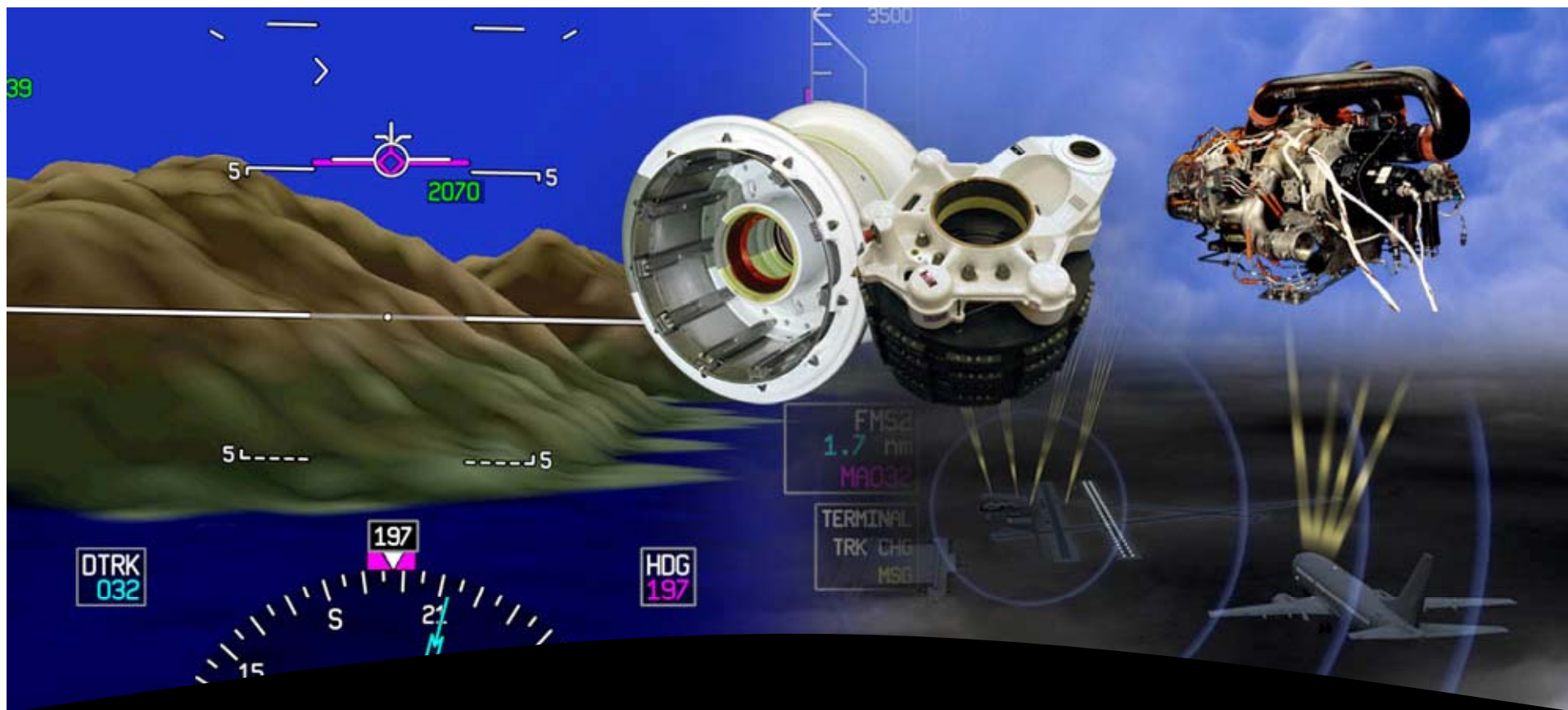




NavDB Training

March 2013

Honeywell



导航数据库 培训

2013年3月

Honeywell

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Agenda

- **Navigation Database**
 - Overview
 - ARINC 424
 - NavDB Production

- **Required Navigation Performance (RNP)**
 - Definition
 - Operational Benefits
 - Characteristics
 - RNP Regulatory Guidance
 - Honeywell Go Direct Service

议程

- 导航数据库
 - 概述
 - ARINC 424
 - 导航数据库制作
- 所需性能导航 (RNP)
 - 定义
 - 运行效益
 - 特点
 - RNP 法规指南
 - Honeywell直接服务 (Go Direct Service)

Engineering Specifications

- **Engineering Specifications are driven by:**
 - Aircraft design and functional specifications
 - FMS Design
 - Software Requirements
 - Database format specifications
 - Changes are driven by OEMs and FMS engineering
- The specifications cover different types of database structures:
 - **Non-1 Meg**
 - **1meg / Pegasus**
 - **Flex / NG Flex**

工程规范

- 工程规范考虑以下因素:
 - 飞机设计和功能规范
 - FMS 设计
 - 软件要求
 - 数据库格式规范
 - 因OEM和FMS 设计而引起的变化
- 规范涵盖不同类型的数据库结构:
 - **Non-1 Meg**
 - **1meg / Pegasus**
 - **Flex / NG Flex**

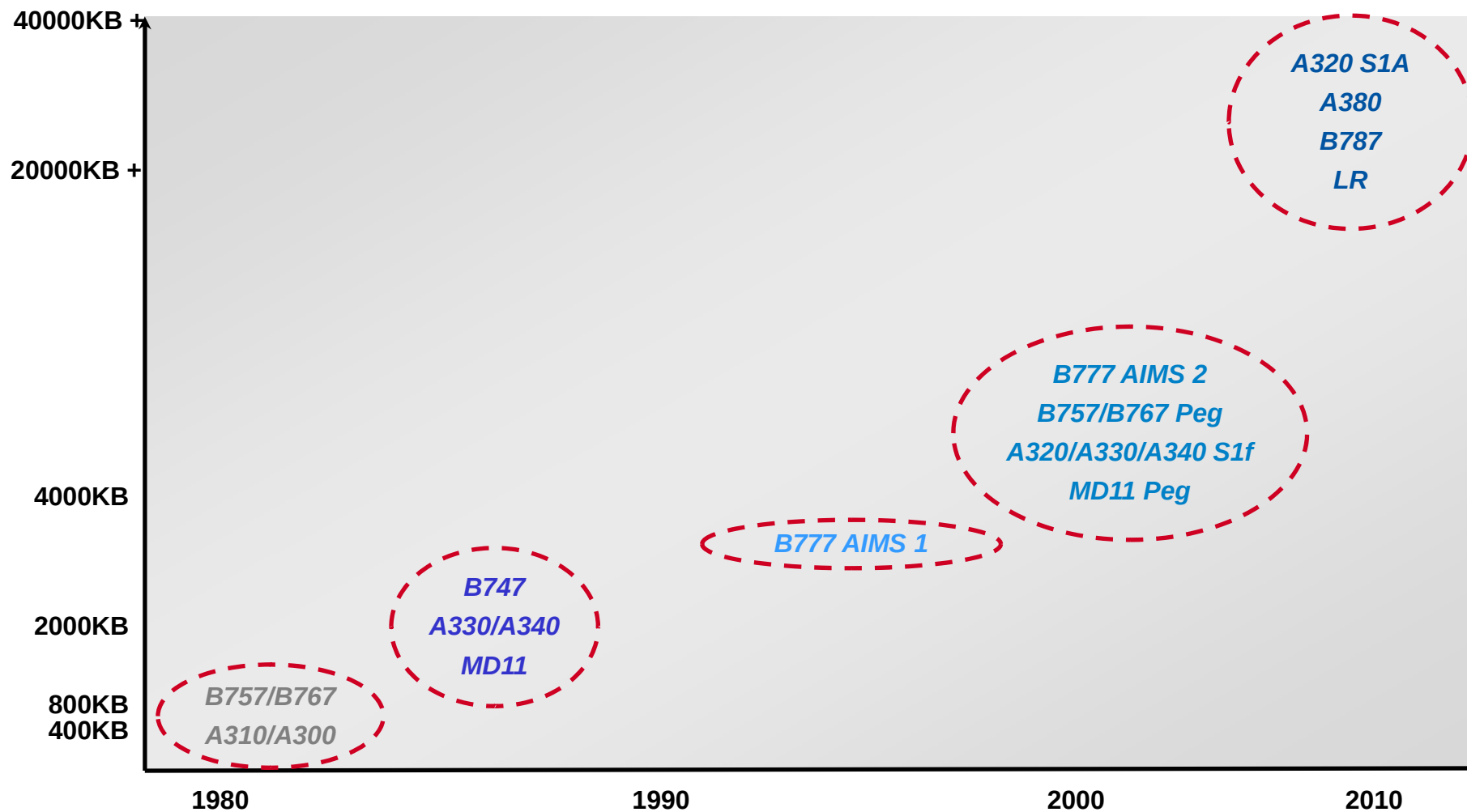
Honeywell's Flight Management System Heritage



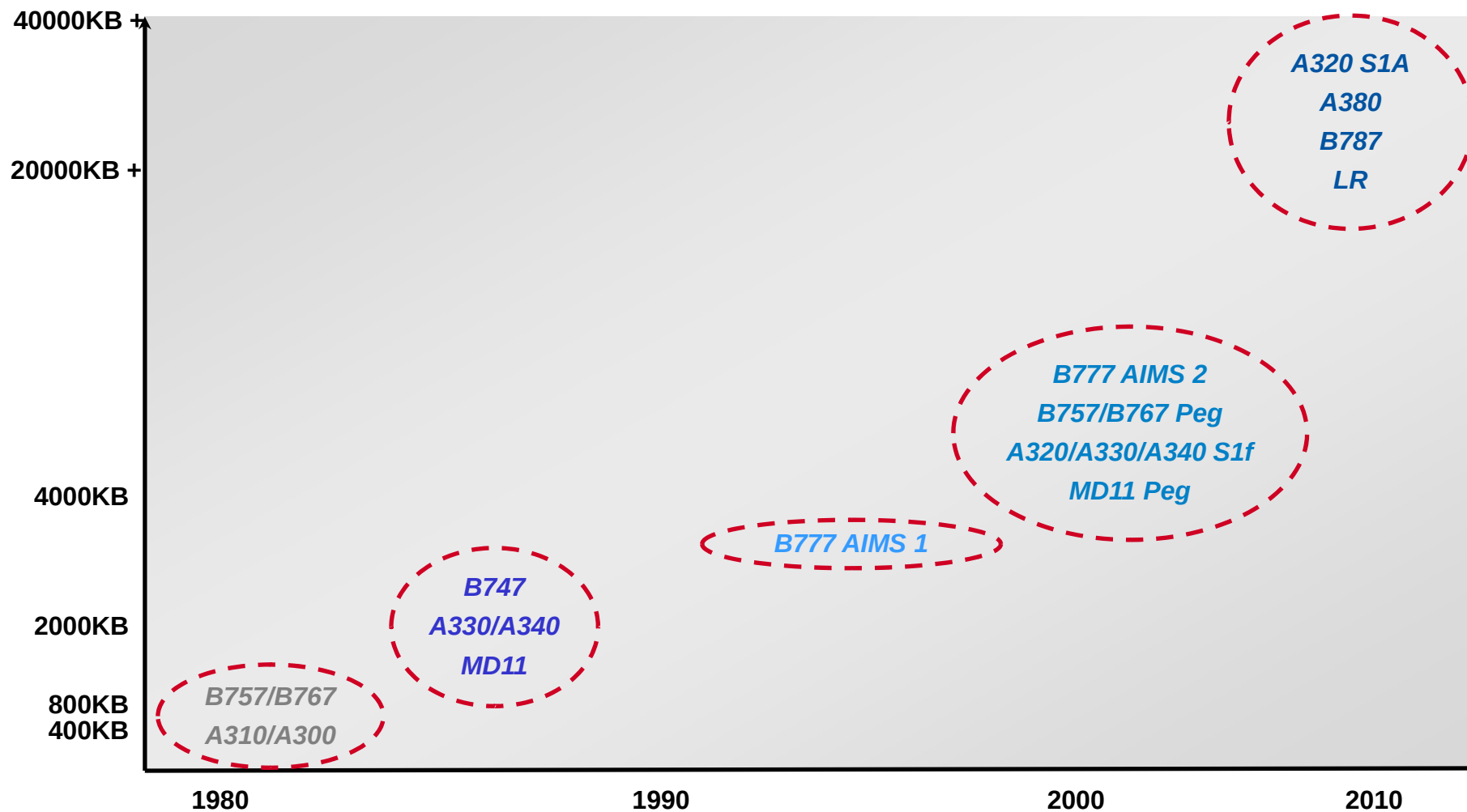
Honeywell飞行管理系统发展历程



Navigation Database Evolution



导航数据库演变



NavDB Formats

- NavDB Engineering Format Specifications (In Words)
 - **Non-1MEG** (101K, 118K, 191K, 200K, 400K, 512K)
 - **1MEG** (650K, 700K, 1M)
 - **Pegasus** (B757 / B767 / A320 / A340) (2M) – (B757/767 – PEG09 – 3.75MB)
(A330 / 340 – 2.75 P3)
 - **FLEX DATA** (A380, B787) – (20MB)
 - **BRGA** (V0, 1, 2, 3.01, EPIC INAV)
 - **HT** (1000, 9000, 9100)
 - **GNS** (XL/XLS)

导航数据库格式

- 导航数据库工程格式规范 (单位: 字节)
 - **Non-1MEG** (101K, 118K, 191K, 200K, 400K, 512K)
 - **1MEG** (650K, 700K, 1M)
 - **Pegasus** (B757 / B767 / A320 / A340) (2M) – (B757/767 – PEG09 – 3.75MB)
(A330 / 340 – 2.75 P3)
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 - **BRGA** (V0, 1, 2, 3.01, EPIC INAV)
 - **HT** (1000, 9000, 9100)
 - **GNS** (XL/XLS)

NavDB Size by Airframe

• A310/A300	118K,191K,512K
• A320	191K, 400K, 2097K
• A330/A340	1040K, 2097K,2.75MB(P3)
• A380	20 MB / 64 MB
• B717	2097K
• B747	999Kb
• B757/767	101K,200K ,700K, 999K, 2097K, 3.75M (PEG 09)
• B777	1400K / 2097K, 6MB (BP14+)
• B787	40MB
• B747-8	30 MB (126MB)
• BRGA / Epic	1000K, 2000K, 3000K, 8000K
• F100/F70	191K,512K
• HT	8000K
• MD11	1030K, 2097K
• MD80	200K, 650K
• MD90	2097K
	RED – Non 1MEG

各机型导航数据库容量

• A310/A300	118K,191K,512K
• A320	191K, 400K, 2097K
• A330/A340	1040K, 2097K,2.75MB(P3)
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• F100/F70	191K,512K
• HT	8000K
• MD11	1030K, 2097K
• MD80	200K, 650K
• MD90	2097K
	RED – Non 1MEG

Database Structure

- **Non-1meg -**
 - Standard and tailored data is stored in the same space
 - OneNav cannot tell the difference
 - Fixed size tables
 - Means limits on the number of elements in each data type
- **1meg**
 - Separate tables for standard and tailored data
 - Fixed size tables
- **Flex**
 - Separate tables for standard and tailored data
 - Table sizes are not fixed

Note – Test database for 787 selecting all airports with procedures with runways 5,000 ft and greater takes up over 15 meg (words)

数据库结构

- **Non-1meg -**
 - 在相同的存储空间内，标准数据和客户化数据
 - OneNav版不能区分差别
 - 固定容量表
 - 意味着每种数据类型所含元素的数量有限制
- **1meg**
 - 标准数据和定制数据表格不同
 - 固定容量表
- **Flex**
 - 标准数据和定制数据表格不同
 - 表格容量不固定

注 – 波音**787**测试导航数据库，选用了全部有仪表飞行程序且跑道长度不小于**5000英尺**的机场，数据存储空间超过**15M**（字）

Data Quality Requirements (DQR)

- **Defines requirements for ARINC 424 data suppliers**
- **Data requirements cover:**
 - Delivery schedule
 - Area coverage
 - Data content
 - Quality requirements
- **Process requirements cover:**
 - Communication
 - Timeliness
 - Process procedures (RTCA DO-200A process model)
 - Specific Actions (V & V prior to delivery)
 - Process Integrity
 - Audits

数据质量要求 (DQR)

- 定义了对**ARINC 424** 数据供应商的要求
- 数据要求涵盖:
 - 交付时间表
 - 覆盖区域
 - 数据内容
 - 质量要求
- 处理要求涵盖:
 - 交流
 - 时间表
 - 处理程序 (RTCA DO-200A 处理模型)
 - 特殊活动(交付前核实与验证)
 - 工序完好性
 - 审核

DQR (continued...)

- **DO-200A specifies data quality and processing activities**
- **Data Quality covers:**
 - Accuracy
 - Resolution
 - Integrity
 - Traceability
- **Processing Activities**
 - Receive and/or Originate
 - Assemble
 - Select
 - Format
 - Distribute

数据质量要求 (续...)

- **DO-200A** 规定了数据质量和处理方法
- 数据质量包括:
 - 精度
 - 分辨率
 - 完好性
 - 可追溯性
- 处理方法
 - 接受或原创
 - 收集
 - 挑选
 - 格式化
 - 分发

ARINC 424

ARINC 424 – a Specification for Navigation System Data Bases

- The requirement for on-board navigation data bases was identified in the 1970s with the development of the first Flight Management Systems (FMS).
- ARINC 424 - first edition was published in May 1975 and adapted by the industry in July 1975. At this stage the ARINC 424 document was developed to support conventional Navigation.
- 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. Now in its 20th revision.
- Moving to ARINC 424A, which is a XML-based model.

ARINC 424 – 导航系统数据库规范

- 上世纪七十年代，随着第一代飞行管理系统的开发，就明确了机载导航数据库的要求。
- **ARINC 424** - 第一版本于**1975年5月**发布，同年**7月**业界进行了改编。在这一时期**ARINC 424** 文件支持传统导航。
- 随着区域导航方法的实施以及多传感器数据输入的实现，要求强制使用更复杂的机载导航数据库。 (**TGL 10**)
- **ARINC 424** 多年来不断地改进与调整，以适应新的导航程序、功能、标准以及技术特性。现在最新版为第**20**版。
- **ARINC 424A**正在向基于可扩展标识语言（**XML**）模型方向发展。

ARINC 424 Database Structure



ARINC 424 数据库结构



ARINC 424 Path & Terminator concept

- The Path and Terminator concept is a means to permit coding of Terminal Area Procedures, SIDs, STARs and Approach Procedures
- Charted procedure are translated into a sequence of ARINC 424 legs in the Navigation Database
- Flight plans are entered into the FMS by using procedures from the navigation database and chaining them together
- 23 leg types have been created to translate into computer language

ARINC 424 路径和终结码概念

- 路径和终结码概念，是一种允许对终端区程序，SID、STAR以及进近程序进行编码的方式。
- 在导航数据库中，将已制图程序转换成一系列ARINC 424航段。
- 选用导航数据库中的程序并将其串在一起，可以将飞行计划输入到FMS中。
- 已创建了23种转换成计算机语言的航段类型。

Path & Terminator Leg Types

<u>Code</u>	<u>Path Definition</u>	<u>Code</u>	<u>Path Definition</u>
IF	Initial fix	RF	Constant radius ARC (ARC center)
TF	Track to a Fix	AF	Arc to a fix (ARC is a DME ARC)
CF	Course to a fix	VA	Heading to an altitude
DF	Direct to a fix	VD	Heading to a DME distance
FA	Fix to an altitude	VI	Heading to an intercept
FC	Track from a fix to a specified distance	VM	Heading to a manual termination
FD	Track from a fix to a DME distance	VR	Heading to a radial
FM	Fix to a manual termination	PI	Procedure turn
CA	Course to an altitude	HA	Altitude termination
CD	Course to a DME distance	HF	Single circuit terminating at the fix
CI	Course to an intercept	HM	Manual termination
CR	Course to a radial		

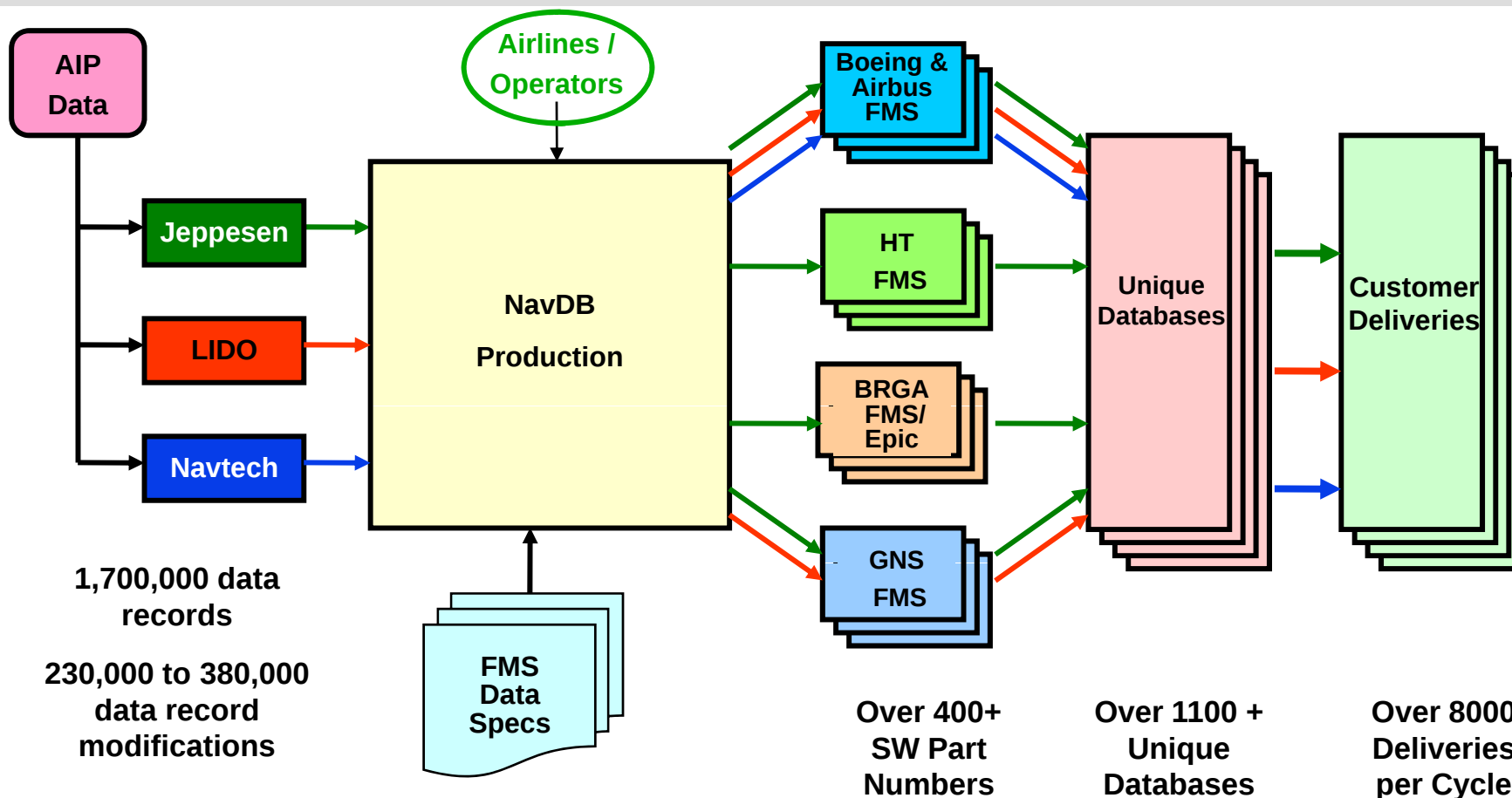
路径和终结码航段类型

代码	路径定义	代码	路径定义
IF	Initial fix	RF	Constant radius ARC (ARC center)
TF	Track to a Fix	AF	Arc to a fix (ARC is a DME ARC)
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NavDB Production

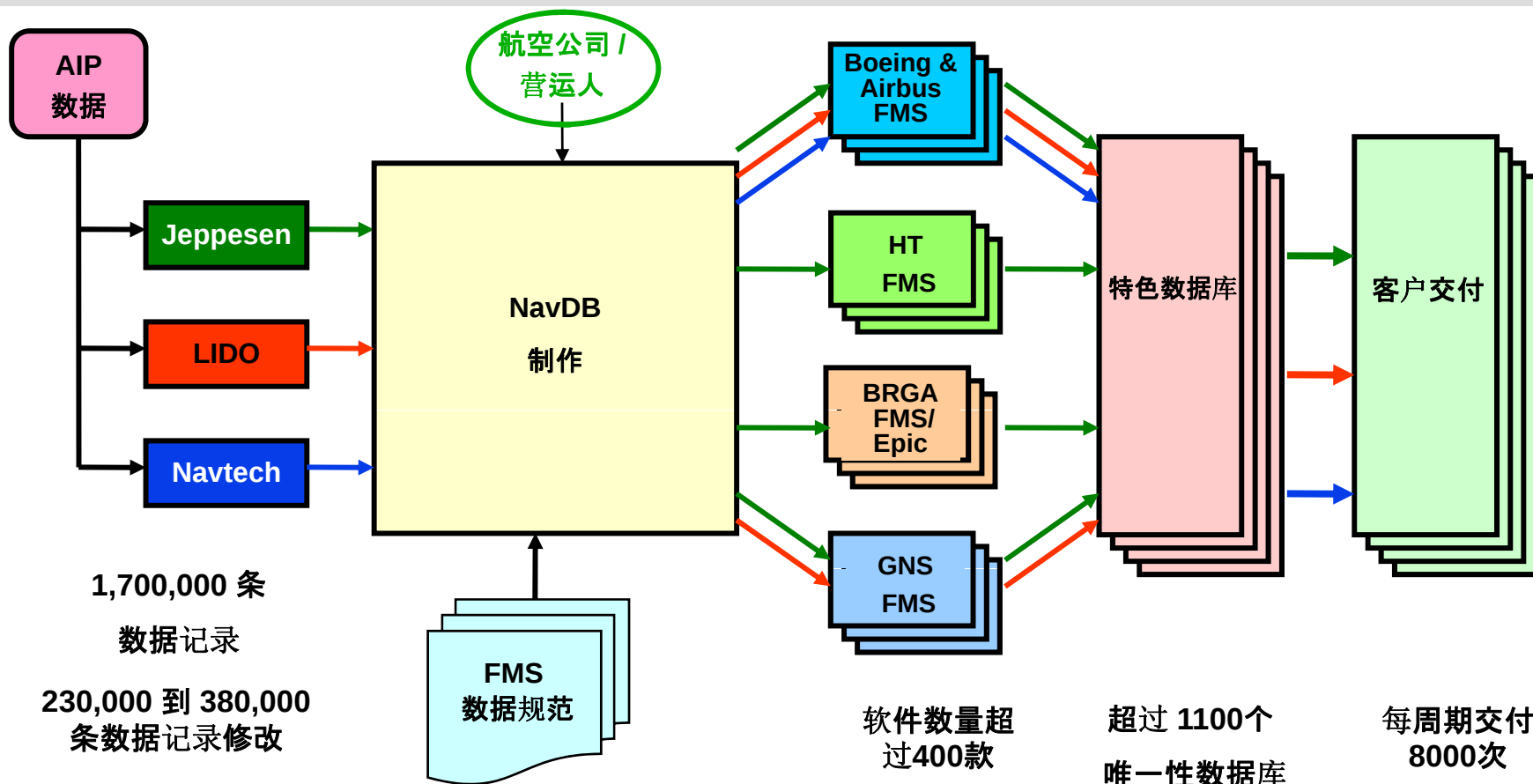
导航数据库制作

Production Overview



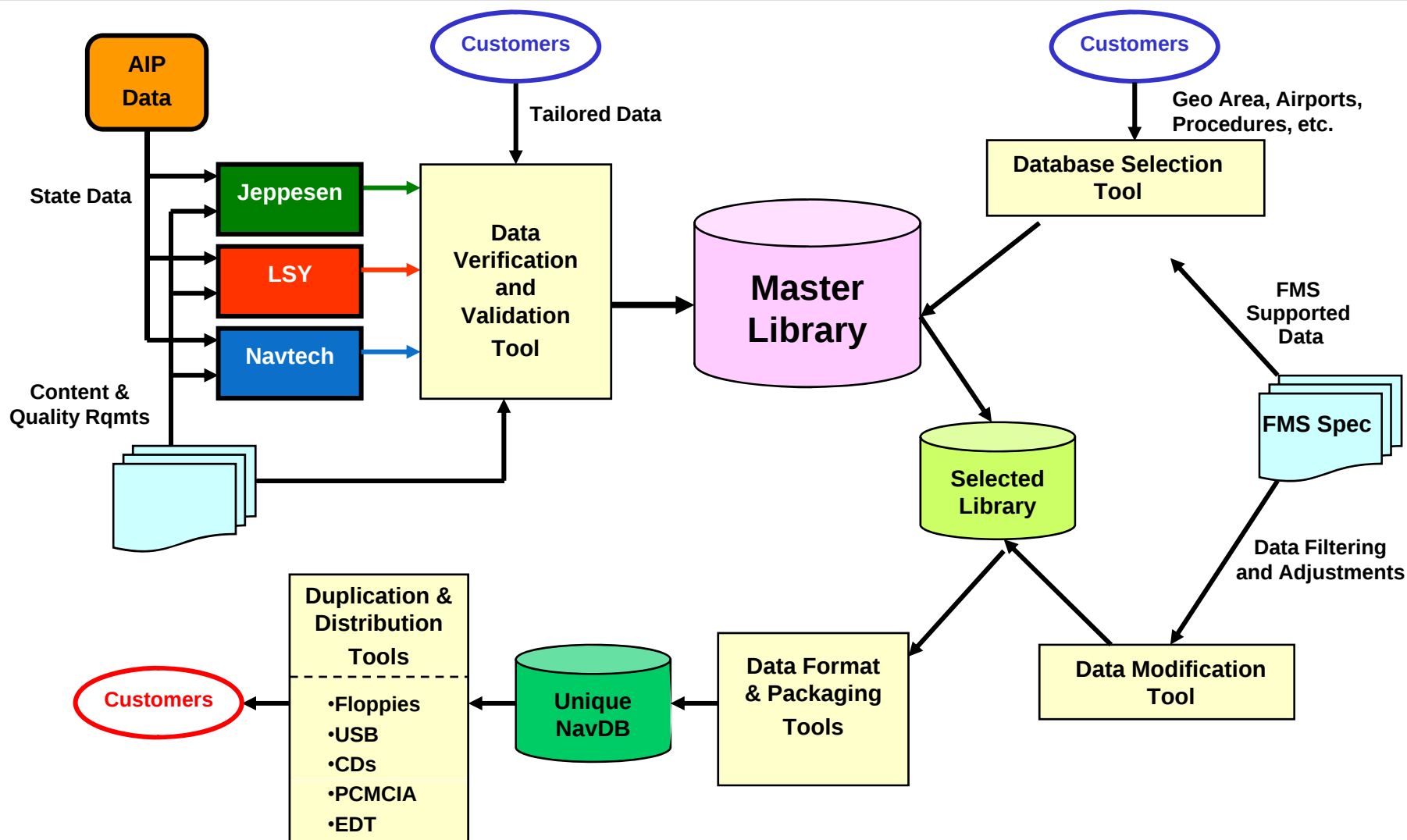
Over 16,500 aircraft fly with Honeywell NavDBs

制作概述

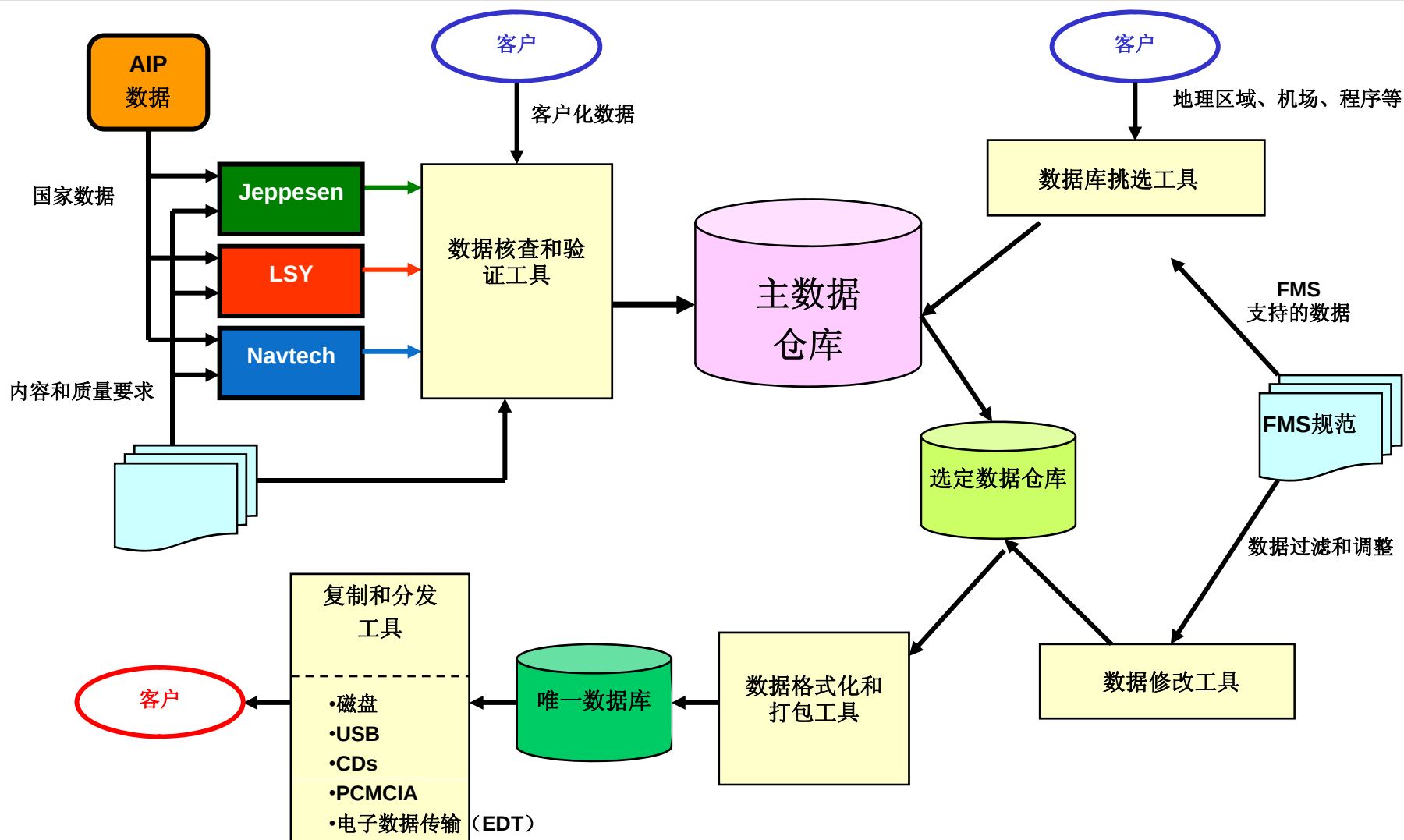


超过16500架飞机使用Honeywell导航数据库

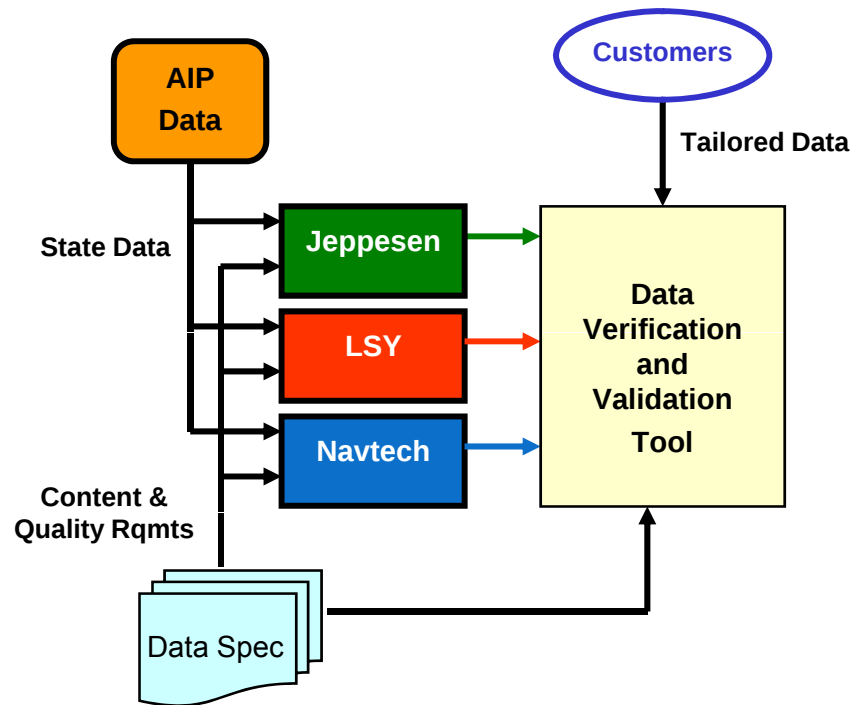
NavDB Production Flow with CorePT



使用CorePT工具的导航数据库制作流程

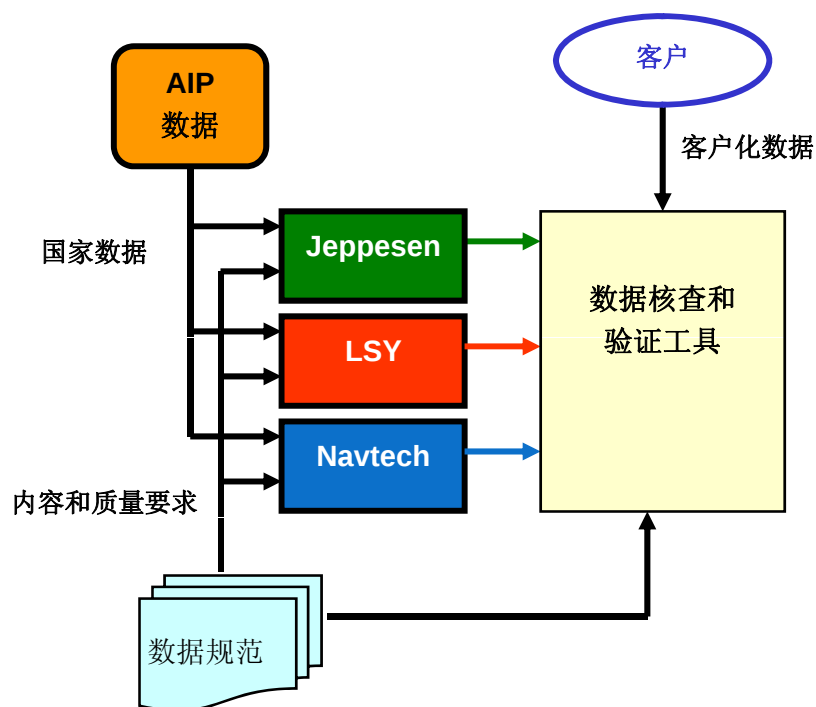


Data Verification & Validation



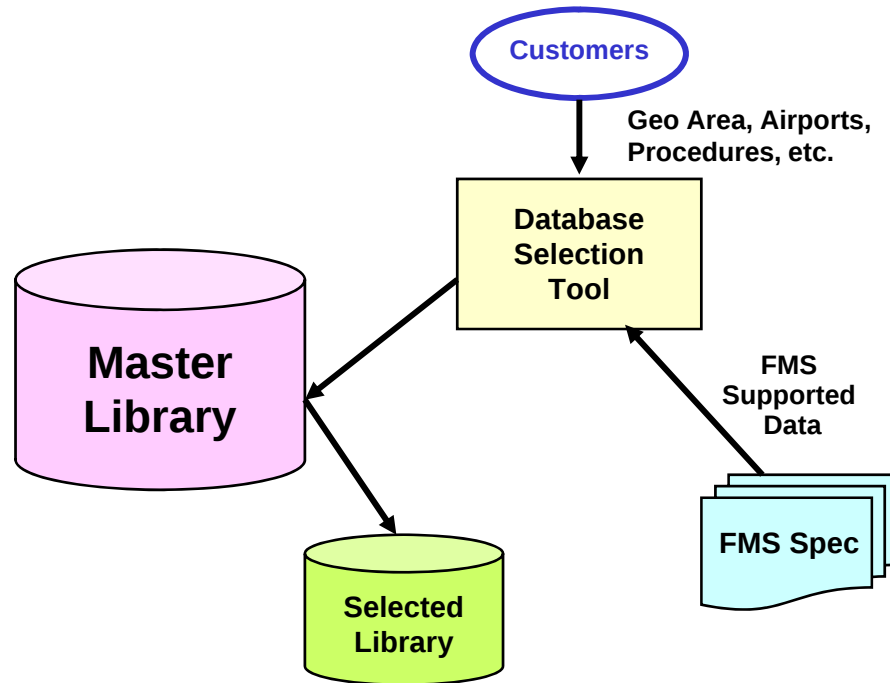
- Data is checked for both structural and relational correctness
- Errors are sent to the data providers for correction
- Customer data is checked in the same manner as source data
- Only complete and accurate data is migrated to the Master library.

数据核查和验证



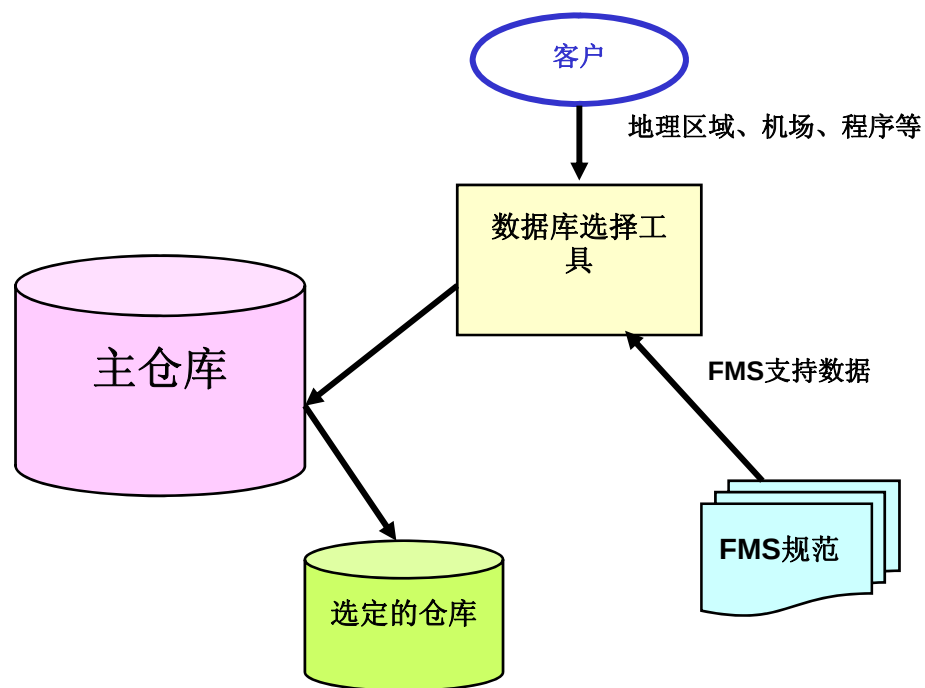
- 检查数据结构及关联正确性
- 错误数据将发送给数据提供者，以进行修正
- 客户数据作为源数据检查方式相同
- 只有完整且正确的数据才能装入主数据库

Data Selection



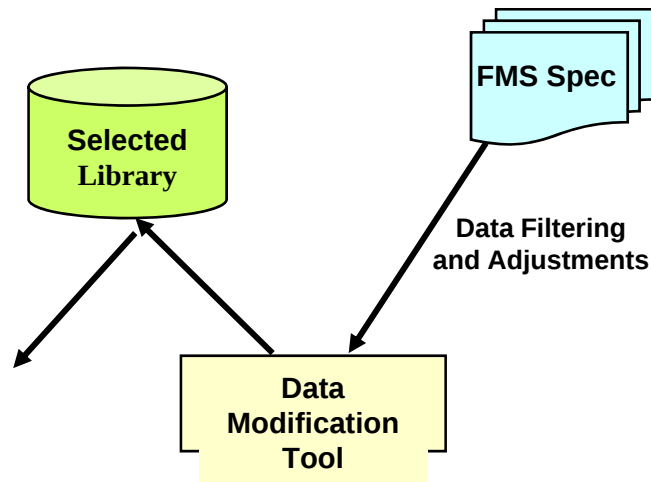
- Data is selected from the Master Library
- Selection based on customer requirements and FMS capabilities
- Checks are performed to ensure all relational data is captured in the Selected Library
- A Selected Library is created for each unique NavDB.

数据选择



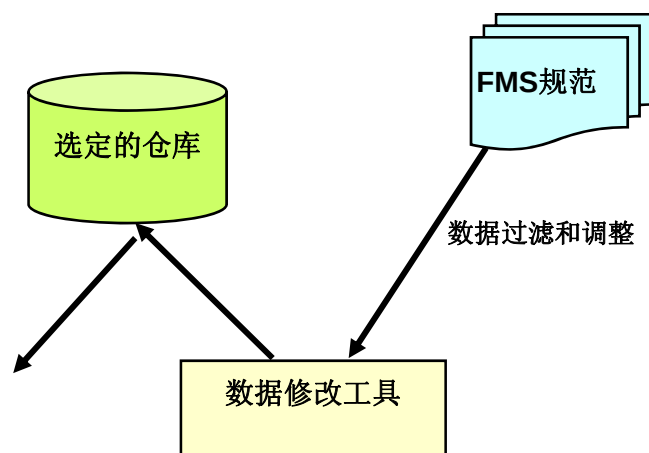
- 从主仓库中选取数据
- 基于客户要求和**FMS**性能来选择
- 检查选定的仓库涵盖了所有相关联的数据
- 为每一特定导航数据库创建一个选定的仓库

Data Modification



- Modifications are done on the data within the **Selected Library**
- Modifications can be either customer requests or FMS requirements
- Modifications typically involve translation of the data into a format that is more compatible with a particular FMS.

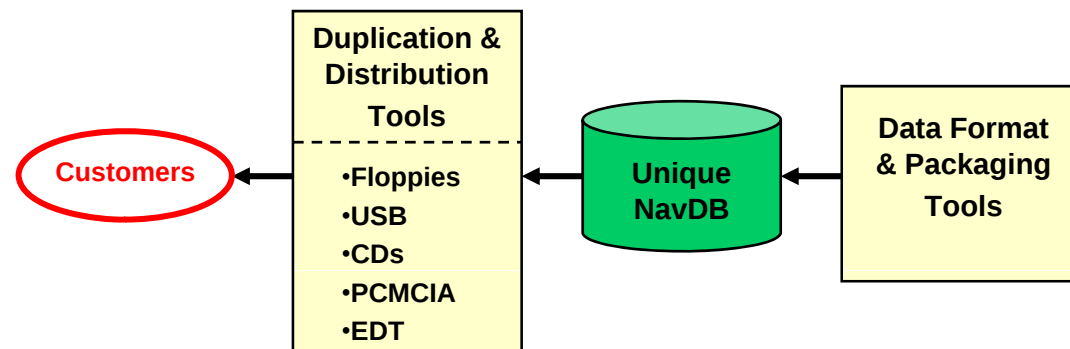
数据修改



- 修改针对选定仓库中的数据
- 根据用户要求或**FMS**要求修改数据
- 典型数据修改涉及数据格式，以便兼容特定**FMS**

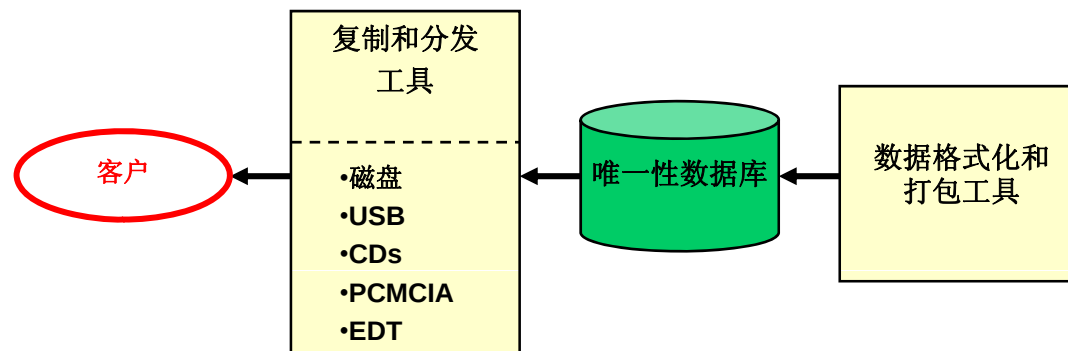
Data Formatting and Distribution

- Data is formatted to meet FMS and Loader requirements
- Physical media is generated and shipped
- Files are posted for Electronic Distribution.



数据格式化及分发

- 数据格式化以满足**FMS**和载入工具的要求
- 生成物理介质并发货
- 用电子分发方式邮寄数据文件



Data Change Request

数据变更申请

Data Change Request – Sample

- Date : October 20th 2012
- From : XXX Airlines
- To : Aviation.Services@Honeywell.com
- Subject : **Change requests – XX1, XX3, XX6 Cycle 1212**

(The details of change required can be mentioned as the body/contents of this mail (or) can be sent as an attachment)

Mentioning Database Ident and Cycle referred in the subject line in all the correspondences would ensure speedy / prompt action.

数据变更申请- 模板

- 日期 : 2012年10月20日
- 来自 : XXX 航空公司
- 送至 : Aviation.Services@Honeywell.com
- 主题 : 变更要求 – XX1, XX3, XX6 周期 1212

(具体要求变更内容, 可在邮件的主体/内容部分表述, 或者添加在附件里)

在所有往来邮件主题栏提及数据库编号和周期, 以便加快处理。

Selection Criteria

选择标准

Database Definitions

- A database definition is dependent on the type of aircraft and the associated FMS hardware and software
 - Most of the time sharing of databases is not possible
 - A NavDB is two-cycle, meaning the current cycle's data and the upcoming cycle's data are contained in a single NavDB
 - Database definitions start with determining the customer's requirements for enroute, terminal, and tailored data
 - The customer's requirements are translated into a set of selection criteria

数据库定义

- 数据库定义与航空器的类别和机载FMS硬件软件相关
 - 大部分情况无法共享数据库
 - 一个导航数据库两个周期，即当前生效周期数据和下一个周期数据在同一个数据库中
 - 明确客户对航路、终端区和客户化数据的要求，即开始定义数据库
 - 客户化要求被转变成一组选择标准

Selection Process

- **Selection Criteria**

- A set of choices used to reduce the entire global set of Navigational data to a loadable subset of data
- Retained from cycle to cycle unless a specific modification of the choices is made.
- Selection criteria applies to both cycles of the NavDB
- Tied to a specific 3 character NavDB ID
- Can be easily copied for use in another NavDB ID

Note – Test database for 787 selecting all airports with procedures with runways 5,000 ft and greater takes up over 15 meg (words)

The CorePT selection tools are a set of choices

选择过程

- 选择标准

- 利用一组选择标准，从整个总导航数据集中，筛选得到可加载的数据子集
- 除非选择标准有特殊的更改，否则将会在下一个周期中保留上一个周期的信息
- 选择标准适用于导航数据库中的两个周期
- 绑定三个字符的导航数据库编号
- 用其他导航数据库识别码，便于拷贝使用

注 –波音**787**测试导航数据库，选用了全部有仪表飞行程序且跑道长度不小于**5000**英尺的机场，数据存储空间超过**15M**

CorePT 选择工具为一组选项

Selection Process (continued...)

- **Selection Criteria**

- **Enroute**

- Airways
 - Nav aids
 - Waypoints

- **Terminal**

- Runways
 - Procedures
 - Nav aids
 - Waypoints

The CorePT selection tools are a set of choices

选择过程 (续...)

- 选择标准
 - 航路
 - 航线
 - 导航台
 - 航路点
 - 终端区
 - 跑道
 - 程序
 - 导航台
 - 航路点

The CorePT selection tools are a set of choices

Defining Customer Requirements

定义客户需求

Definition of Customer Requirements

- Customer and Honeywell work together to define:
 - Geographic Area of operations
 - Enroute Data requirements
 - Nav aids, waypoints, airways,
 - Terminal Data requirements
 - Airports, runways, procedures,
 - Tailored Data requirements
 - Company Routes, gates, procedures,

定义客户需求

- 用户与Honeywell共同定义：
 - 运行地理区域
 - 航路数据要求
 - 导航台、航路点、航线
 - 终端区数据要求
 - 机场、跑道、程序,
 - 客户化数据要求
 - 公司航路、登机门、程序....

Enroute Data Types

- **Enroute Data**

- VHF Navaids
- NDB Navaids
- Waypoints
- Airways
- Holding Patterns
- Grid MORA
- Communication

- **Airspace Data**

- Restrictive Airspace
- Controlled Airspace
- FIR UIR

- **Supplement Enroute Data**

- NDBs
- Navaids
- Grid MORA

航路数据类型

- 航路数据

- VHF 导航台
- NDB 导航台
- 航路点
- 航线
- 等待程序
- 网格最低偏航高度
- 通信

- 补充航路数据

- NDBs
- 导航台
- 网格最低偏航高度

- 空域数据

- 限制空域
- 管制空域
- FIR UIR

Terminal Data Types

- **Airport Data**

- Airports
- Runways
- Localizers /MLS/GLS
- NDBs
- Waypoints
- SIDs, STARs & Approaches
- Holding Patterns
- MSA
- Communication
- Gates

- **Supplement Airport Data**

- Airports
- Runways
- NDBs

- **Heliport Data**

- Heliports
- Helipads
- Localizers /MLS
- NDBs
- Waypoints
- SIDs, STARs & Approaches
- MSA

- **Supplement Heliport Data**

- Heliports
- NDBs

终端区数据类型

- 机场数据

- 机场
- 跑道
- **LOC/MLS/GLS**
- **NDB台**
- 航路点
- **SID, STAR & 进近程序**
- 等待程序
- **MSA**
- 通信
- 登机门

- 补充机场数据

- 机场
- 跑道
- **NDB台**

- 直升机机场数据

- 直升机机场
- 简易直升机机场
- **LOC /MLS**
- **NDB台**
- 航路点
- **SID, STAR & 进近程序**
- **MSA**

- 补充直升机机场数据

- 直升机机场
- **NDB台**

Customer Tailored Data

- **Ability to define tailored data for:**
 - **Terminal data**
 - **Enroute Data**
 - **Company Routes**
 - **Gates / Quick Align Points**
 - **APFs**
 - **Fuel Policy Files (Airbus older databases only)**
 - **Alternate Destinations (Airbus only)**

客户化数据

- 能够定义客户化的数据包括：
 - 终端区数据
 - 航路数据
 - 公司航路
 - 停机位 / 快速校准点
 - **APF**
 - 燃油政策文件 (仅空客早期数据库)
 - 备降机场 (仅空客)

Building a Database

创建数据库

Geographic Coverage

- **Selection Tool choices consist of following Regions**
 - Geographic Polygons
 - Area Codes (USA, CAN, etc.)
 - ICAO Codes (K2, CY, etc.)
 - Lists of Airports to be Included
 - Include/Exclude Lists Functions
- **Each NavDB ID can define all possible combination of above regions.**
- **Recommend selection method is Enroute Data/Coverage by the GEO AREAs and Terminal Data/Coverage by AIRPORT GROUPS.**

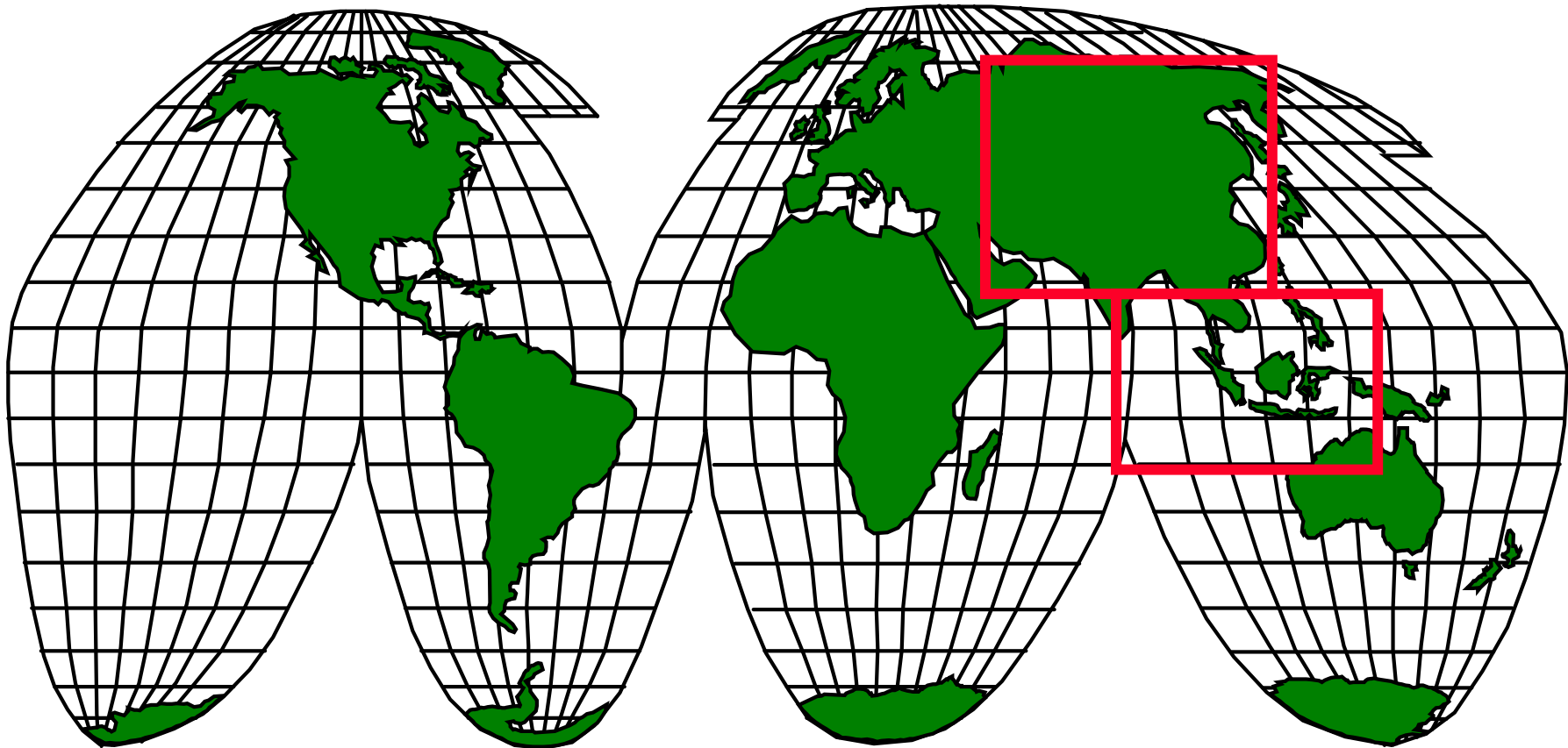
A Database can be made up of multiple areas

地理范围

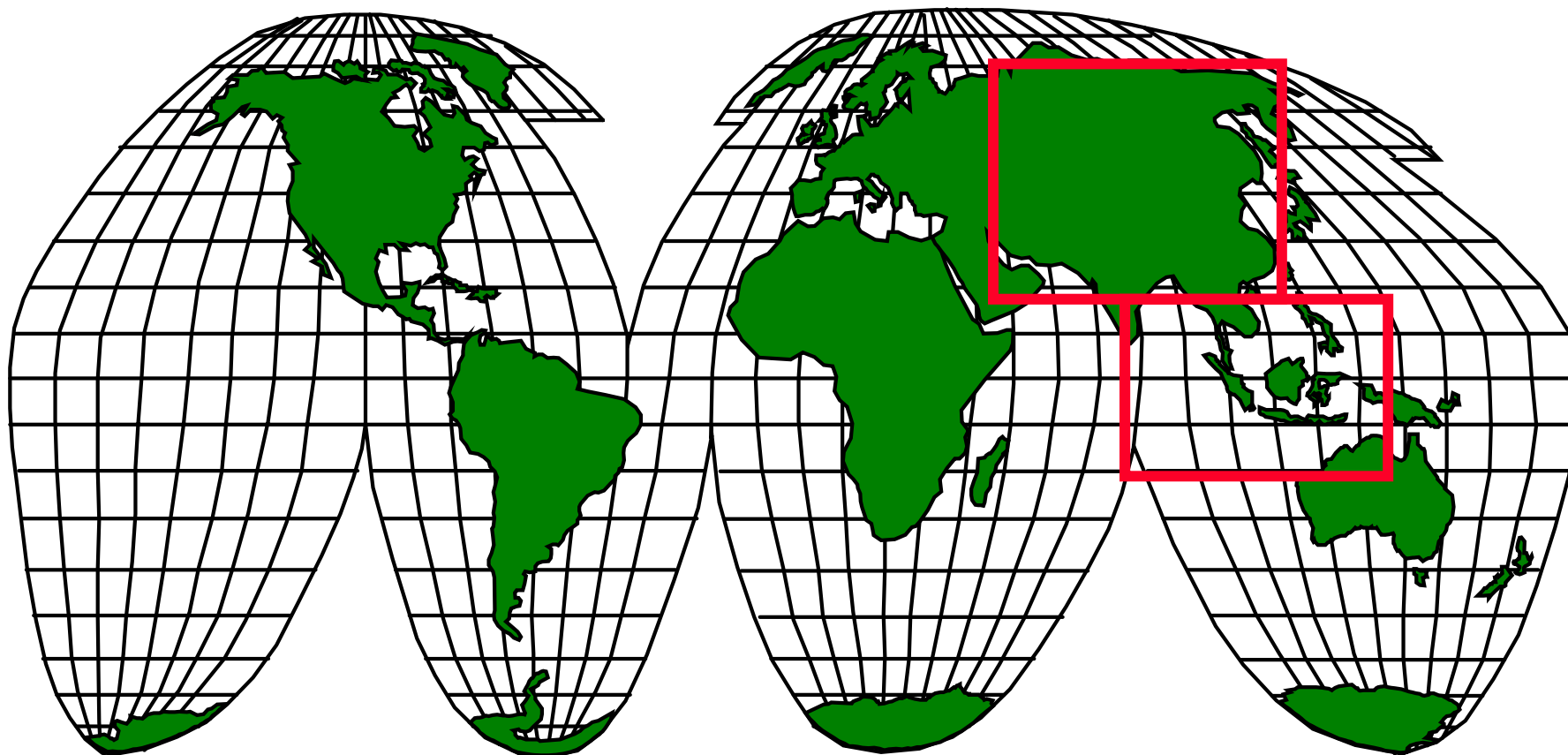
- 工具选项的选择应包含以下项目：
 - 地理边界
 - 区域代码(**USA, CAN**等)
 - **ICAO**代码(**K2, CY**等)
 - 包括机场列表
 - 包含/排除列表功能
- 每一个导航数据编号，可由以上项目的各种组合来定义
- 依据地理区域航路数据/范围以及机场群终端区数据/范围，作为推荐选择方法

一个数据库可由多个区域组成

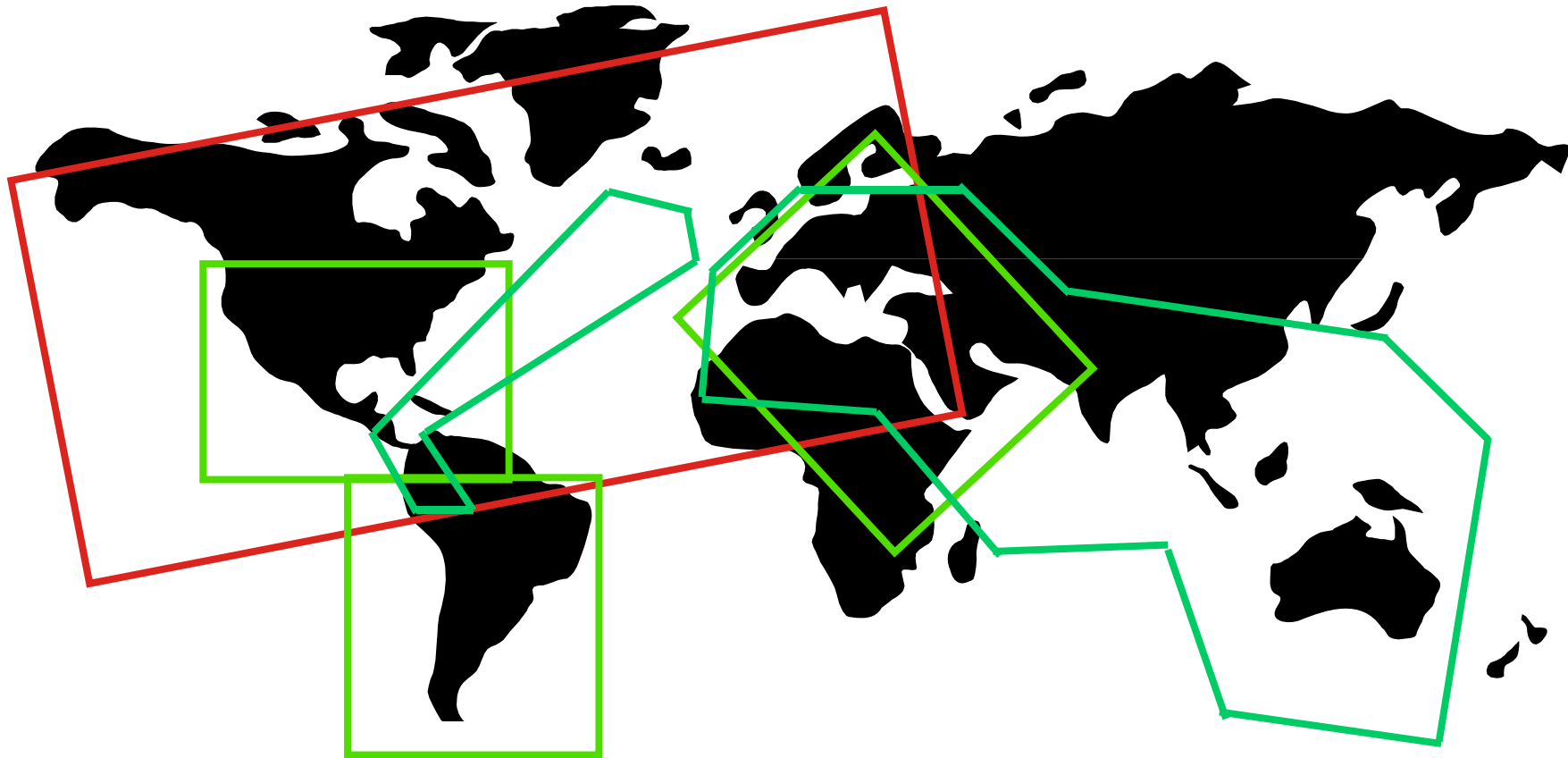
NavDB size - Geo Area Definition



导航数据库容量-地理区域定义

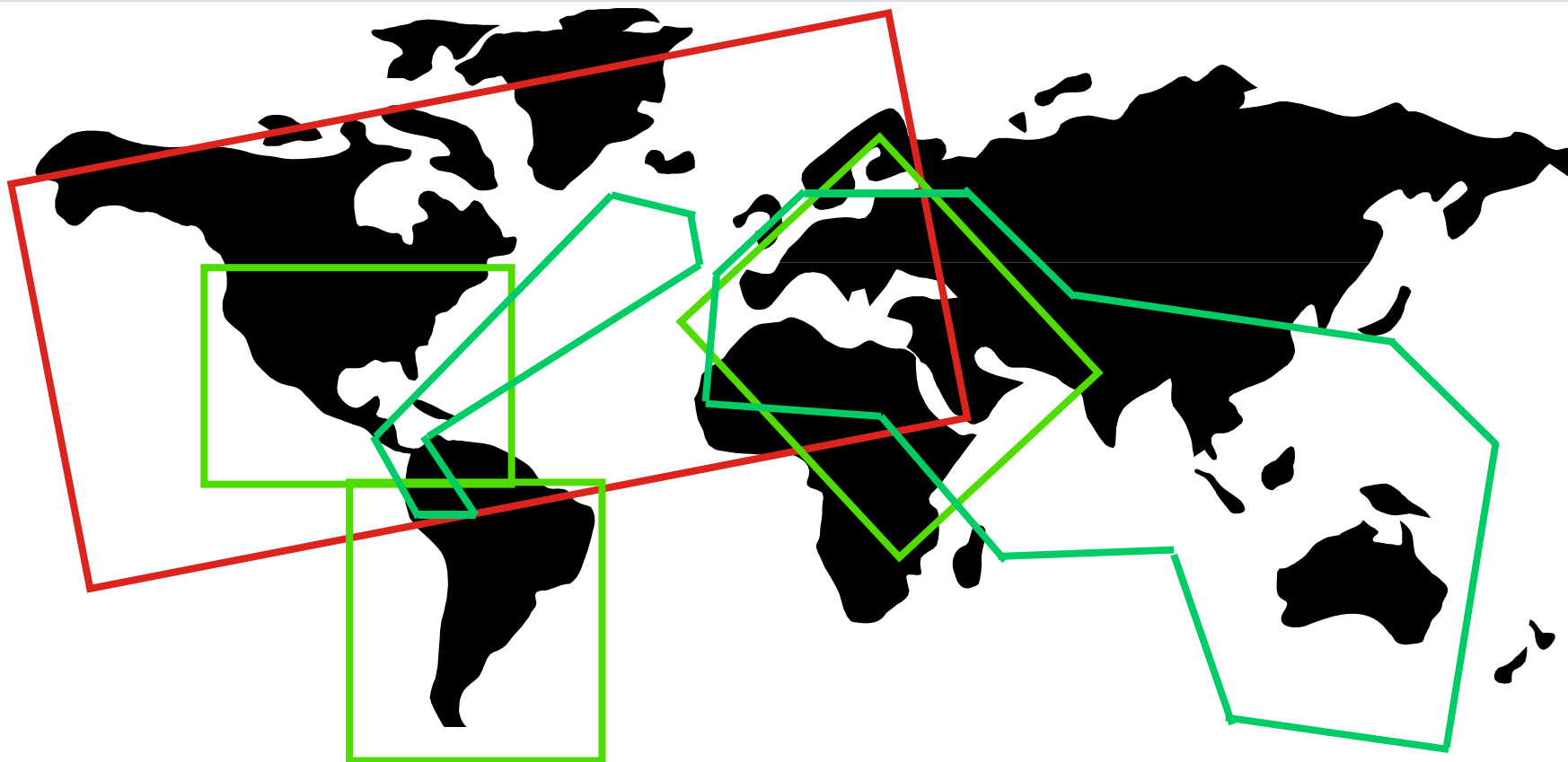


Examples of Geographic Polygons



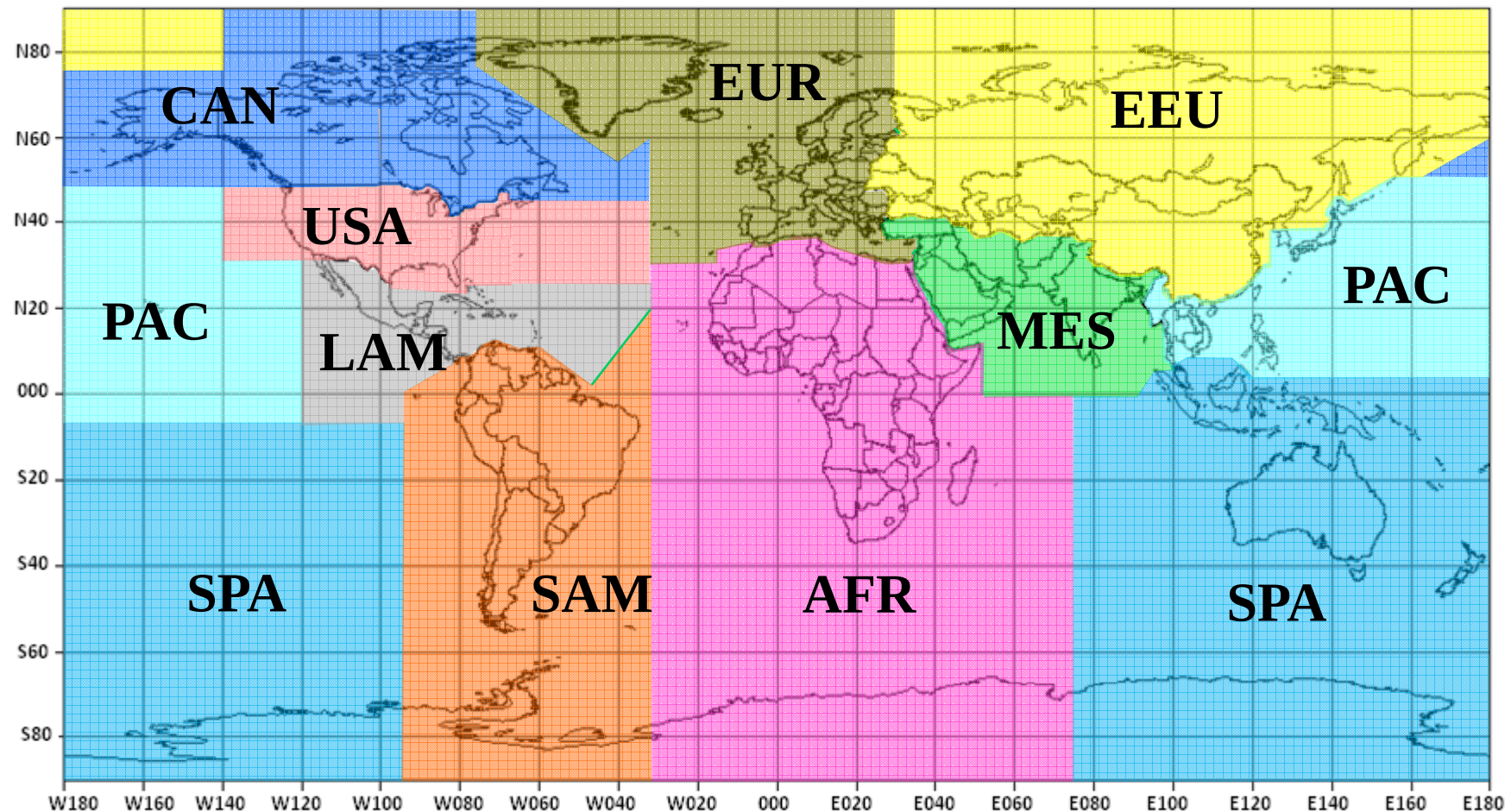
- A minimum of three fixes needed to define a polygon.
- Provision of co-ordinates of vertices would make accurate selection instead of pictorial requests to avoid ambiguity

地理边界示例



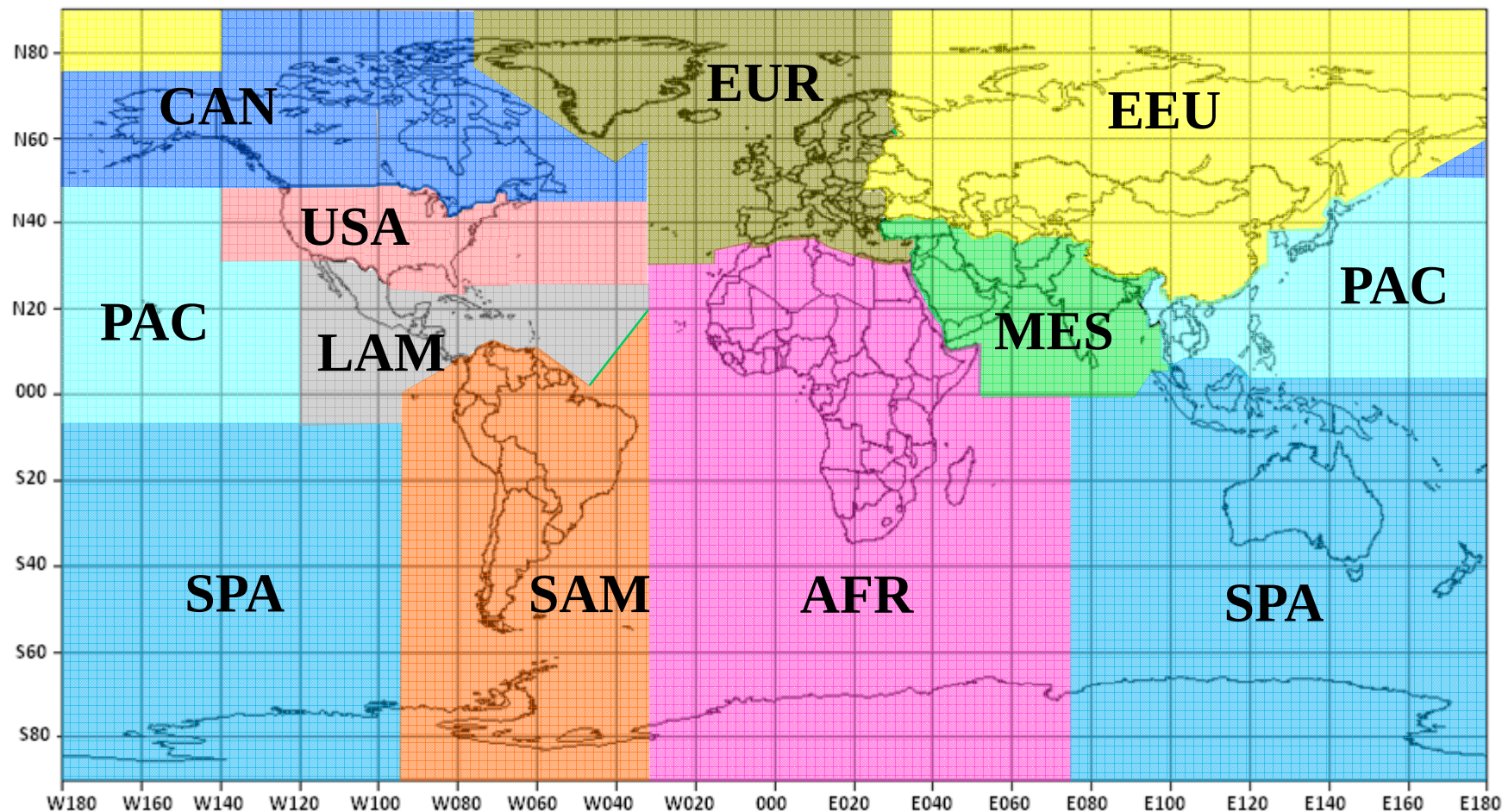
- 至少需要三个点来确定一个（区域）边界。
- （区域边界多边形）坐标顶点须精确选择而非图形描绘，避免（区域边界）模糊。

Selection by Region/Area



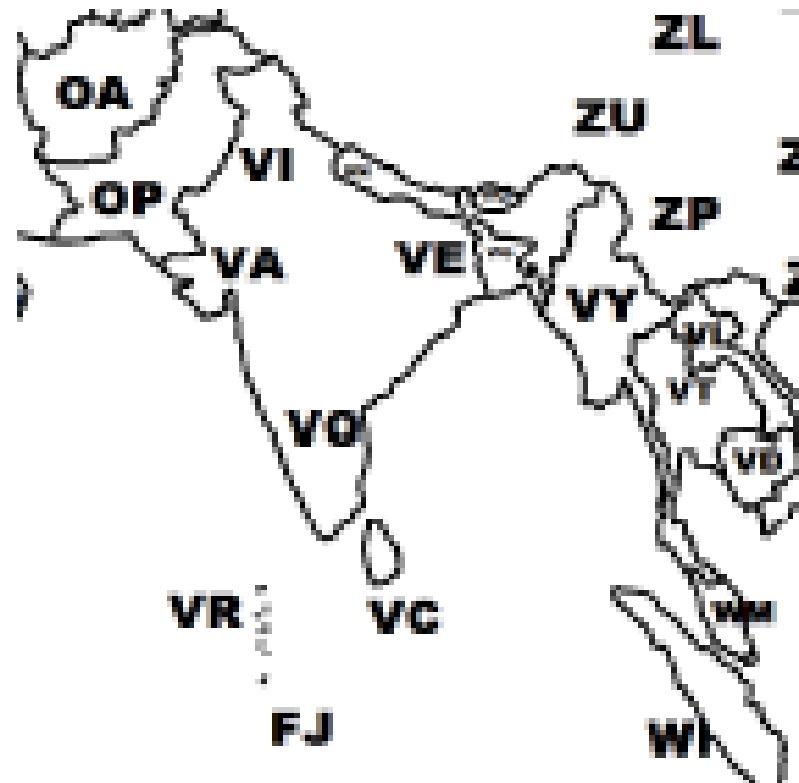
Inclusion/Exclusion of area possible by Selection of Regions

根据地区/区域选择



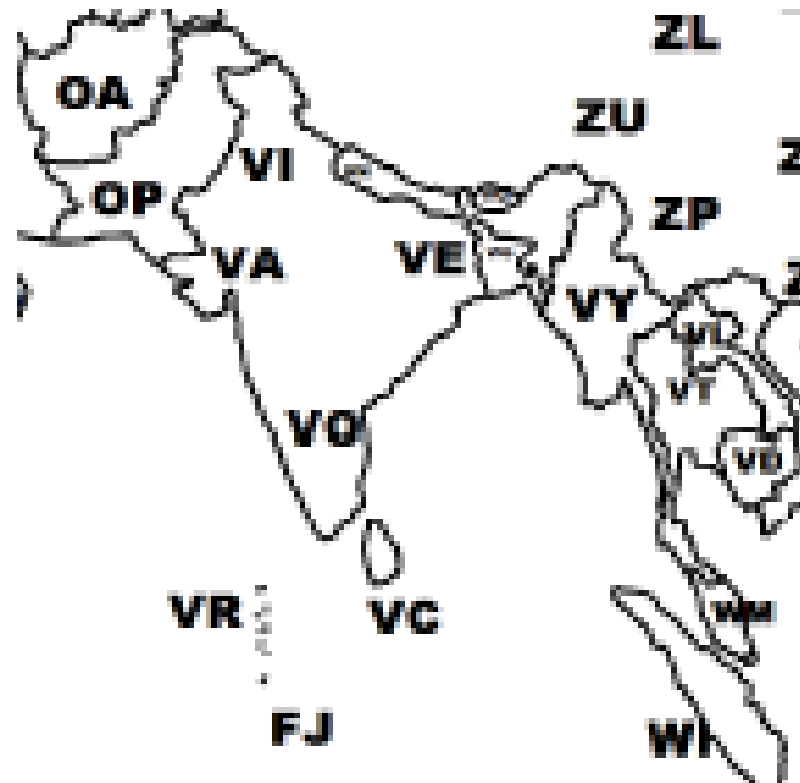
可通过地区选择包含/排除区域

Selection by ICAO Codes



Inclusion/Exclusion of area possible by Selection of ICAO Codes

根据ICAO代码选择



通过ICAO代码选择可包含/排除区域

Selection Approach

- **Terminal and Enroute data can be selected by:**
 - **INCLUDE** - all available items of this type in the database
 - **EXCLUDE** - all available items of this type from the database
 - **RULES** - items that meet the rule will be in the database
 - **REF ONLY** - item will be included if required to meet referential integrity

选择方法

- 终端区和航路数据通过以下方式选择：
 - **INCLUDE**-在数据库中有该类型所有可用条目
 - **EXCLUDE**-从数据库中可获取该类型所有可用条目
 - **RULES**-（规则）条目必须在数据库中
 - **REF ONLY**-如果要求满足引用完好性，数据库中须包括该条目

Terminal Area Coverage

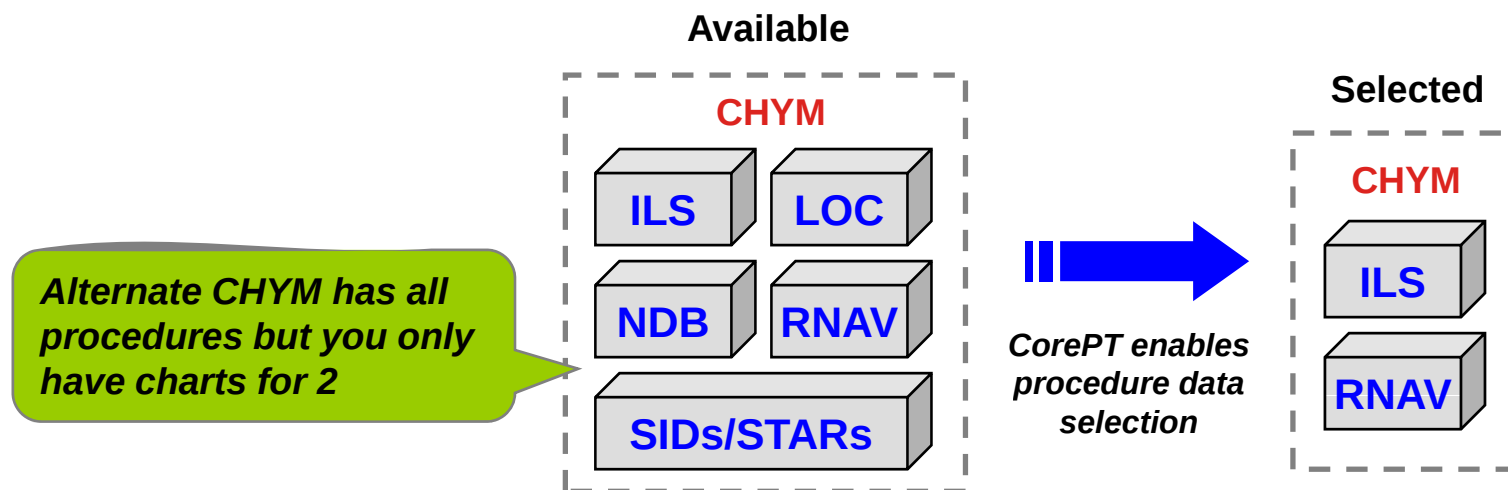
- **Select terminal coverage based on Geo Areas**
 - **Minimum Rwy Length** – *Based on type of aircraft*
- **Select terminal coverage criteria by airport groups**
 - **Dep/Destn Airports** – *With all available Procedures*
 - **Dep/Destn Alternate Apts** – *With Approaches and/or STARs only*
 - **Emergency/Enroute Alternate Apts** – *With ARP and Runway data only*

终端区域范围

- 选择终端区范围基于地理区域
 - 最短跑道长度– 根据飞机类别
- 根据机场群选择终端区域标准
 - 起飞/目的机场 – 有所有可用程序
 - 起飞/目的机场备降场 – 仅有进近程序和/或SID程序
 - 特情/航路备降机场– 仅有机场基准点（ARP）和跑道数据

Procedure Selection

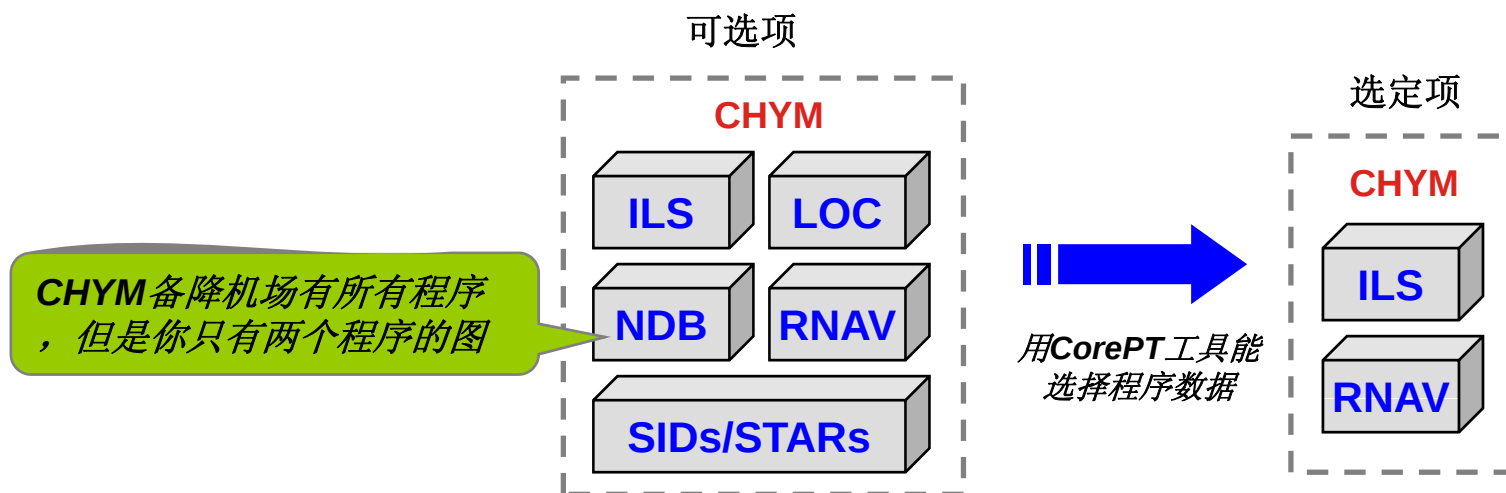
- More finite procedure selection criteria
- Any combination of Approaches, SIDS, STARs for specific airports
- Ability to limit approach types at specific Airports



Allows You to Optimize Procedure Data Selection

程序选择

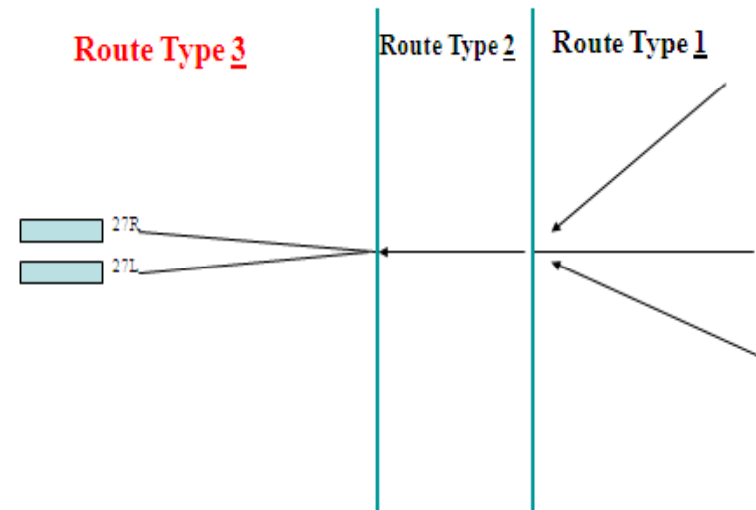
- 更多有限的程序选择标准
- 对特定机场，进近、离场、进场程序的任意组合
- 在特定机场可限定进近类型



允许你优化程序数据选择

Procedure Selection (continued...)

- **SIDs and STARs**
 - Uses Three Part Structure
 - Runway Transition(s)
 - Body of the Procedure (Common)
 - Enroute Transitions
- **Approaches**
 - Uses Two Part Structure
 - Transitions
 - Actual Approach with Missed Approach



程序选择 (续...)

- **SID和STAR程序**

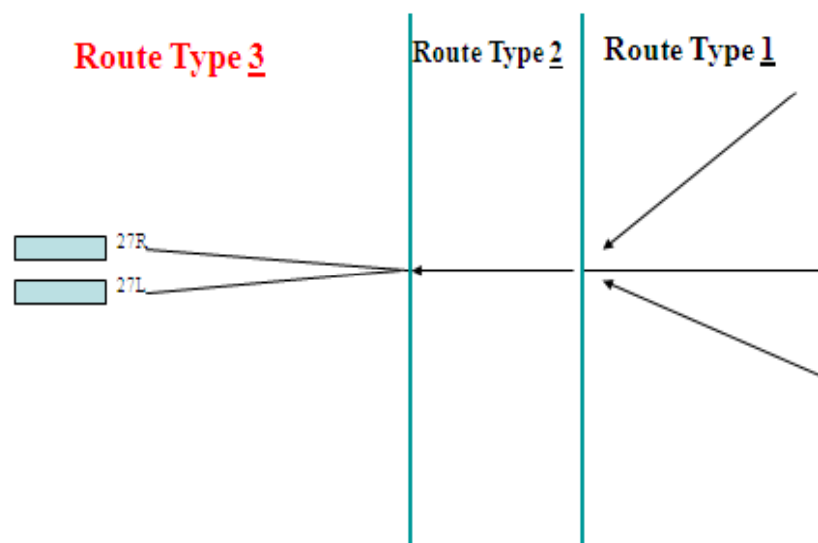
- 用**3**部分结构

- 跑道过渡
 - 程序主体（共用）
 - 航路过渡

- **进近程序**

- 用**2**部分结构

- 过渡
 - 带复飞程序的实际进近程序



Procedure Selection (continued...)

- **SIDs and STARs**
 - Standard
 - RNAV
- **Types can be deselected, if not used**

程序选择 (续...)

- **SID和STAR程序**
 - 标准SID/STAR
 - RNAV SID/STAR
- 不使用的程序，选择可以取消

Procedure Selection (continued...)

- **Precision**

- G -> IGS
- I -> ILS
- M -> MLS

- **Non-Precision**

- B -> LOC/Backcourse
- D -> VORDME
- L -> LOC
- N -> NDB
- P -> GPS
- Q -> NDB+DME
- R -> RNAV
- S -> VORDME/VORTAC
- U -> SDF
- V -> VOR
- W -> MLS Type A
- X -> LDA
- Y -> MLS Type B and C

*** Procedure types can be selected/deselected**

*** Types (Precision/Non-Precision) can be limited to a specific number and a priority set on each type selected**

程序选定 (续...)

- 精密进近程序
 - G -> IGS
 - I -> ILS
 - M -> MLS
- 非精密进近程序
 - B -> LOC/背航道
 - D -> VOR/DME
 - L -> LOC
 - N -> NDB
 - P -> GPS
 - Q -> NDB+DME
 - R -> RNAV
 - S -> VORDME/VORTAC
 - U -> SDF
 - V -> VOR
 - W -> MLS Type A
 - X -> LDA
 - Y -> MLS Type B and C

•程序类型可以选择或者取消选择

*程序类型（精密/非精密）可以用来限制程序数量，以及优先设定每种选定类型

Operator Requested Changes (ORCs)

- **Examples:**
 - **Convert STAR runway transitions (RT3)**
 - **Convert RNAV approaches to GPS**
 - **Multiple Approaches**
 - **Gemini**

营运人要求的变更（ORC）

- 例如：
 - 变换**STAR**程序跑道过渡(**RT3**)
 - 将**RNAV**进近转变为**GPS**进近
 - 多个进近程序
 - **Gemini**

NavDB Size Management

导航数据库容量管理

Source Data Trends

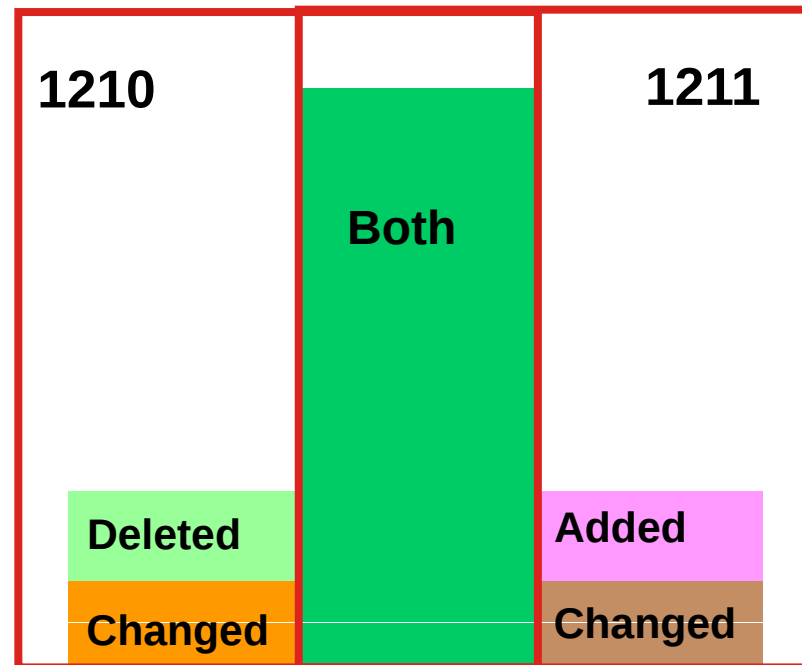
- **State data continues to grow at about 6-8% per year**
 - More Airports, Procedures, Airways, Waypoints
 - More of everything

源数据趋势

- 国家数据连续保持**6%-8%**的年增长率
 - 越来越多的机场、程序、航线和航路点
 - 相关问题也越来越多

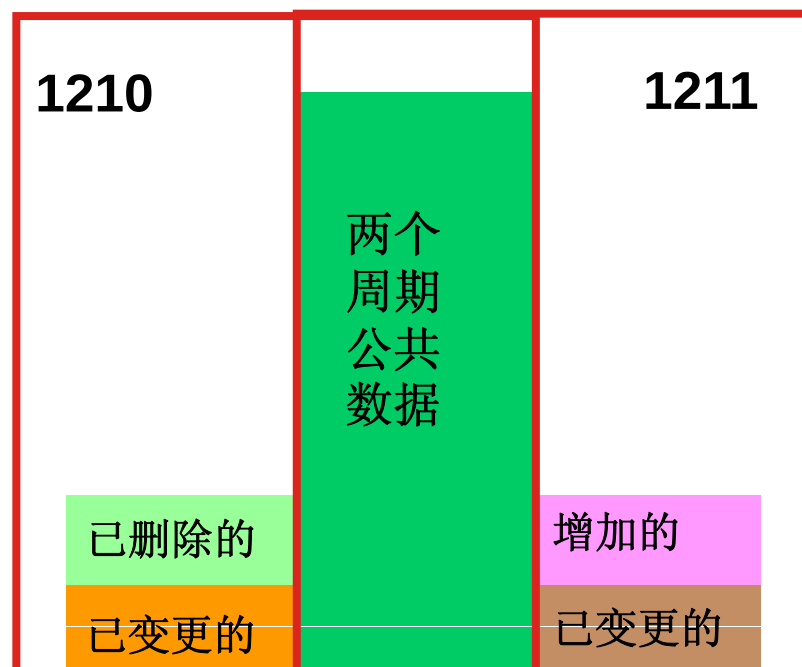
Two-Cycle NavDB Concept

- Customer selection criteria is not cycle dependent
- Changes in AIP data is cycle dependent



双周期导航数据库概念

- 不周期性依赖客户选择规则
- 须周期性依赖**AIP**数据变更



Managing Database Size

- Customer should periodically review the database definition and remove information that is no longer required
- Honeywell recommends maintaining a 5% buffer to address data fluctuation
- If a database goes oversize - Customer must direct Honeywell, on action to take before Honeywell can ship the database

管理导航数据库容量

- 客户应定期地检查数据库，删除数据库中不再需要的数据
- **Honeywell**公司建议维持数据库**5%**的空余容量，以应对数据波动
- 如果数据库超容量，用户必须立即联系**Honeywell**公司，用户在**Honeywell**公司发货前不要采取操作。

Oversize Analysis & Action

- **Mostly, Oversize occurs on one or more of below aspects:**
 - **Waypoint Count**
 - **Overall Database Size**

数据超容量分析和处理

- 大多数情况，数据超容量发生在以下两个方面
 - 航路点数量
 - 数据库总体大小



Required Navigation Performance

Honeywell



所需导航性能（RNP）

Honeywell

Aircraft Certified for RNP AR

- **Airbus 320**
- **Boeing Business Jet**
- **Boeing 737**
- **Boeing 747**
- **Boeing 757 / 767**
- **Boeing 777**
- **Boeing 787**
- **Embraer 170 / 190**
- **Gulfstream 350 / 450 / 500 / 550**
- **Falcon 900EASy**
- **Hawker 4000**
- **Cessna Sovereign**
- **Bombardier Q400**

通过RNP AR认证的机型

- **Airbus 320**
- **Boeing Business Jet**
- **Boeing 737**
- **Boeing 747**
- **Boeing 757 / 767**
- **Boeing 777**
- **Boeing 787**
- **Embraer 170 / 190**
- **Gulfstream 350 / 450 / 500 / 550**
- **Falcon 900EASy**
- **Hawker 4000**
- **Cessna Sovereign**
- **Bombardier Q400**

RNP Operational Benefits

- **Improved Access to Airports & Airspace**
 - Obstacle clearance enabling better access to
 - Terrain challenged airports
 - Congested Airspaces
 - Restricted airspace challenged airports
 - Lower minimums
 - IFR Access



Terrain
E.g. Juneau, Alaska

• Efficiency of Operations

- Time savings
 - Shorter routes
- Fuel savings
- Improved noise footprint

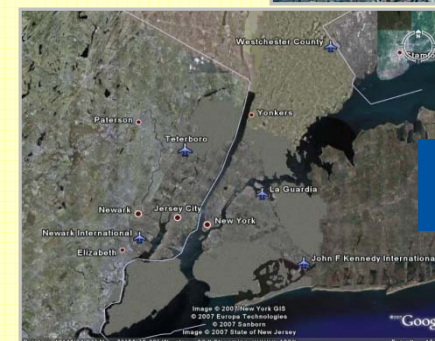
RNP AR supports
Green initiatives!



Airspace
E.g. Washington National

• Safety

- Clearly defined lateral and vertical flight paths = stabilized approach
- Enhanced situational awareness
- Missed approach procedures clearly defined



Traffic
E.g. New York Area

RNP 运行效益

- 改善机场和空域的通行能力

- 超障能获得更好通行能力
 - 地形复杂机场
 - 繁忙空域
 - 受限制空域挑战性机场
- 更低的运行标准
- IFR 通行能力

- 运行效率

- 节约时间
 - 缩短航路
- 节约燃油
- 降低噪声

RNP AR 支持绿色行动

- 安全性

- 明确定义的水平 and 垂直飞行航径
 - = 稳定连续进近
- 情景意识强化
- 明确定义复飞程序



Terrain

E.g. Juneau, Alaska



Airspace

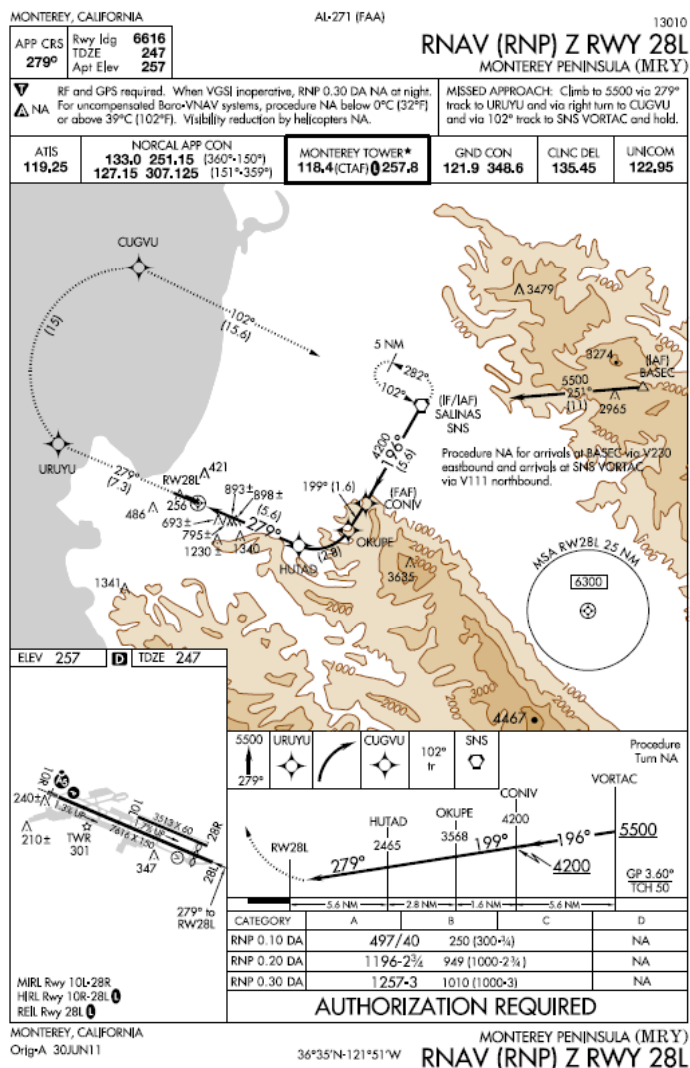
E.g. Washington National



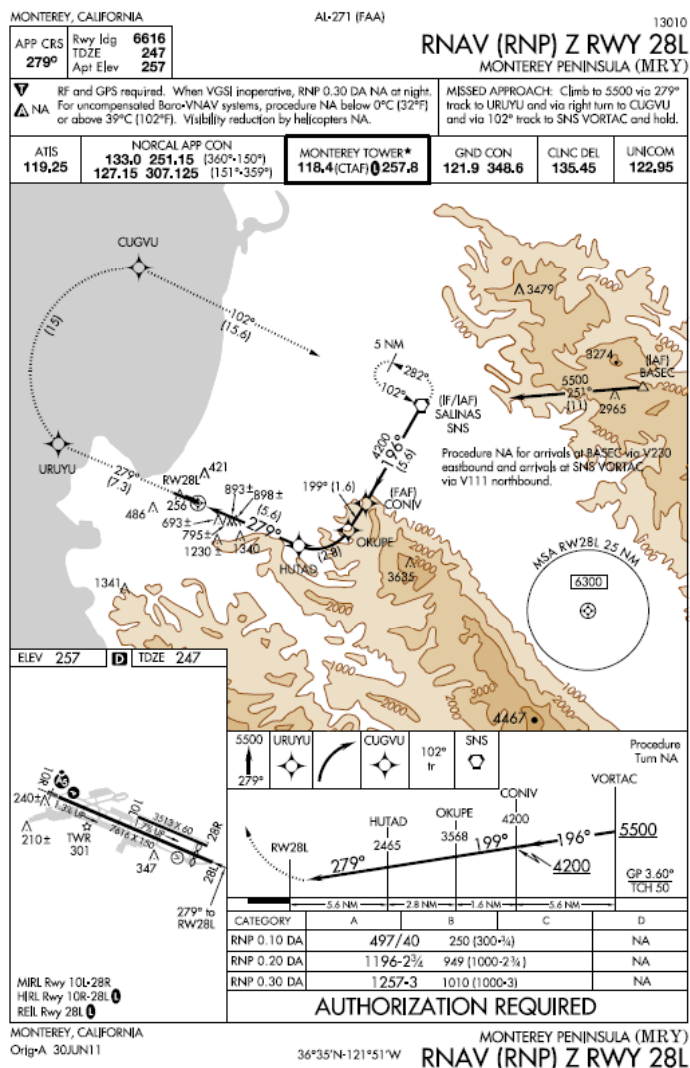
Traffic

E.g. New York Area

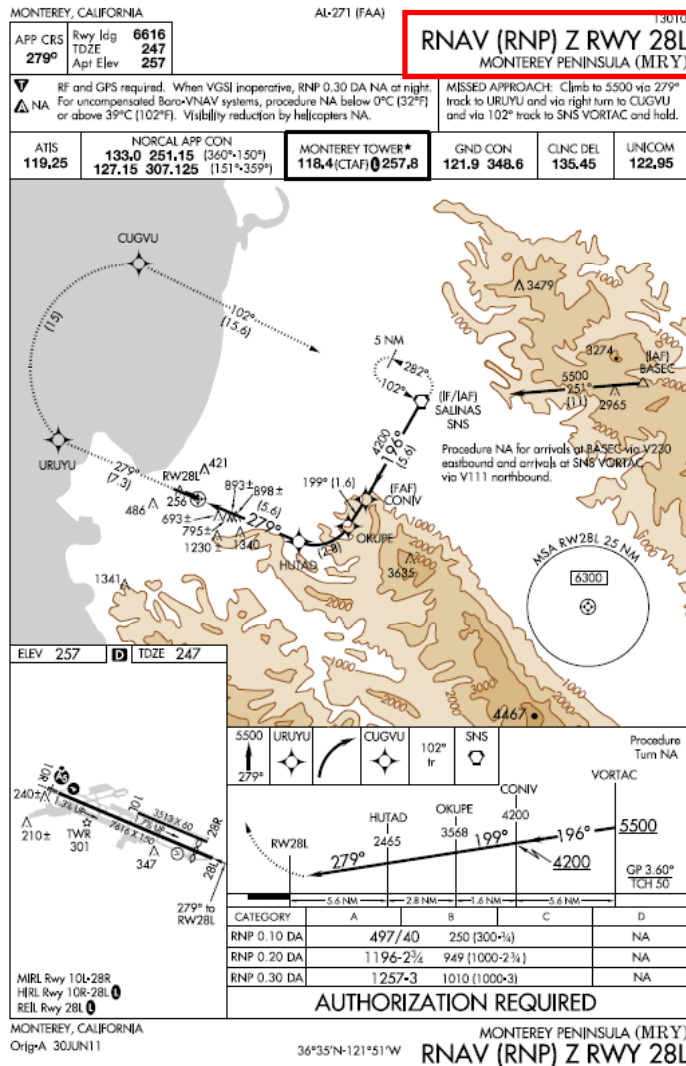
Characteristics of an RNP AR Approach



RNP AR 进近特点

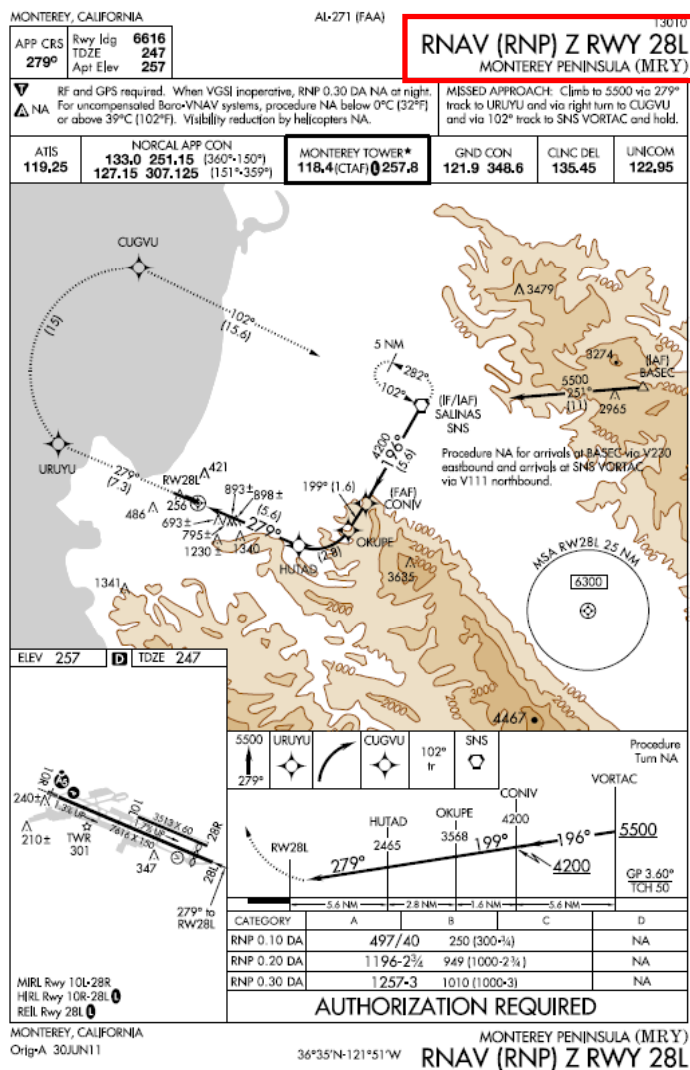


Characteristics of an RNP AR Approach



- Titled RNAV (RNP) Z RWY XX
 - Alphabetic character used when multiple RNAV approaches to the same runway

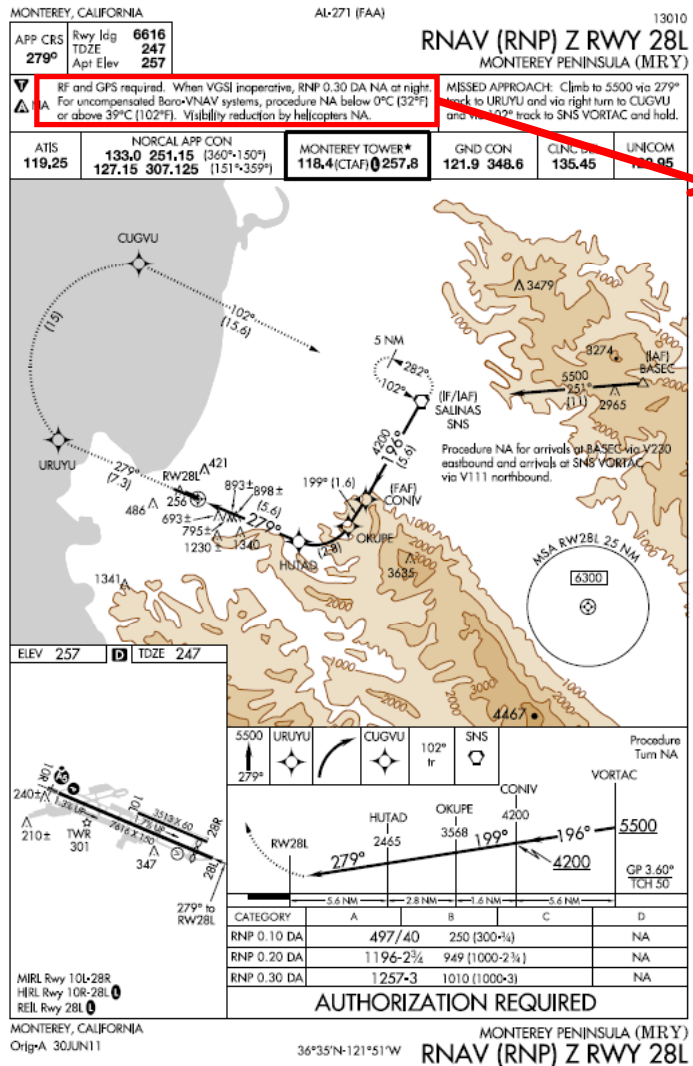
RNP AR 进近特点



• 程序名称为 RNAV (RNP) Z RWY XX

— 当同一跑道有多个RNAV进近时，则用字母来区分

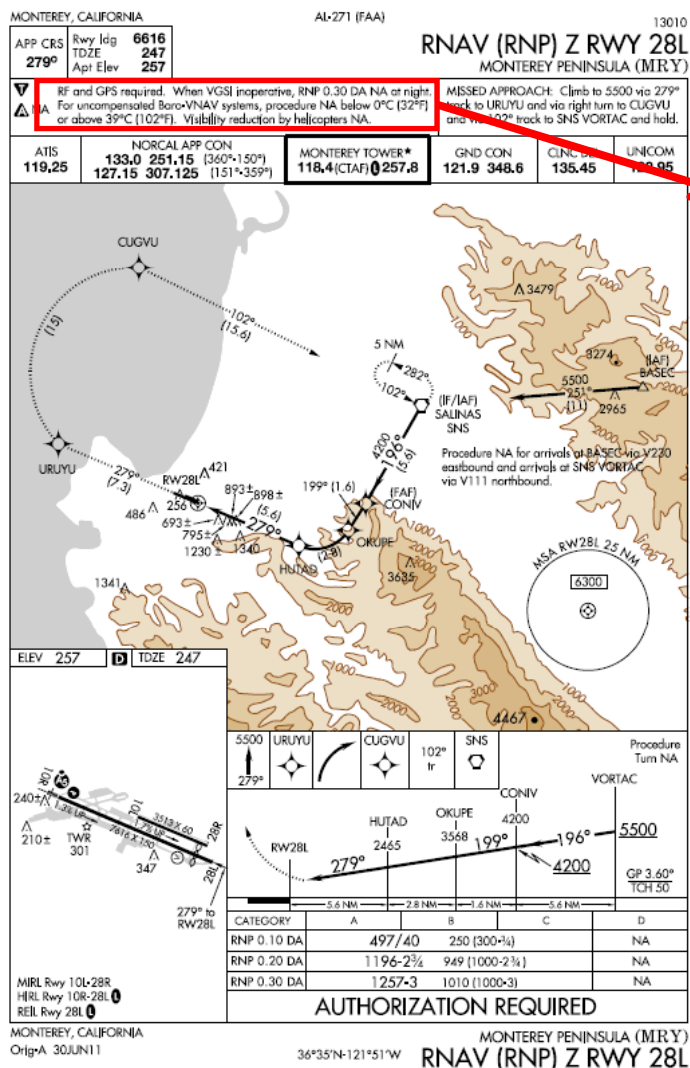
Characteristics of an RNP AR Approach



RF and GPS required. When VGSI inoperative, RNP 0.30 DA NA at night. For uncompensated Baro-VNAV systems, procedure NA below 0°C (32°F) or above 39°C (102°F). Visibility reduction by helicopters NA.

- GPS is the required navigation sensor
- Constant radius turns (radius to fix - RF legs may be required)
- Temperature limits are required due to Baro-VNAV
 - Temp compensation capability eliminates limits

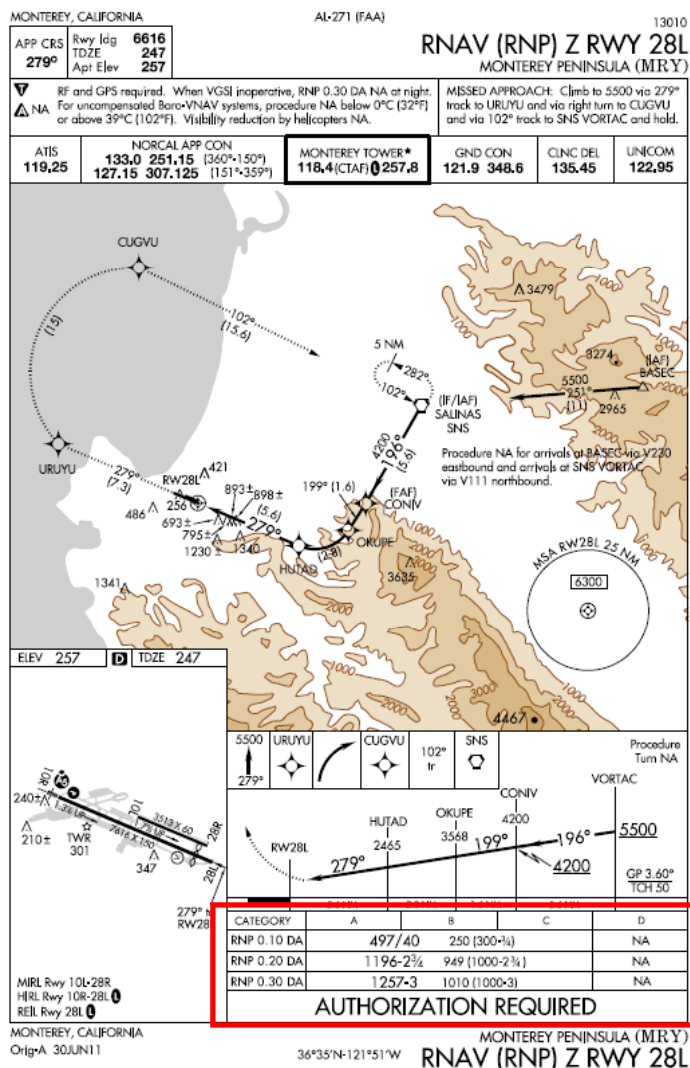
RNP AR 进近特点



RF and GPS required. When VGSI inoperative, RNP 0.30 DA NA at night. For uncompensated Baro-VNAV systems, procedure NA below 0°C (32°F) or above 39°C (102°F). Visibility reduction by helicopters NA.

- GPS 为必备导航传感器
- 固定半径转弯(半径到定位点-可能需要RF航段)
- 因为气压垂直导航 (Baro-VNAV)，需要限制温度
 - 具备温度补偿能力，则可以不考虑温度限制

Characteristics of an RNP AR Approach



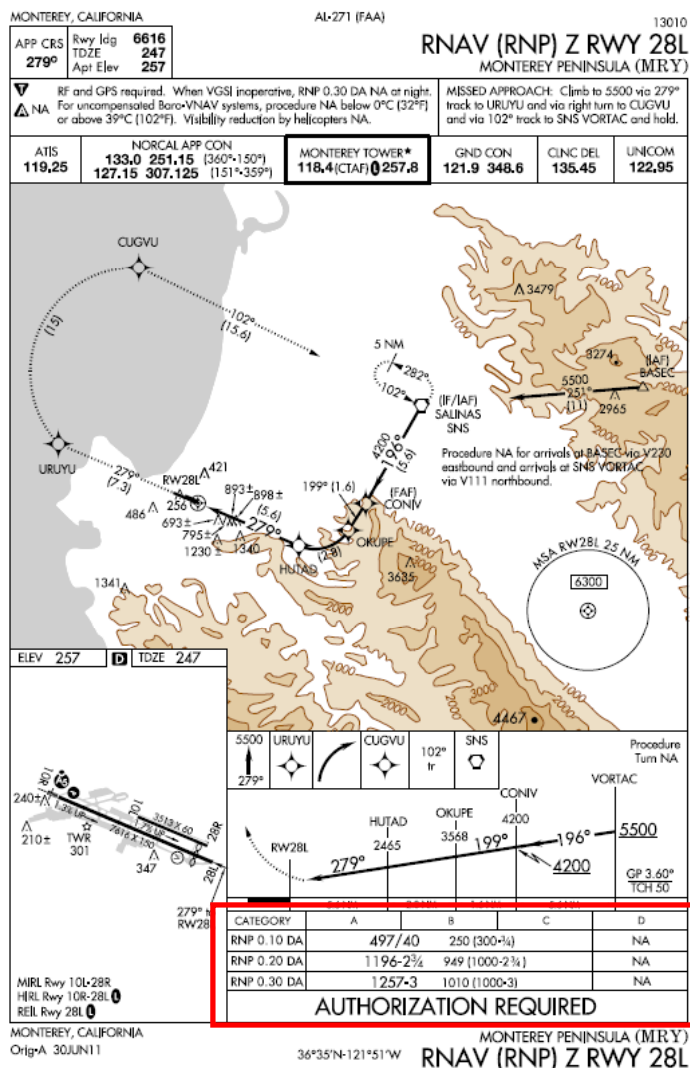
- RNP AR approach procedures can have up to 4 lines of minima (RNP 0.3 – 0.1)
 - Will include lines of minima for RNP 0.3 if possible
 - When beneficial procedure designers will include lines of minima for lower RNP values
 - RNP 0.1 is the lowest allowed

CATEGORY	A	B	C	D
RNP 0.10 DA	497/40	250 (300-¾)		NA
RNP 0.20 DA	1196-2¾	949 (1000-2¾)		NA
RNP 0.30 DA	1257-3	1010 (1000-3)		NA

AUTHORIZATION REQUIRED

An AR / SAAAR approach will always be clearly labeled as such

RNP AR 进近特点



- RNP AR 进近程序可多达4栏着陆最低标准 (RNP 0.3 – 0.1)
 - 如果可能, 包括RNP 0.3着陆最低标准
 - 当有益时, 将设计更低的RNP值着陆最低标准
 - RNP 0.1 为允许最低值

CATEGORY	A	B	C	D
RNP 0.10 DA	497/40	250 (300-¾)		NA
RNP 0.20 DA	1196-2¾	949 (1000-2¾)		NA
RNP 0.30 DA	1257-3	1010 (1000-3)		NA

AUTHORIZATION REQUIRED

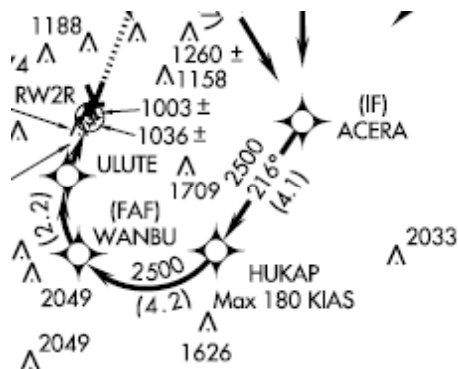
AR / SAAAR 进近总会像这样清楚标注

RNP AR Approaches

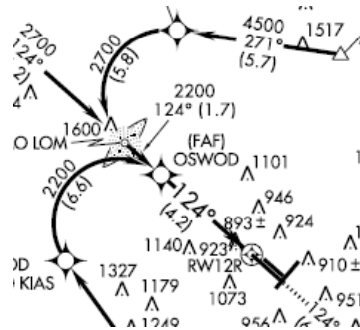
RNP AR is utilized to create approaches at airports

- As a supplement to existing ILS approaches
- As an approach tool for terrain challenge airports
- As an approach tool for traffic challenged airports
- As an approach tool that utilizes RF legs to shorten distances

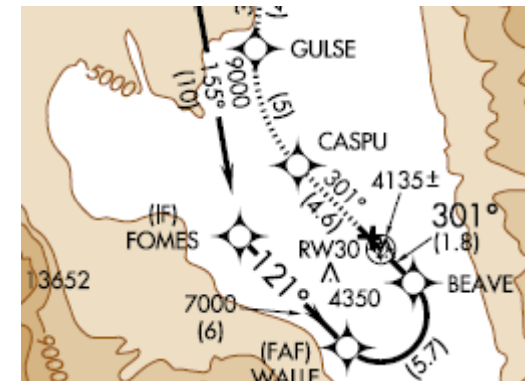
Airlines are utilizing RNP AR to decrease flight times



Traffic de-confliction
KPDK



RF turn-to-final
KSAT



Terrain challenged
KBIH

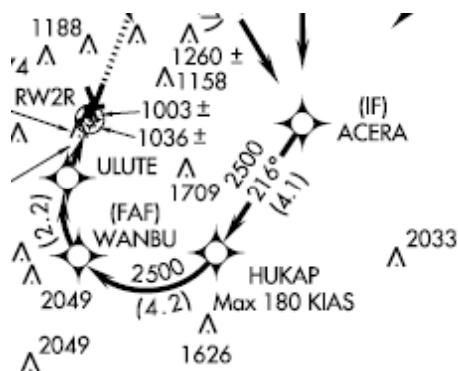
Examples of RNP AR approaches improving airport access

RNP AR 进近

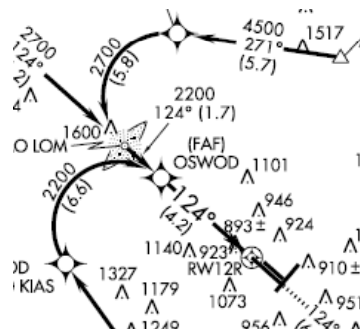
在机场采用RNP AR建立进近:

- 作为现有ILS进近的补充
- 作为地形复杂机场的进近手段
- 作为繁忙机场的进近手段
- 用有RF航段的进近方式, 缩短距离

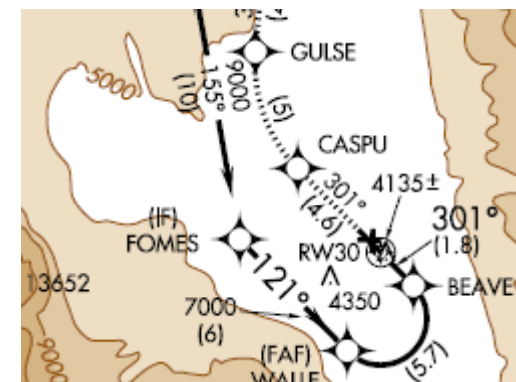
航空公司用RNP AR 缩短飞行时间



KPDK解决交通冲突



KSAT机场用RF航段转向五边



KBIH机场解决复杂地形

RNP AR 改善机场通行能力举例

JFK ILS RWY 13L

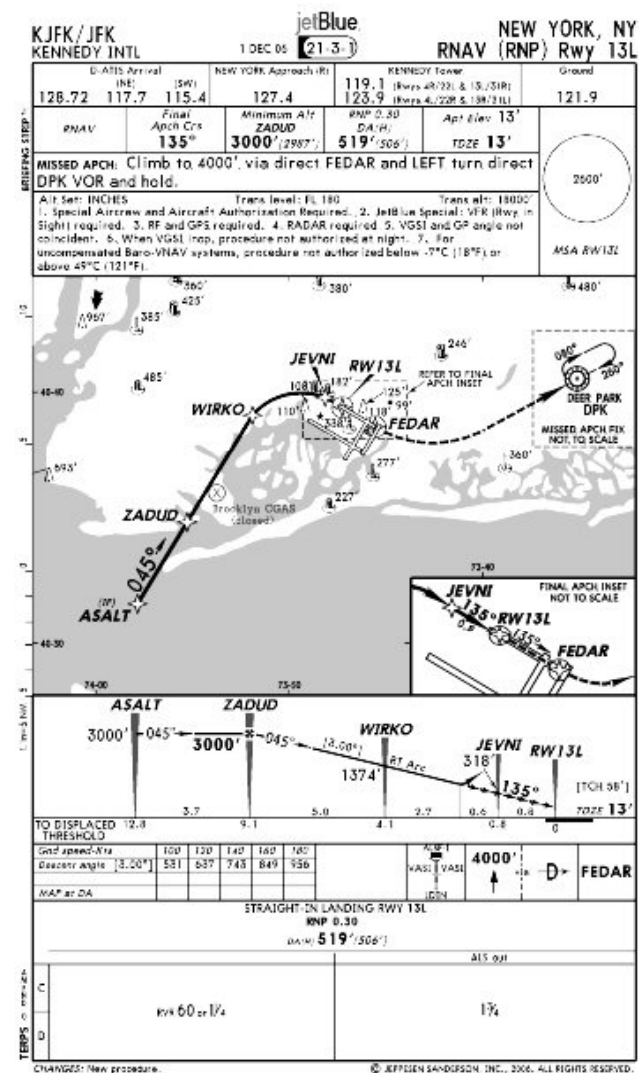
LGA ILS Approaches

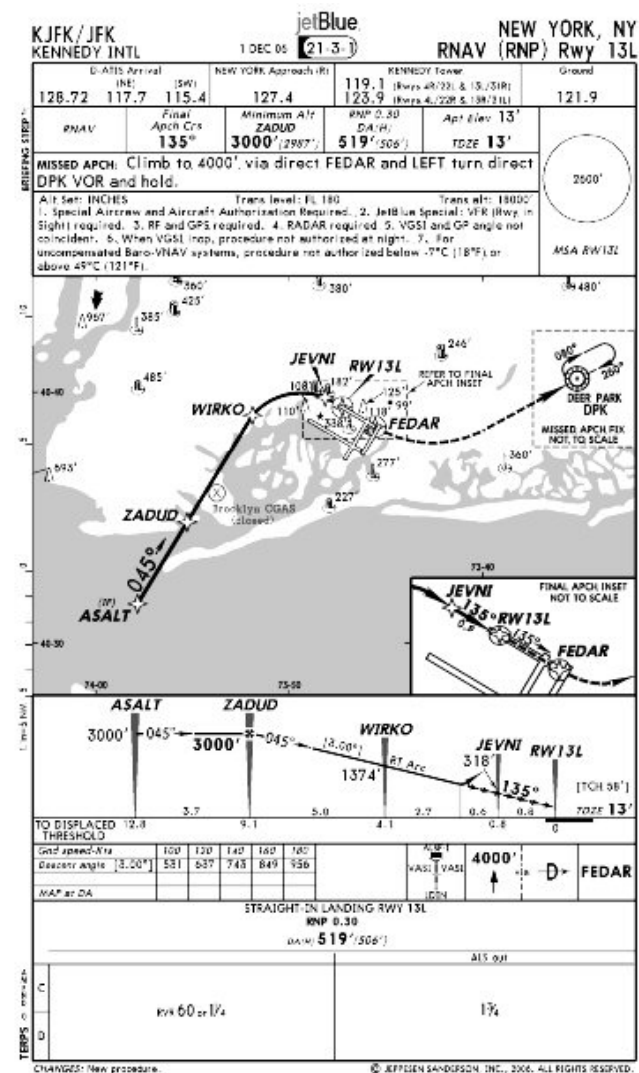
La Guardia Airport (LGA)

John F. Kennedy Airport (JFK)

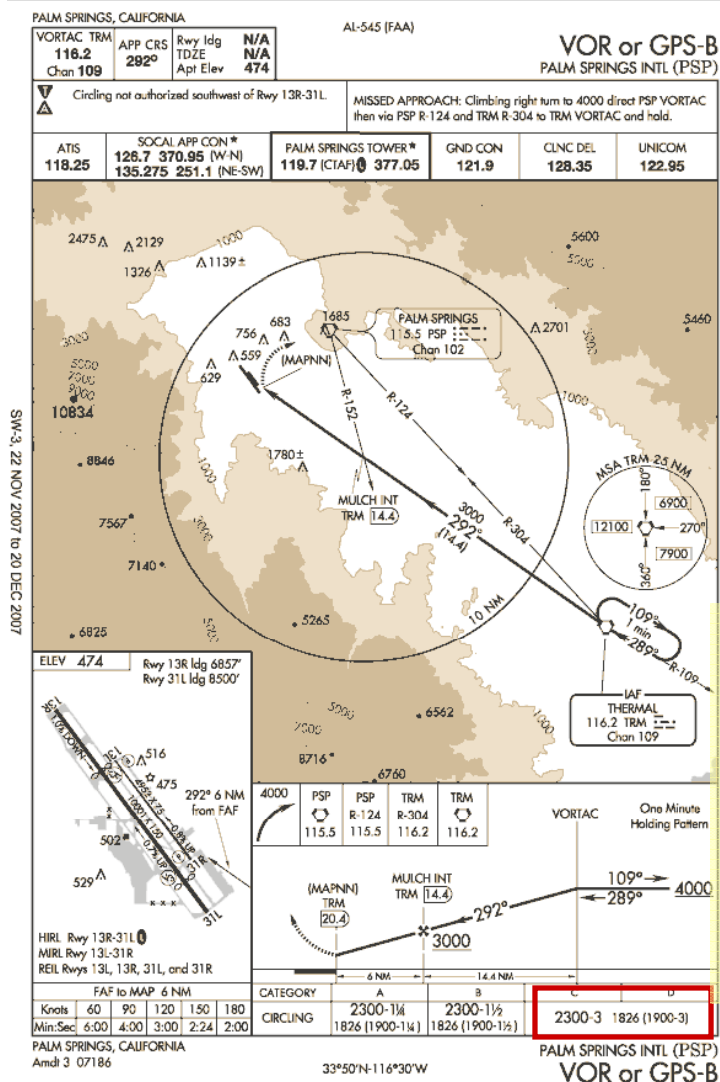
LGA ILS RWY 4

JFK RNP Approaches





Stabilized Approach – PSP RNP RWY 31L



VOR or GPS B

– No ILS available at PSP

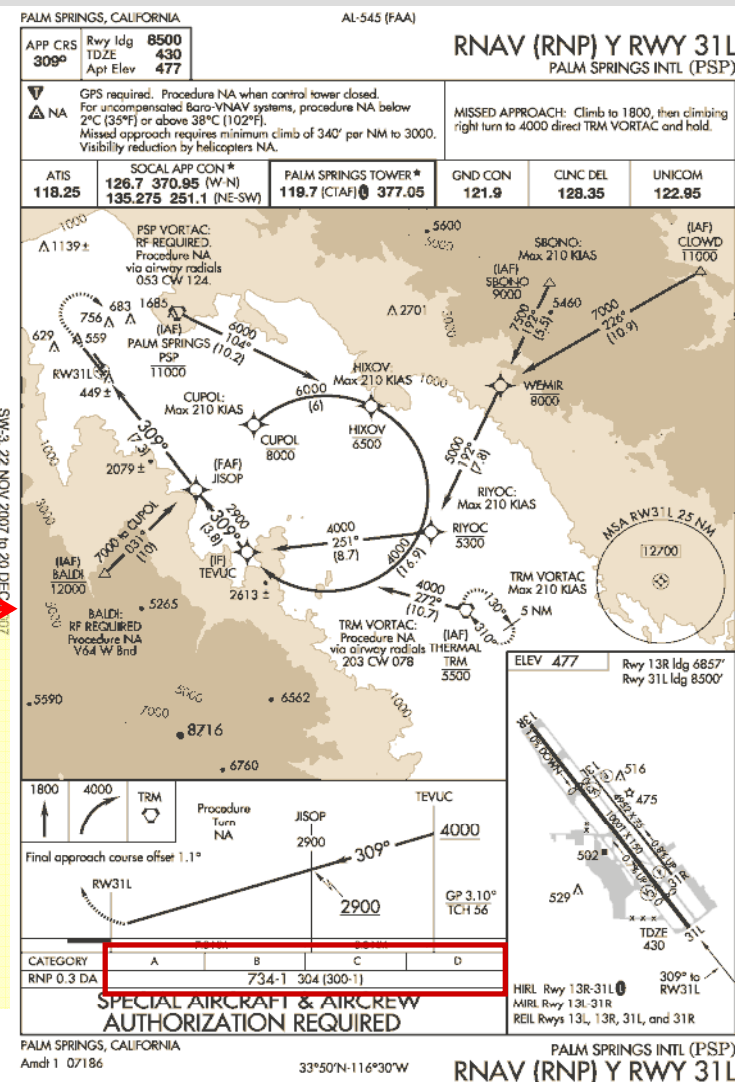
– Minimums:
1900' / 3

RNAV RNP Z Rwy 31L

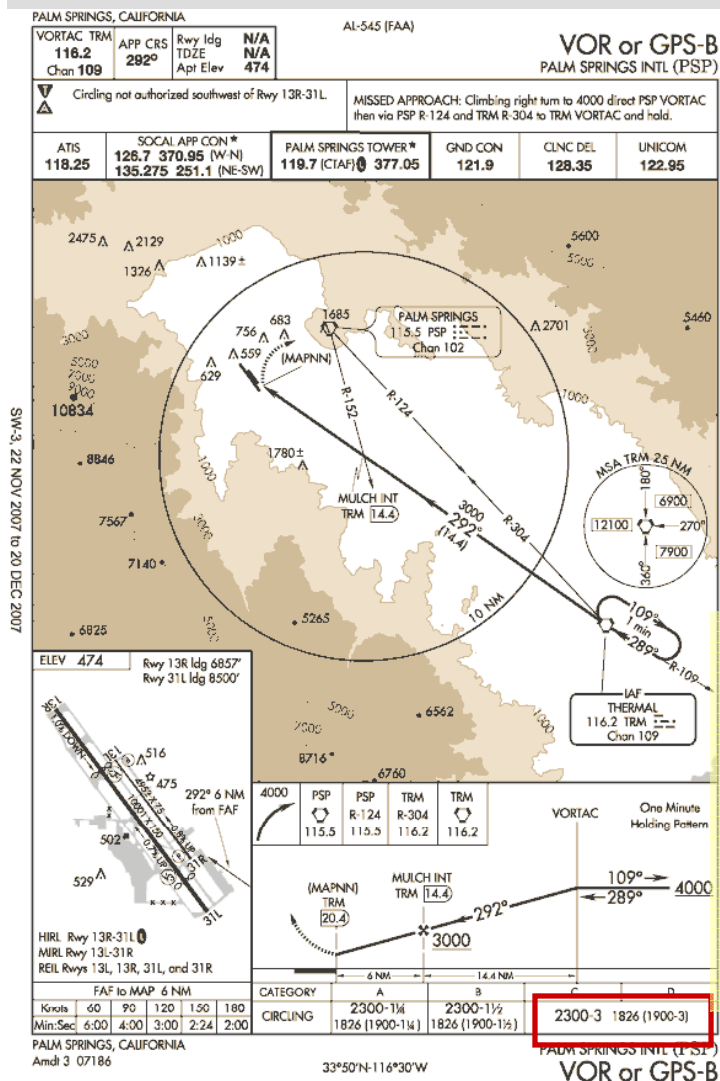
– Constant descent turns from high altitudes

– IAF's at all quadrants

– Minimums:
300' / 1 (RNP 0.3)

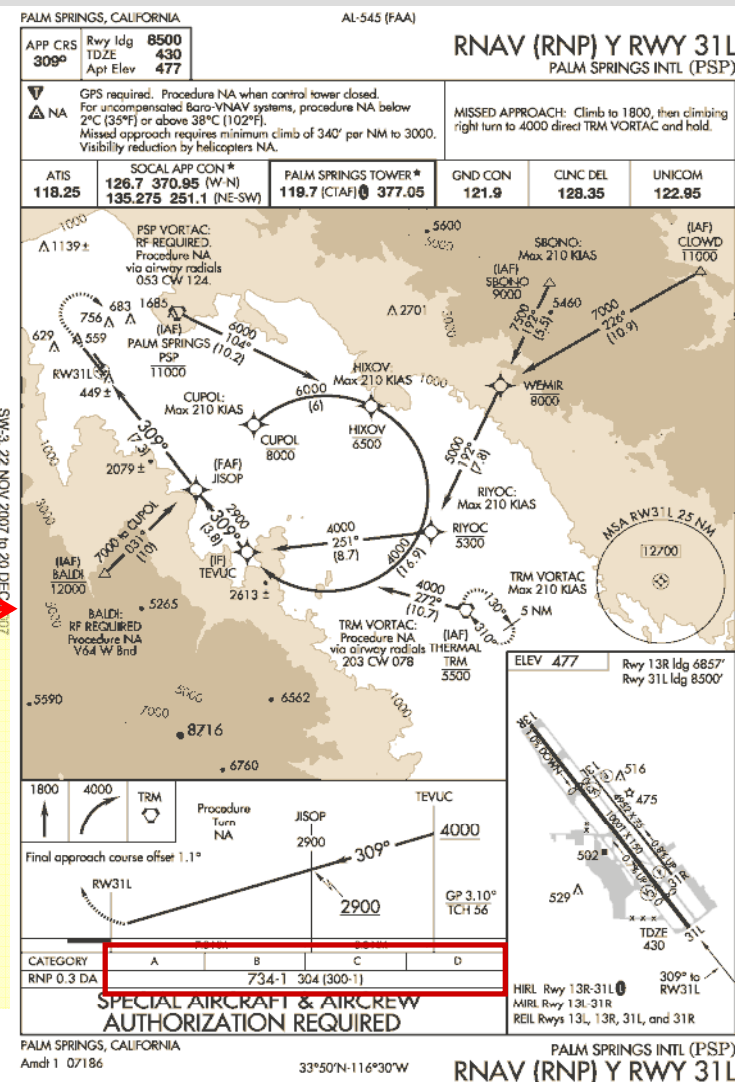


稳定进近— PSP机场31L跑道RNP AR进近



VOR or GPS B
—PSP机场无可用ILS
— 最低着陆标准:
1900' / 3

RNAV RNP Z Rwy 31L
— 从高高高度测定下降转弯
— IAF位于所有扇区内
— 最低标准:
300' / 1 (RNP 0.3)



Improved Access – RNO RNP RWY 16R



ILS Rwy 16R

–Minimums:

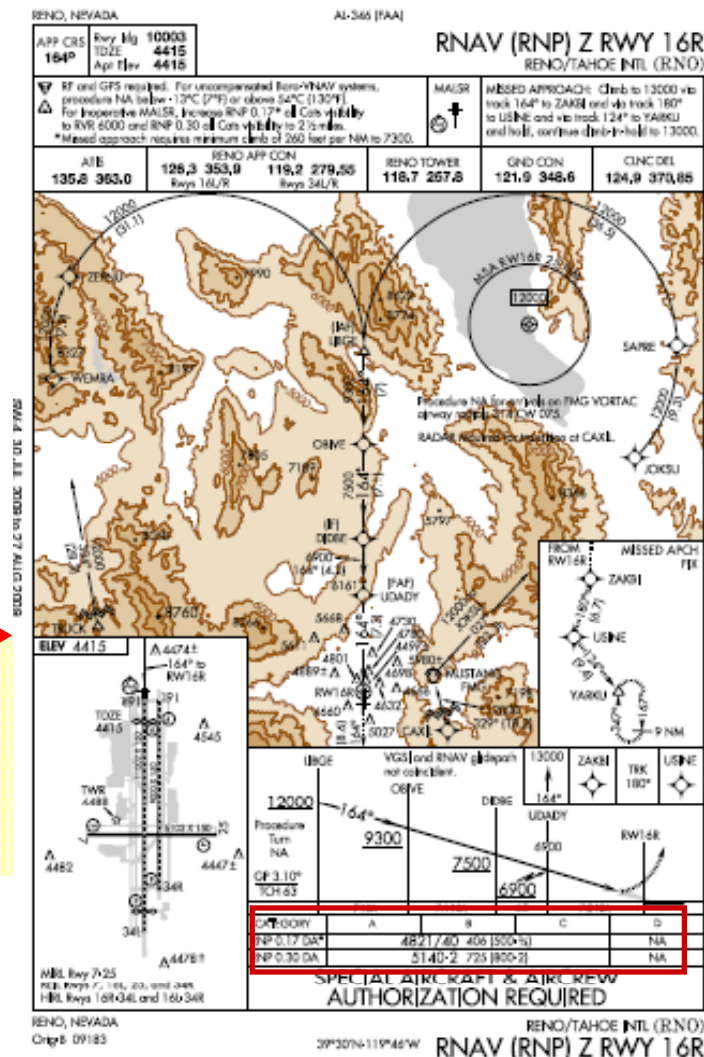
2100' / 7

RNAV RNP Z Rwy 16R

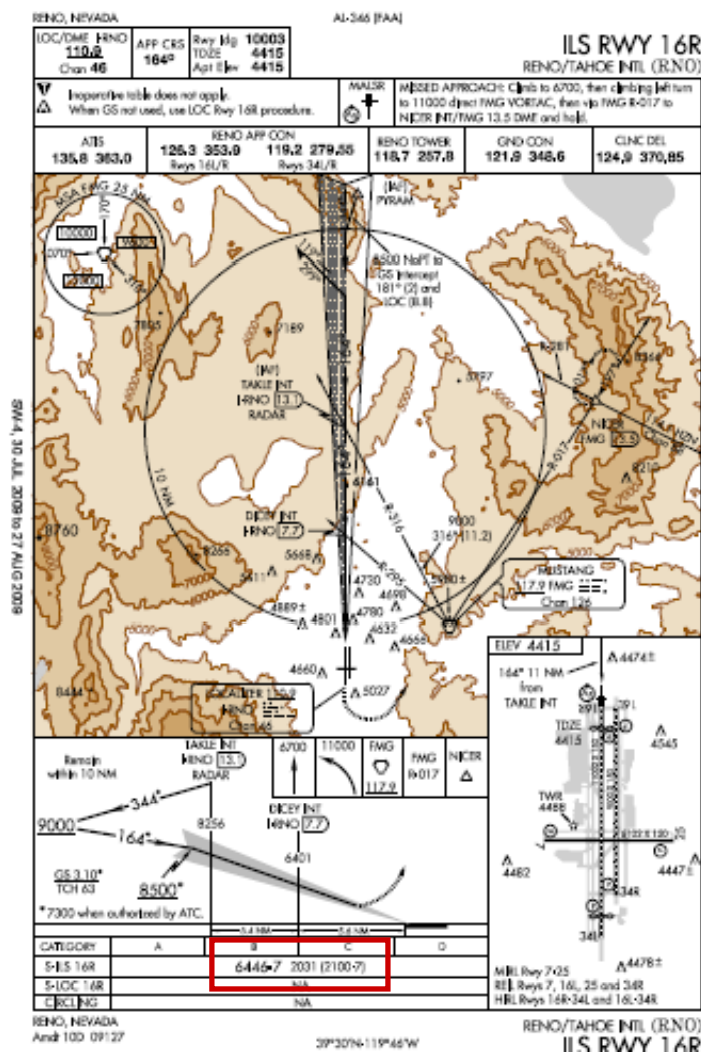
Minimums:

500' / 3/4 (RNP 0.17)

800' / 2 (RNP 0.3)



改善通行能力- RNO机场16R跑道RNP AR进近



ILS Rwy 16R

—最低标准:

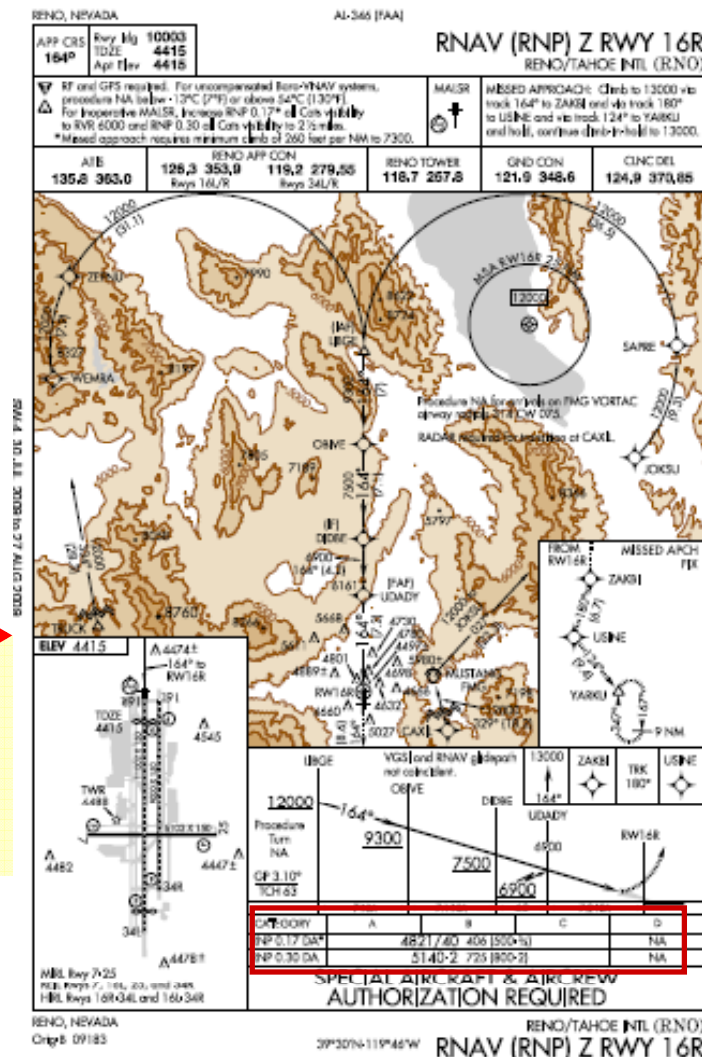
2100' / 7

RNAV RNP Z Rwy 16R

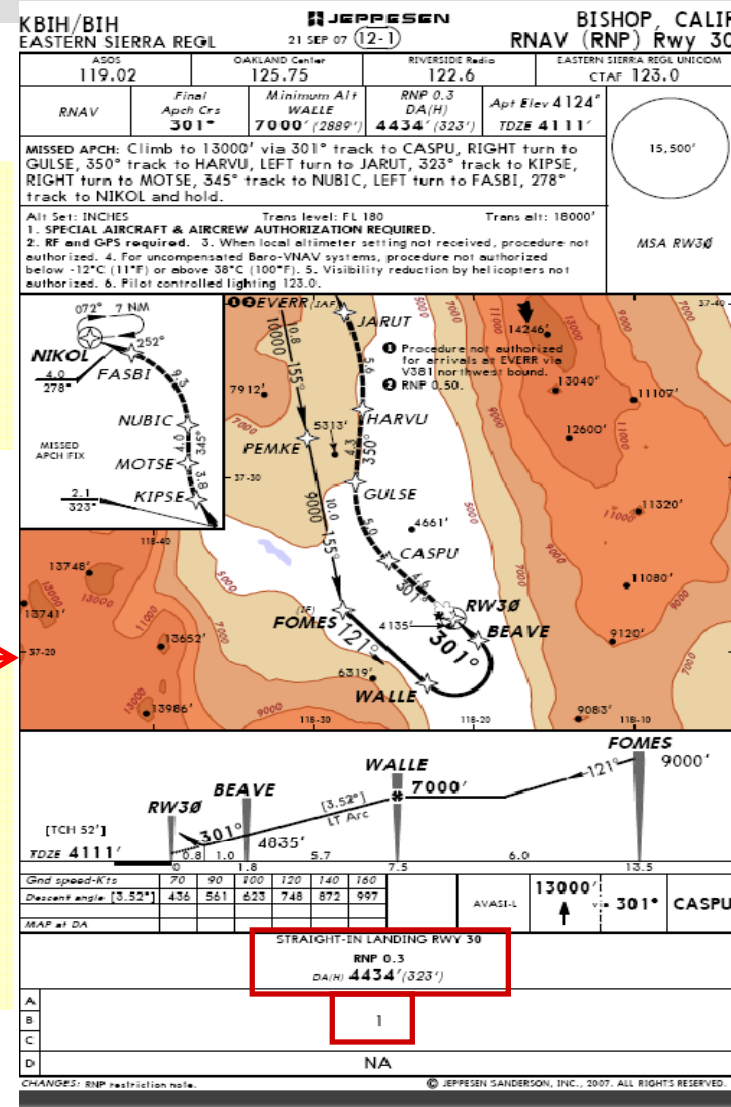
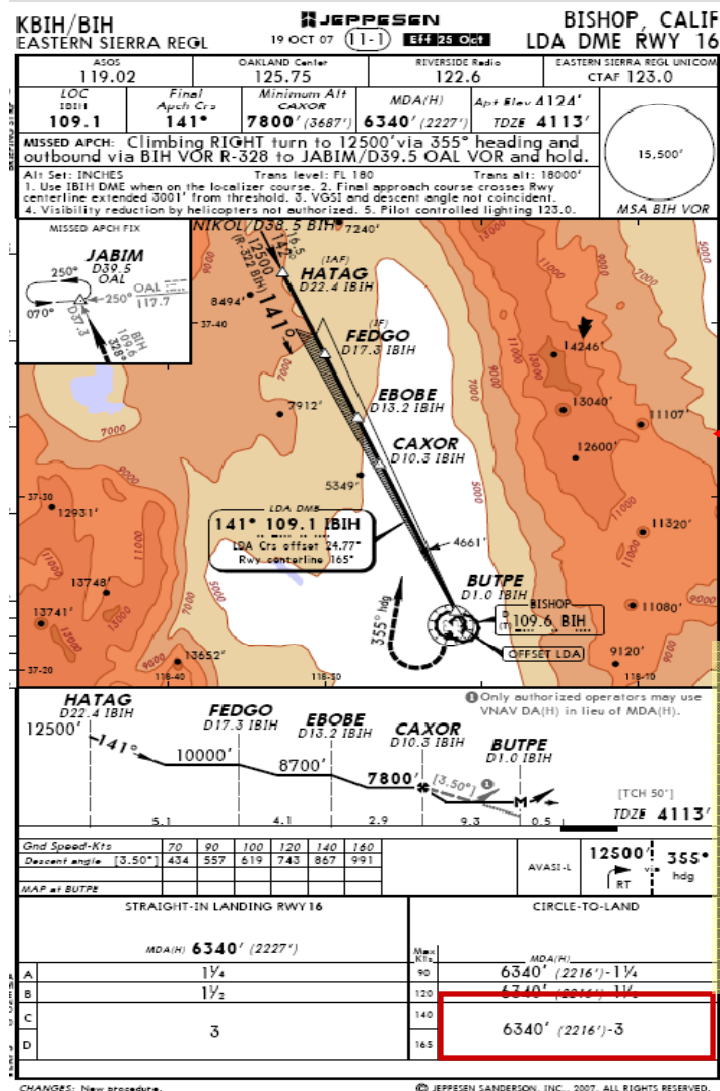
最低标准:

500' / 3/4 (RNP 0.17)

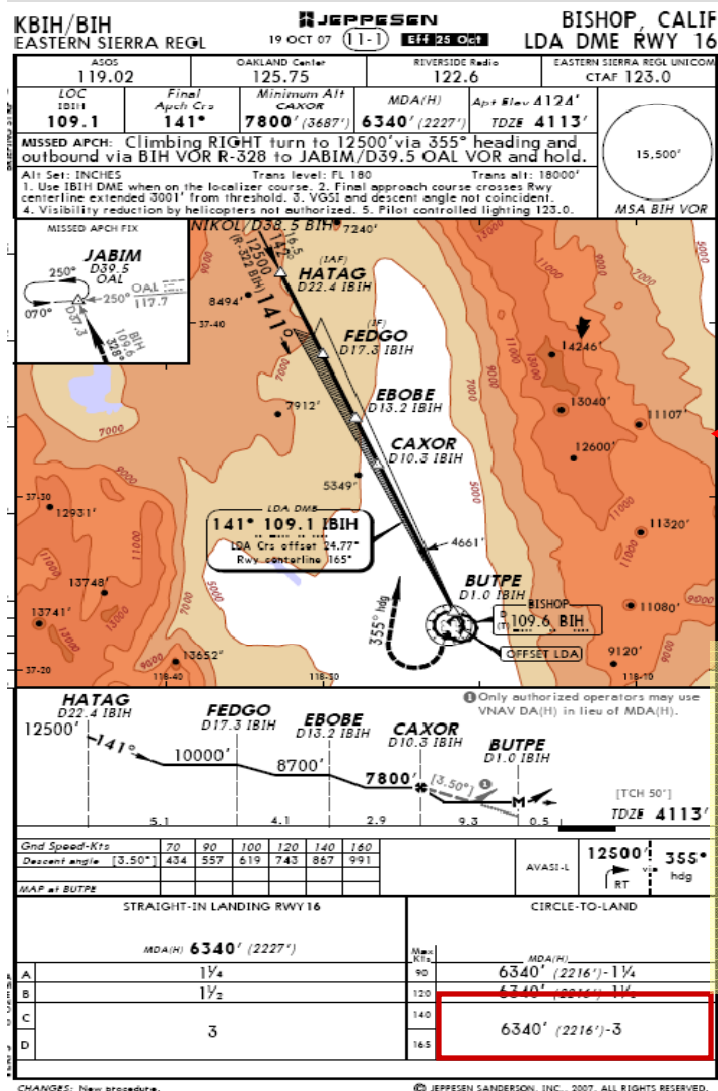
800' / 2 (RNP 0.3)



Improved Access – BIH RWY 30



改善通行能力- BIH机场30跑道RNP AR进近

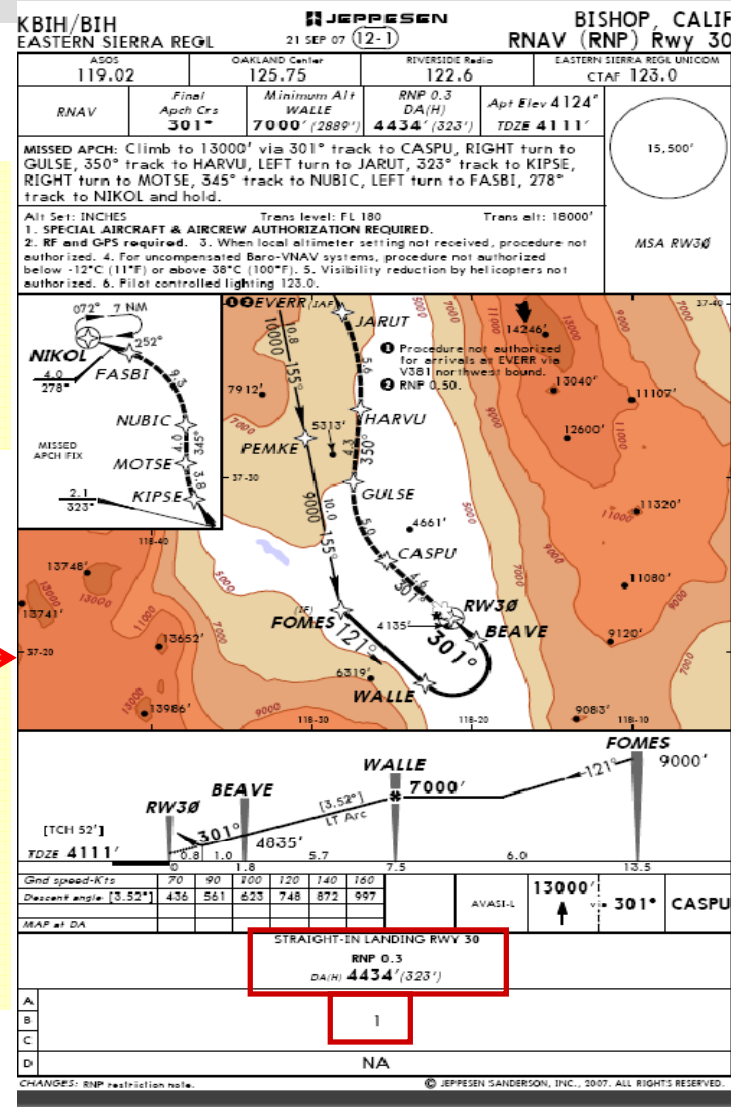


盘旋着陆

- RWY 30无直线进近
- 最低标准:
2216' / 3

RNAV RNP Rwy 30

- 在最后进近和复飞航段采用了RF
- 最低标准:
323' / 1



MISSOULA, MONTANA AL-266 (FAA)

GPS-D
MISSOULA INTL (MSO)

APP CRS 335°	Rwy Idg TDZE Apt Elev N/A N/A 3205	MISSED APPROACH: Climb to 5300 then climbing left turn to 9600 direct LIBRE WP and hold.	
ATIS 126.65	SPOKANE APP CON* 124.9 298.95	MISSOULA TOWER* 118.4 (CTAF) 0 377.175	GND CON 121.9
UNICOM 122.95			

MISSED APCH FIX

100°
280°
LIBRE

5300 9600
LIBRE
△

ALHOB

WOJHO

VISVE

8000

6800

335°

Procedure Turn NA

6 NM 5 NM

CATEGORY

A	B	C	D
5120-1 1/4 1915 (2000-1 1/4)	5120-1 1/2 1915 (2000-1 1/2)	5120-3 1915 (2000-3)	

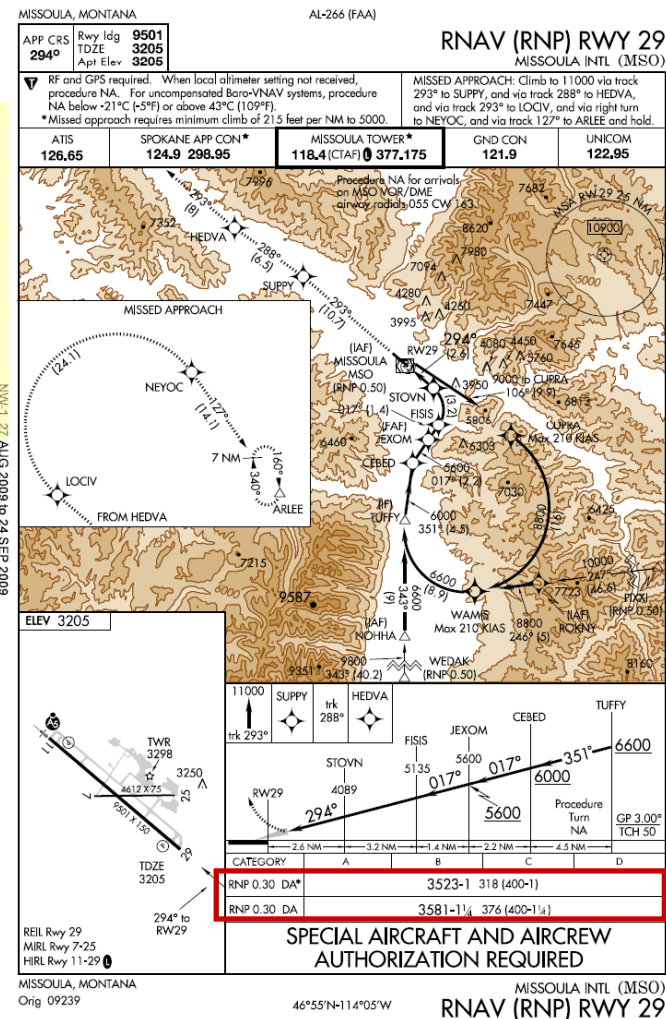
CIRCLING

MISSOULA, MONTANA
Orig-A 09239

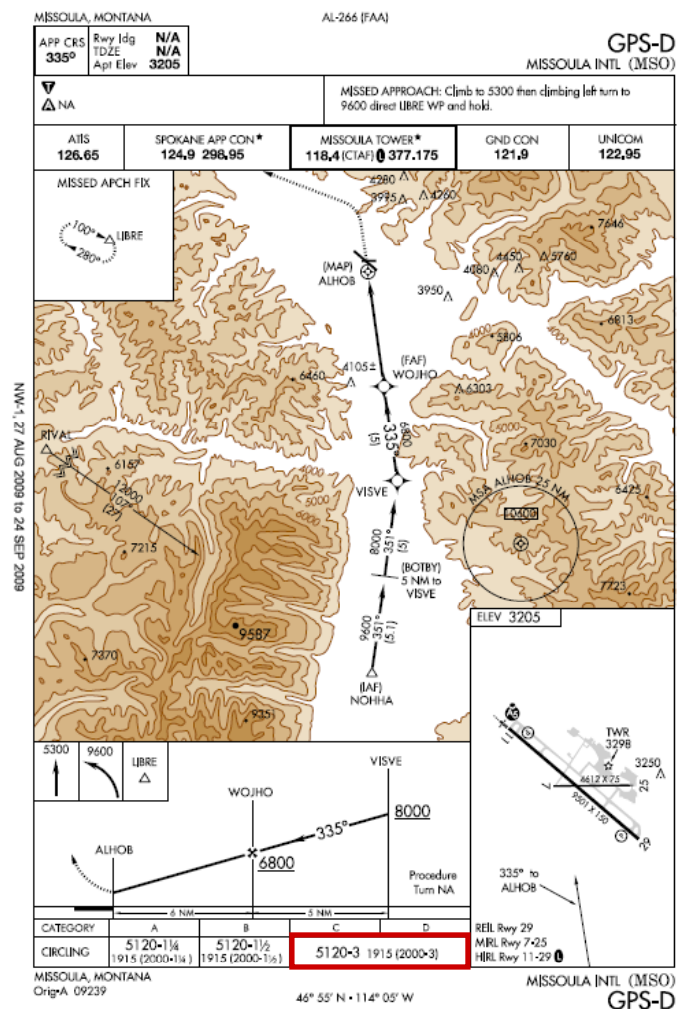
46° 55' N • 114° 05' W

GPS-D
MISSOULA INTL (MSO)

- RF legs used
- Minimums:
400' / 1



改善通行能力- MSO机场29跑道RNP AR进近

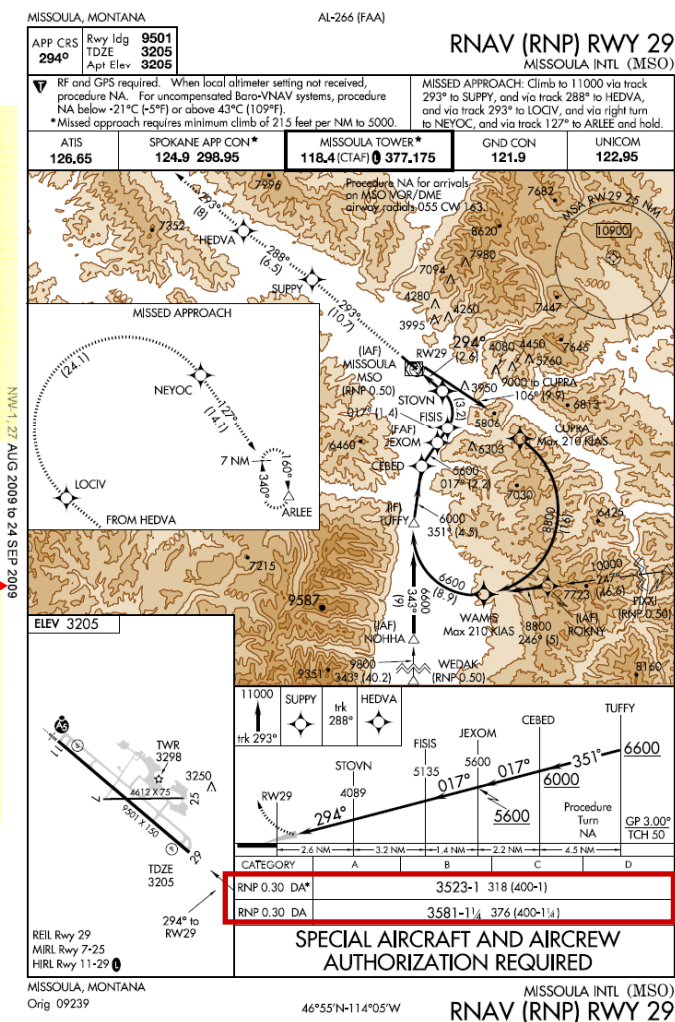


29跑道盘旋着陆

- 29跑道 无直线进近
- 最低标准:
2000' / 3

RNAV RNP Rwy 29

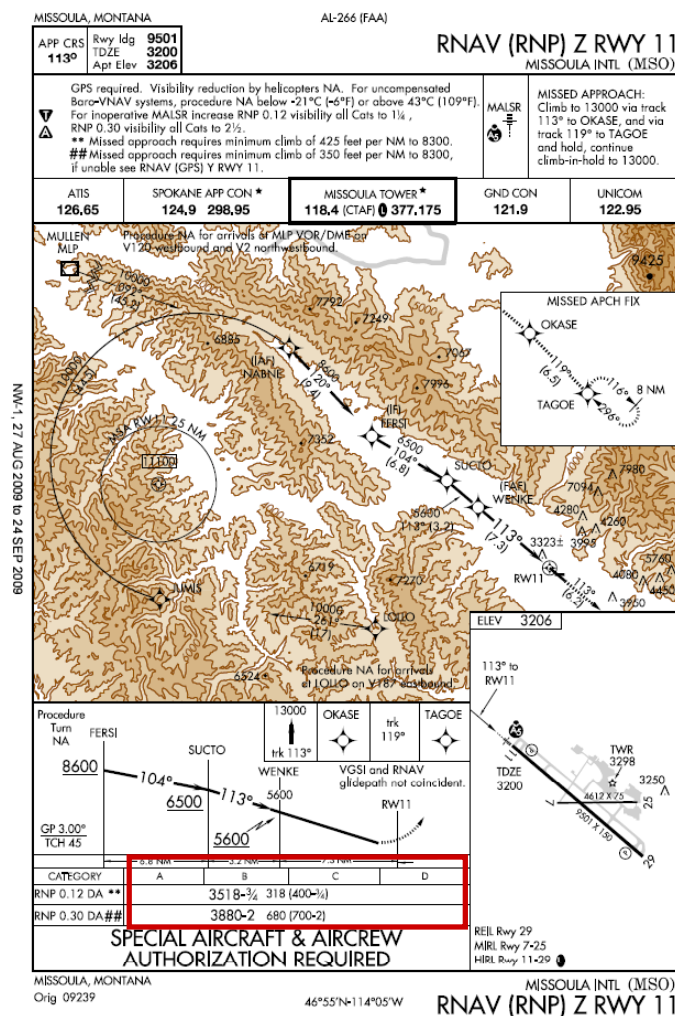
- 使用RF航段
- 最低标准:
400' / 1



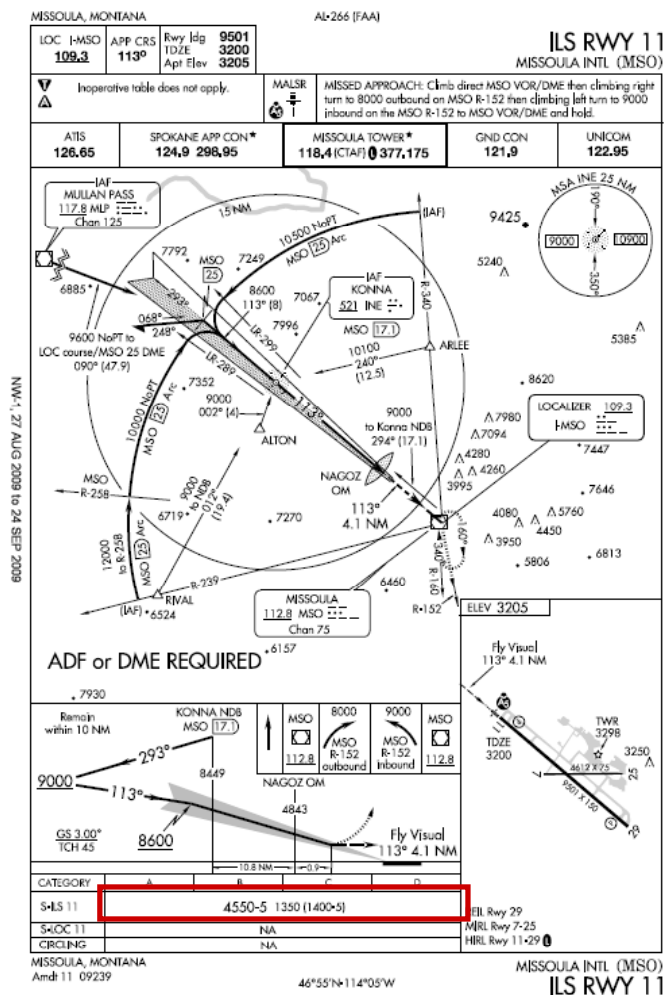
[illegible]

RNAV RNP Rwy 11

- RF legs used
- Minimums:
400' / 1 ¼ (RNP 0.12)
700' / 2 (RNP 0.3)



改善通行能力- MSO机场11跑道RNP AR进近



ILS 11

一 最低标准:

1400' / 5

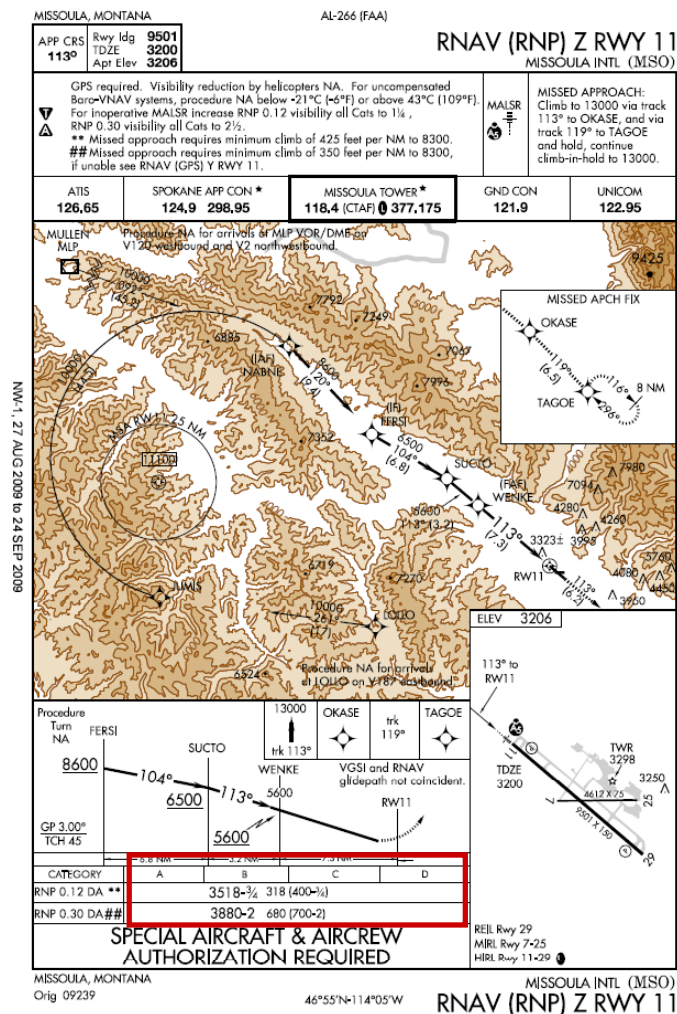
RNAV RNP Rwy 11

- 采用RF legs

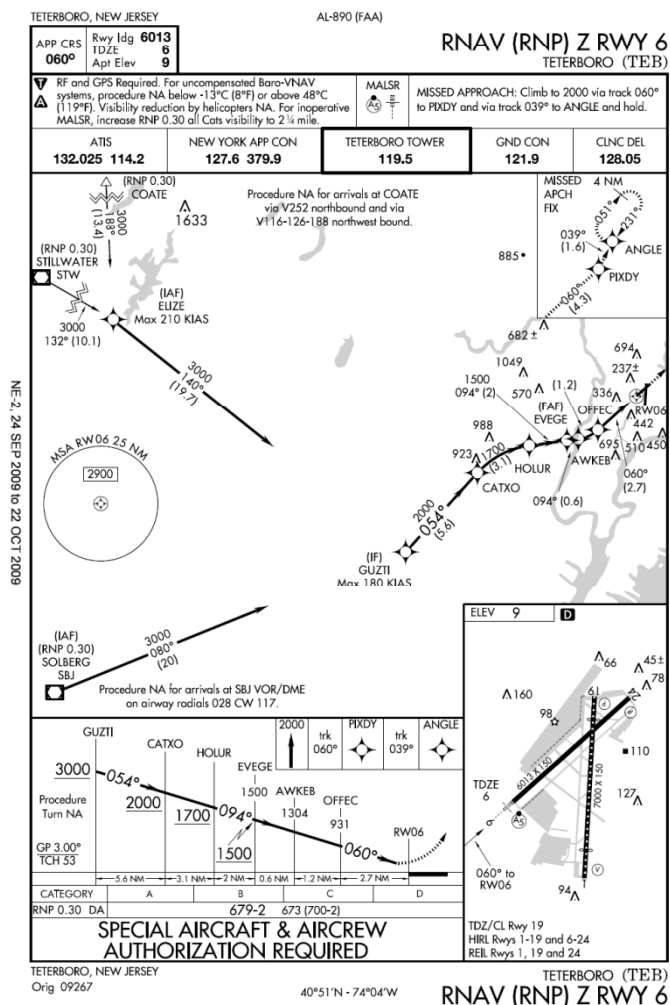
一 最低标准:

400' / 1 ¼ (RNP 0.12)

700' / 2 (RNP 0.3)



Traffic De-Confliction – TEB RWY 06 & 19

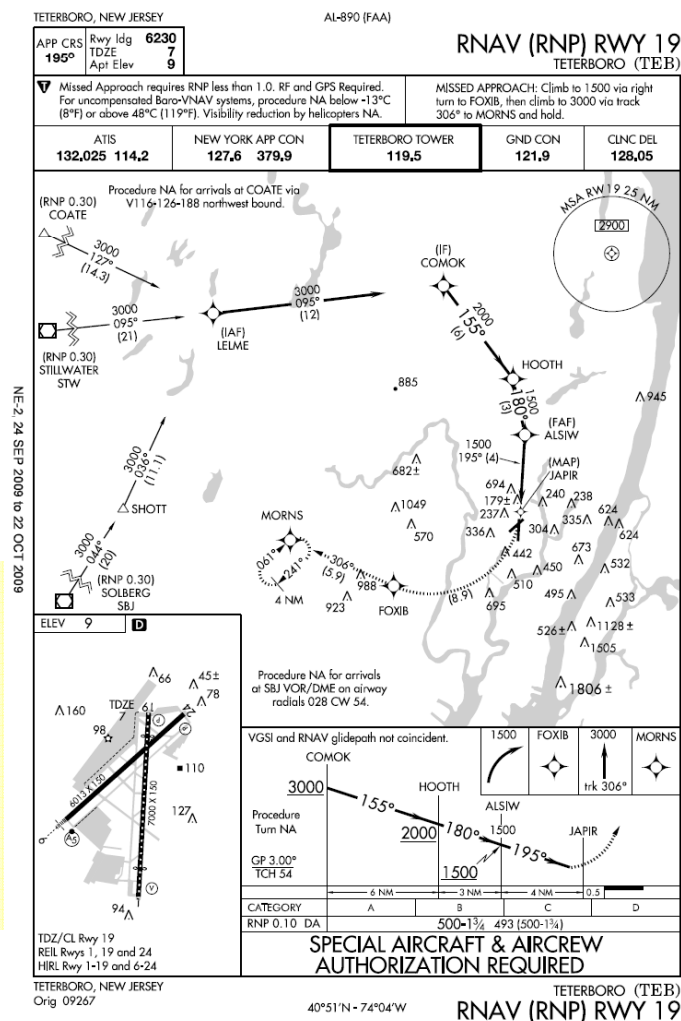


RNAV RNP RWY 6

- RNP 0.3
- RF legs used
- Airspace and Obstacle de-confliction

RNAV RNP Rwy 19

- RNP 0.1
- RF legs used
- Airspace and Obstacle de-confliction



TETERBORO, NEW JERSEY

APP CRS 060°	Rwy Idg TDZE Apt Elev	6013 8 9
-----------------	-----------------------------	-------------------------------------

AL-890 (FAA)

RNAV (RNP) Z RWY 6
TETERBORO (TEB)

V RF and GPS Required. For uncompensated Baro-VNAV systems, procedure NA below -1°C (8°F) or above 48°C (119°F). Visibility reduction by helicopters NA. For inoperative MALS/R, increase RNP 0.30 all Cats visibility to 2½ mile.

MALS/R

MISSED APPROACH: Climb to 2000 via track 060° to PIXDY and via track 039° to ANGLE and hold.

ATIS	NEW YORK APP CON	TETERBORO TOWER	GND CON	CINC DEL
132.025 114.2	127.6 379.9	119.5	121.9	128.05

SPECIAL AIRCRAFT & AIRCREW AUTHORIZATION REQUIRED

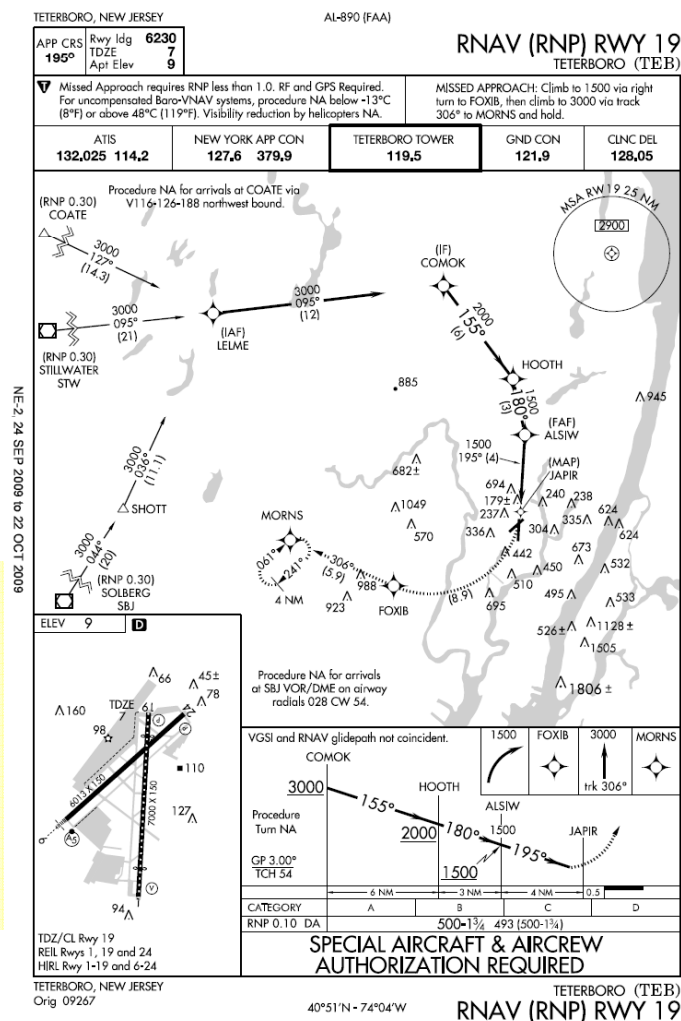
TETERBORO, NEW JERSEY
Orig 09267

40°51'N · 74°04'W

TETERBORO (TEB)
RNAV (RNP) Z RWY 6

- RNP 0.3
- 使用RF航段
- 消除空域及障碍物冲突

- RNP 0.1
- 使用**RF**航段
- 消除空域及障碍物冲突



GUNNISON, COLORADO AL-517 [FAA]

LOC/DME I-GUC 110.5 Chan 42	APP CRS 062°	Rwy Idg TDZE Apt Elev 9400 7667 7660
---	------------------------	--

ILS or LOC/DME RWY 6
GUNNISON-CRESTED BUTTE RGNL (GUC)

▼ Inoperative table does not apply.
 ▲ When local altimeter setting not received, procedure NA.
 DME required. Visually reduction by helicopters NA.
 Procedure NA when airport closed except by prior arrangement.

AWOS-3 135.075	DENVER CENTER 125.35 354.05	UNICOM 122.7 (CTAF) 0
--------------------------	---------------------------------------	---------------------------------

MISSED APPROACH: Climb to 10000 then climbing right turn to 12000 via heading 180° and HBU VOR/DME R-050 to WIDIG/HBU 4. DME continue via HBU VOR/DME R-050 to HBU VOR/DME and hold.

LOC/DME I-GUC 110.5
Chan 42

LOCALIZER 110.5
I-GUC
Chan 42

BLUE MESA
114.9 HBU
Chan 96

ELEV 7680

602° 7.5 NM
from FAM

TDZE 7667

0.38 UP
41
3000
X 150

7773 ±

9400 X 150

35

CATEGORY	A	B	C	D
SLIS 6	8590-3 923 (1000-3)			NA
S-LOC 6	9020-3 1353 (1400-3)			
CIRCLING	9180-3 1500 (1500-3)			
	JOEVE DME MINIMUMS			
S-LOC 6	8640-3 973 (1000-3)			
CIRCLING	9180-3 1500 (1500-3)			

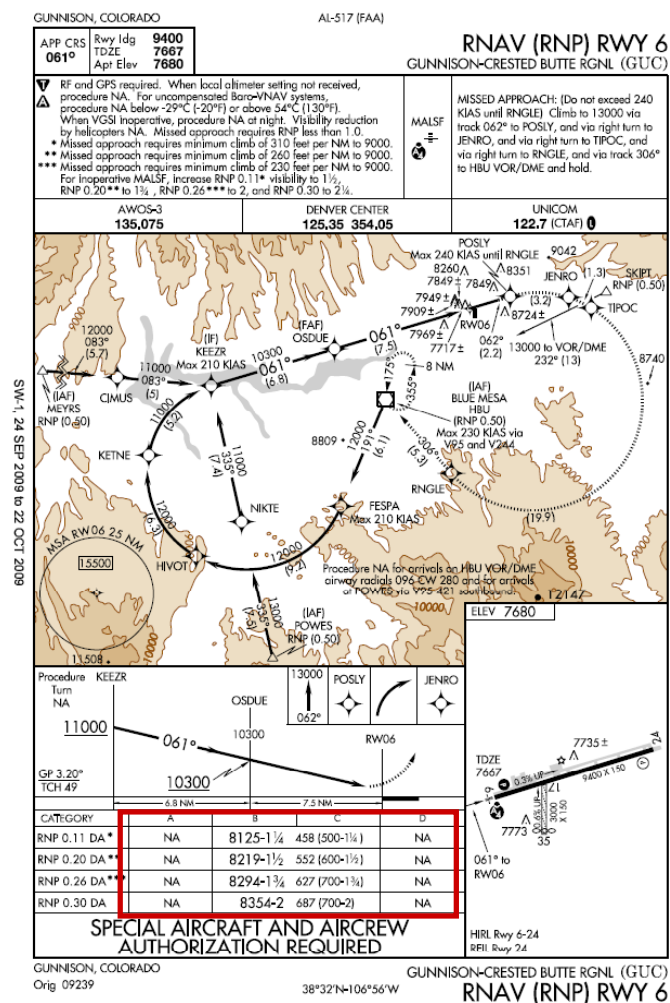
HRL Rwy 6-24
REL Rwy 24

GUNNISON, COLORADO **38°32'N 106°56'W**

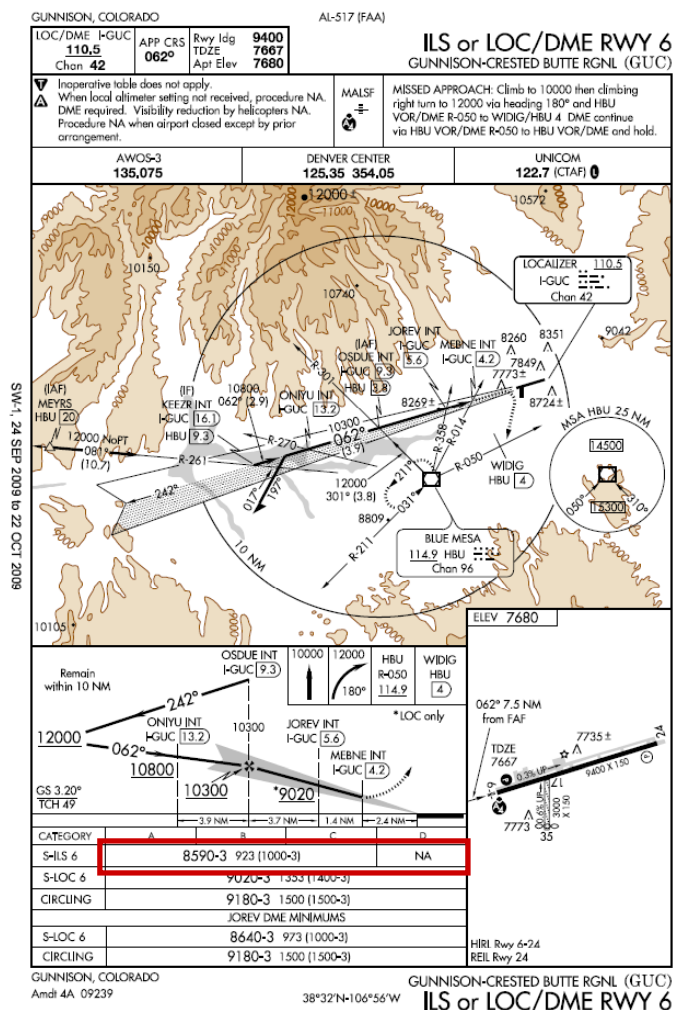
GUNNISON-CRESTED BUTTE RGNL (GUC)
ILS or LOC/DME RWY 6

RNAV RNP Rwy 06

- RF legs used
- Minimums:
500' / 1 ¼ (RNP 0.12)
700' / 2 (RNP 0.3)



改善通行能力- GUC机场06跑道RNP AR进近



ILS Rwy 06

— 最低标准:

1000' / 3

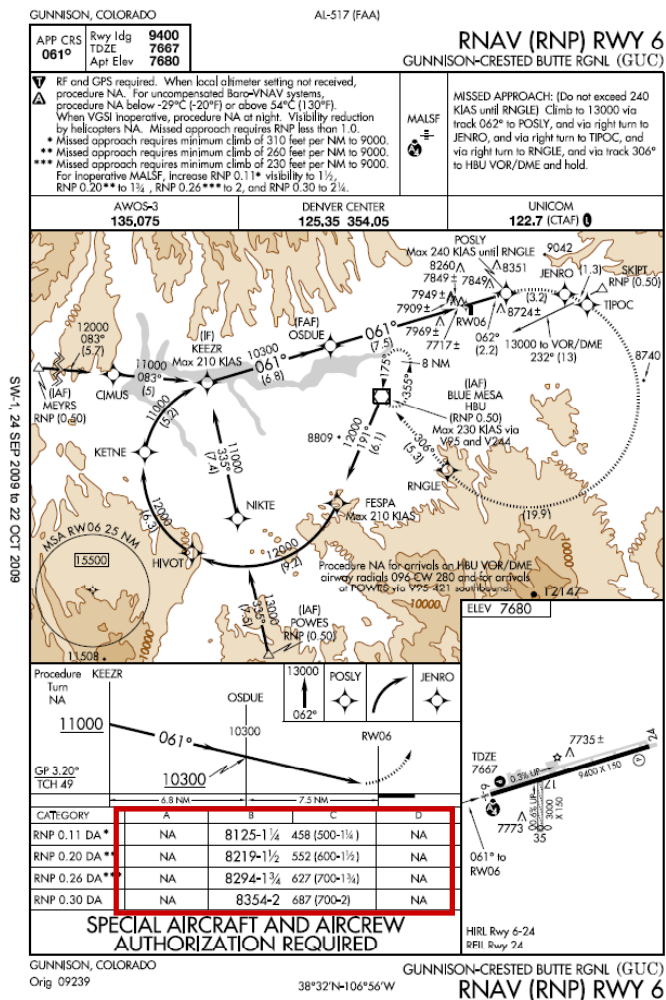
RNAV RNP Rwy 06

— 使用RF航段

— 最低标准:

500' / 1 ¼ (RNP 0.12)

700' / 2 (RNP 0.3)



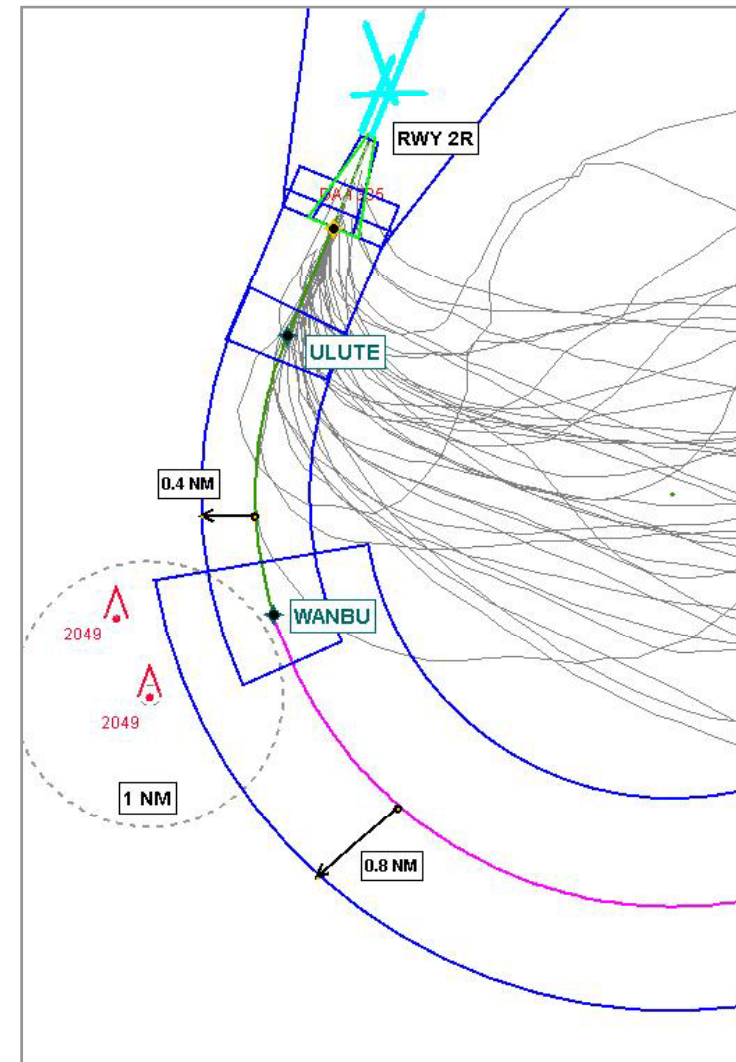
RNP AR Benefits – Traffic Deconfliction

Dekalb-Peachtree机场 (KPDK)

RNAV (RNP) Rwy 2R

- RNP (0.2 NM) AR approach
- Enables IMC operations to Runway 2R to a 340 ft Decision Altitude (DA)
- Mitigates obstacles on the approach course (the extended runway centerline)
- De-conflicts KPDK and KATL traffic flows

VMC track data to runway 2R (4/11/07)



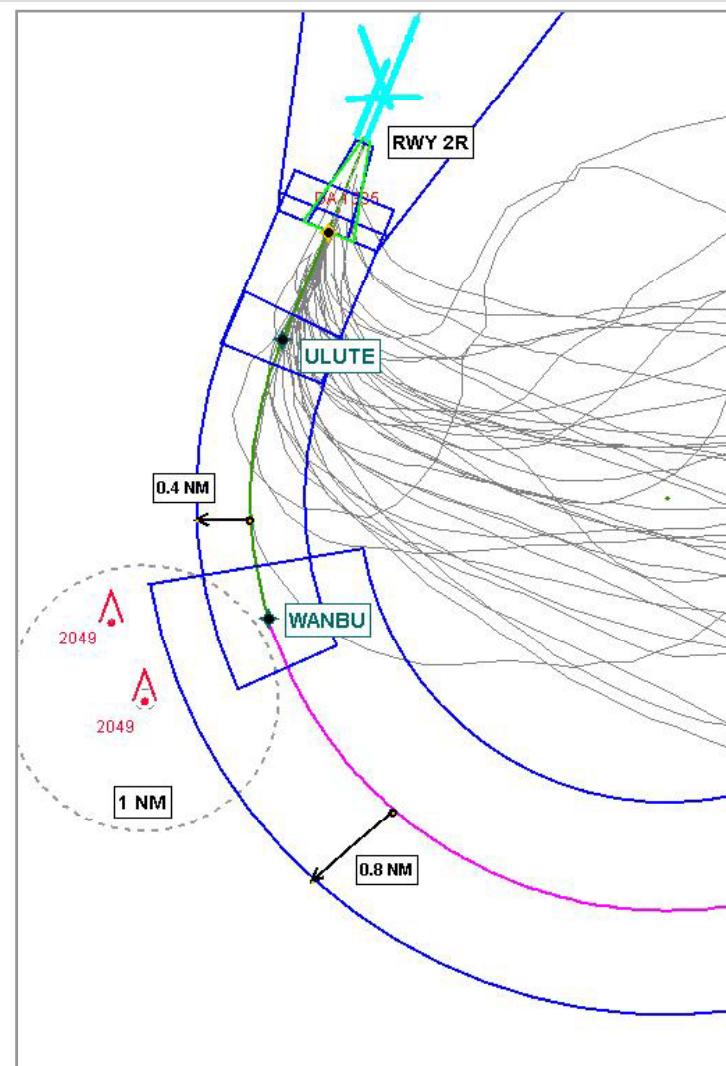
RNP AR 效益 – 消除交通冲突

Dekalb-Peachtree KPDK

RNAV (RNP) Rwy 2R

- RNP (0.2 NM) AR 进近
- 在仪表气象条件（IMC），02R跑道 决断高度（DA）到340ft
- 避开了进近航航上（跑道中线延长线）的障碍物
- 缓解了KPDK机场和KATL机场的交通流量冲突

VMC track data to runway 2R (4/11/07)

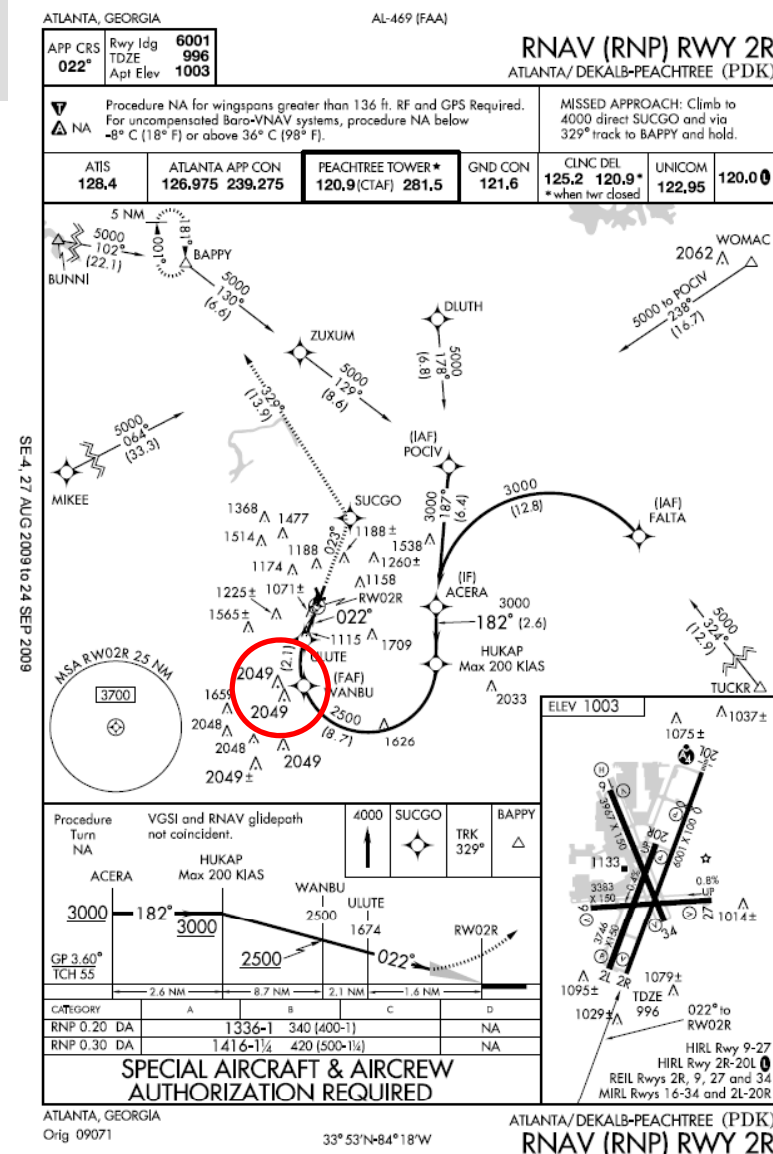


PDK Rwy 2R

Dekalb-Peachtree KPDK

RNAV (RNP) Rwy 2R

- No northbound instrument approaches available (2L, 2R or 34) due to antenna farm on south side of airport
- Enables operations to Runway 2R with a 340 ft Decision Altitude (DA)
- Mitigates obstacles on the approach course (the extended runway centerline)
- De-conflicts KPDK and KATL traffic flows

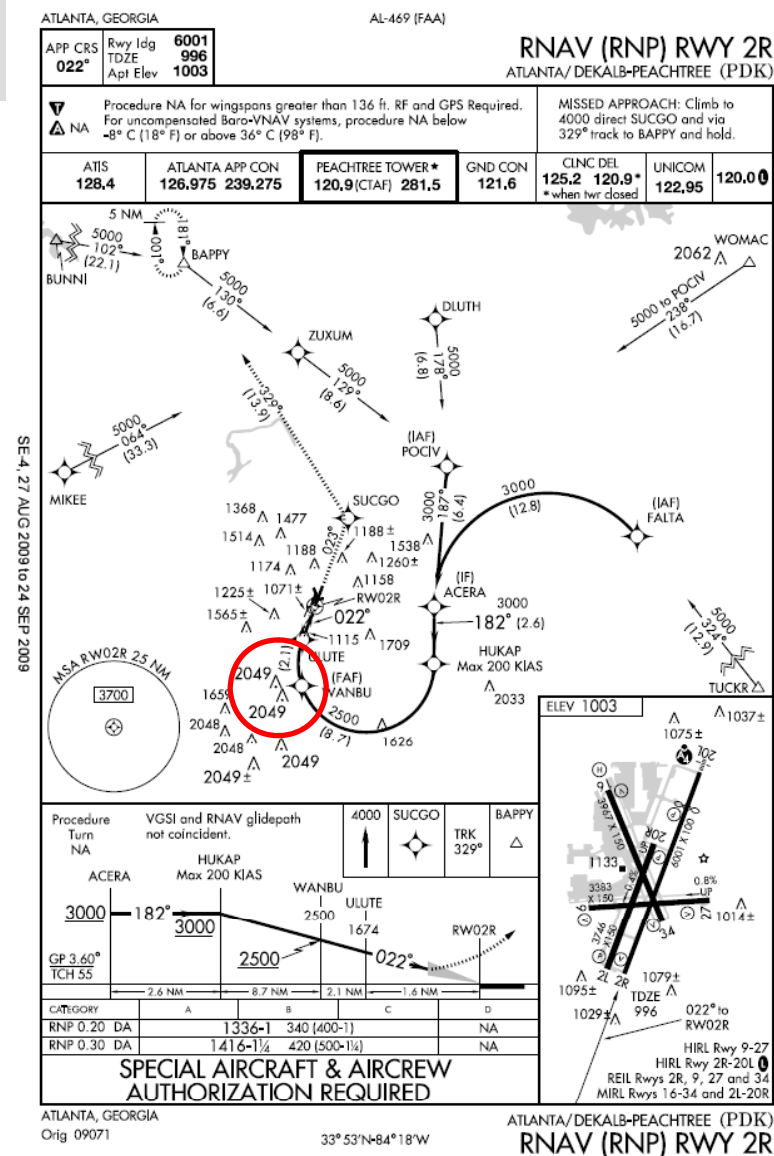


PDK机场02R跑道

Dekalb-Peachtree机场 (KPDK)

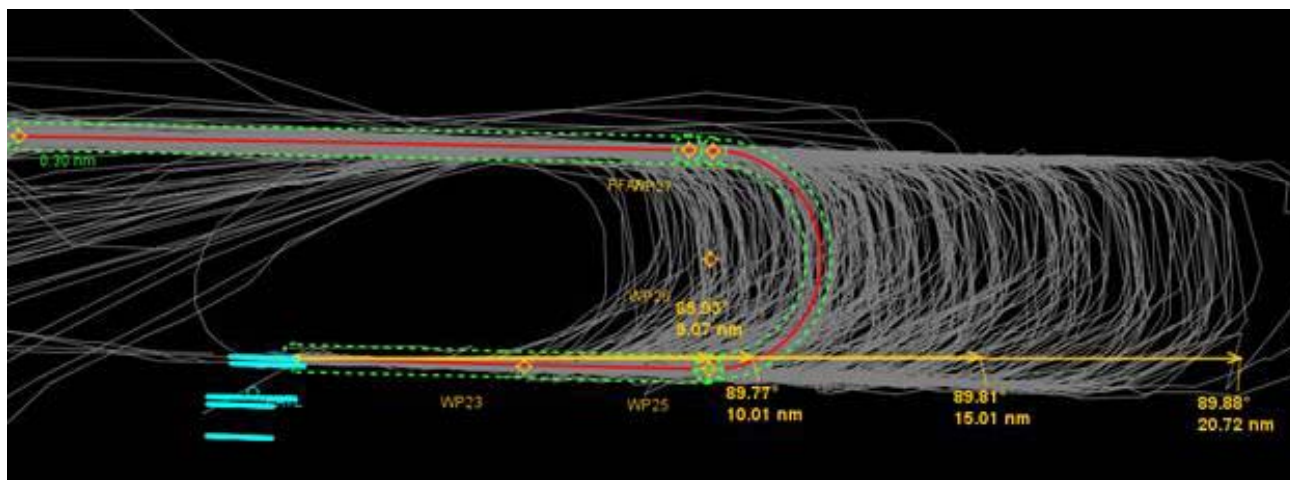
RNAV (RNP) Rwy 2R

- 跑道02L、02R、34跑道北边，无可仪表进近程序，因天线安装在机场的南边
- 使02R跑道能用DA 340ft运行
- 避开了进近航道上（跑道中线延长线）的障碍物
- 缓解了KPDK和KATL机场交通流量冲突

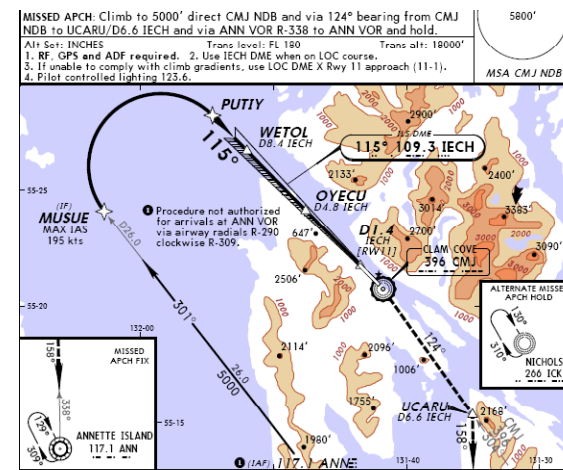


RNP Initiatives

RNP Transition to an ILS

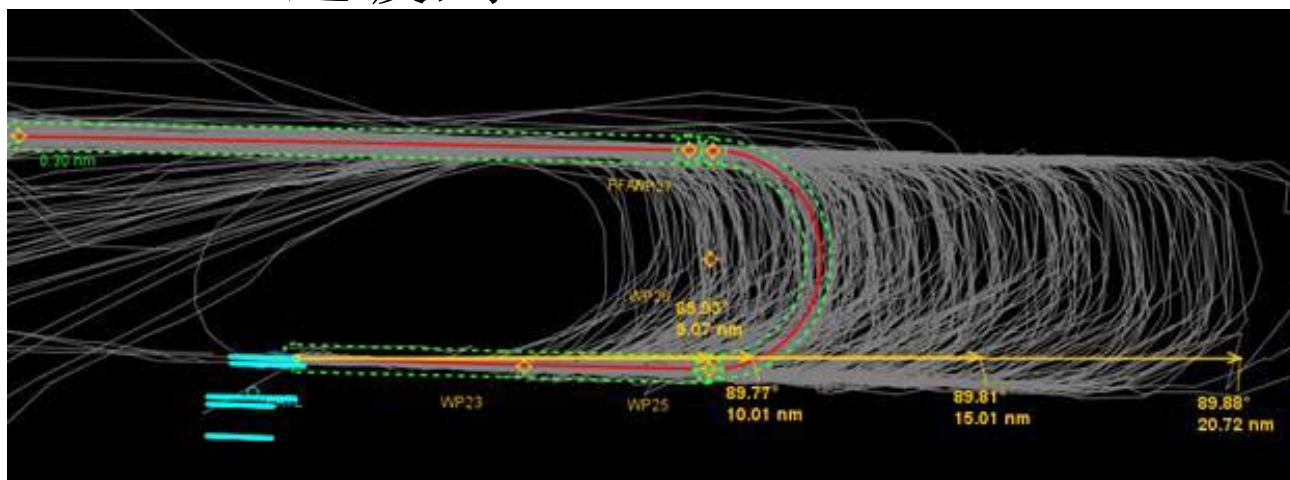


Enables use of RNP transitions to an ILS
to reduce track mileage

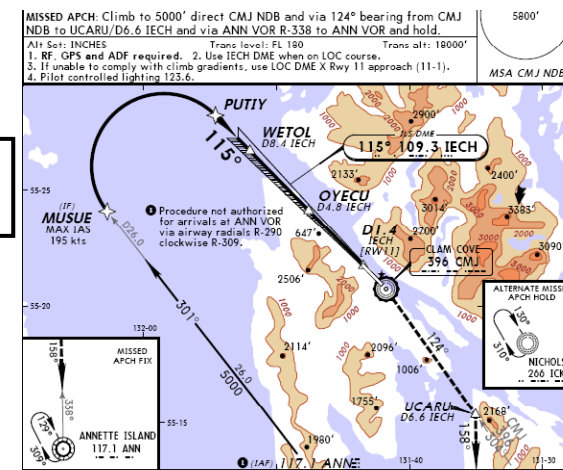


RNP 举措

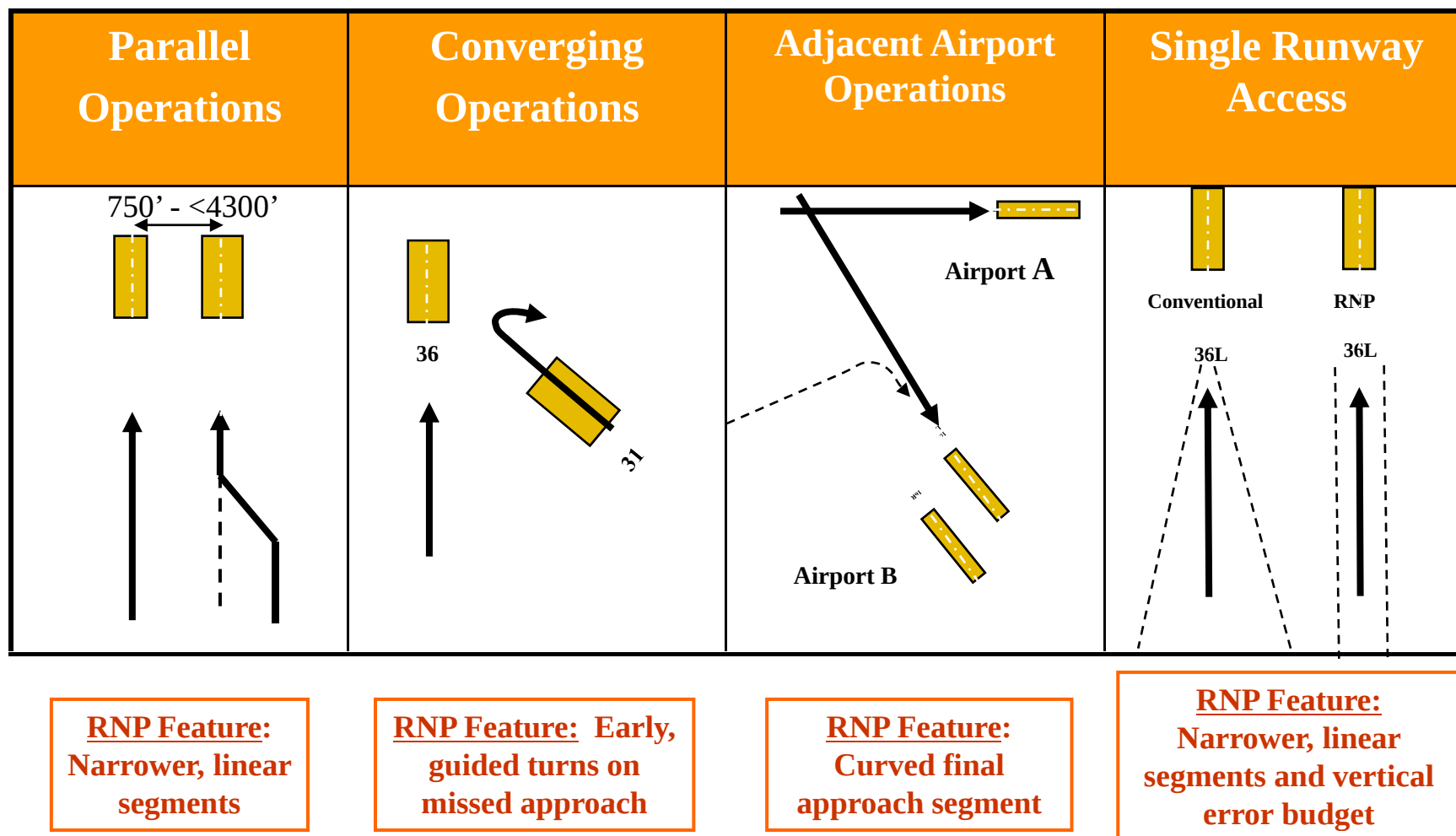
RNP 过渡到ILS



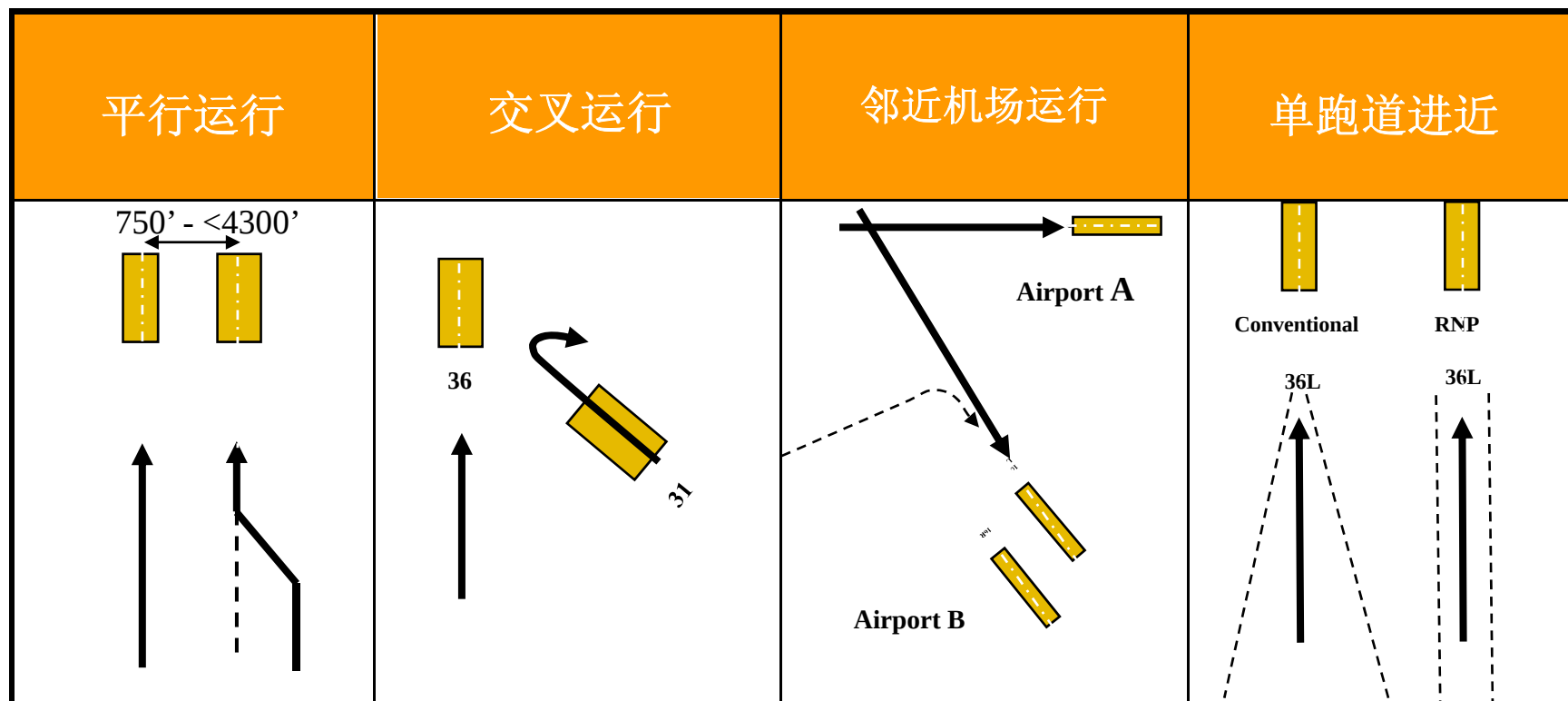
可采用RNP 过渡到ILS，以减少航段距离



Future RNP Benefits and Applications



未来RNP效益和应用



**RNP 特征: 更窄
线性航段**

**RNP 特征: 容易地
引导转弯至复飞**

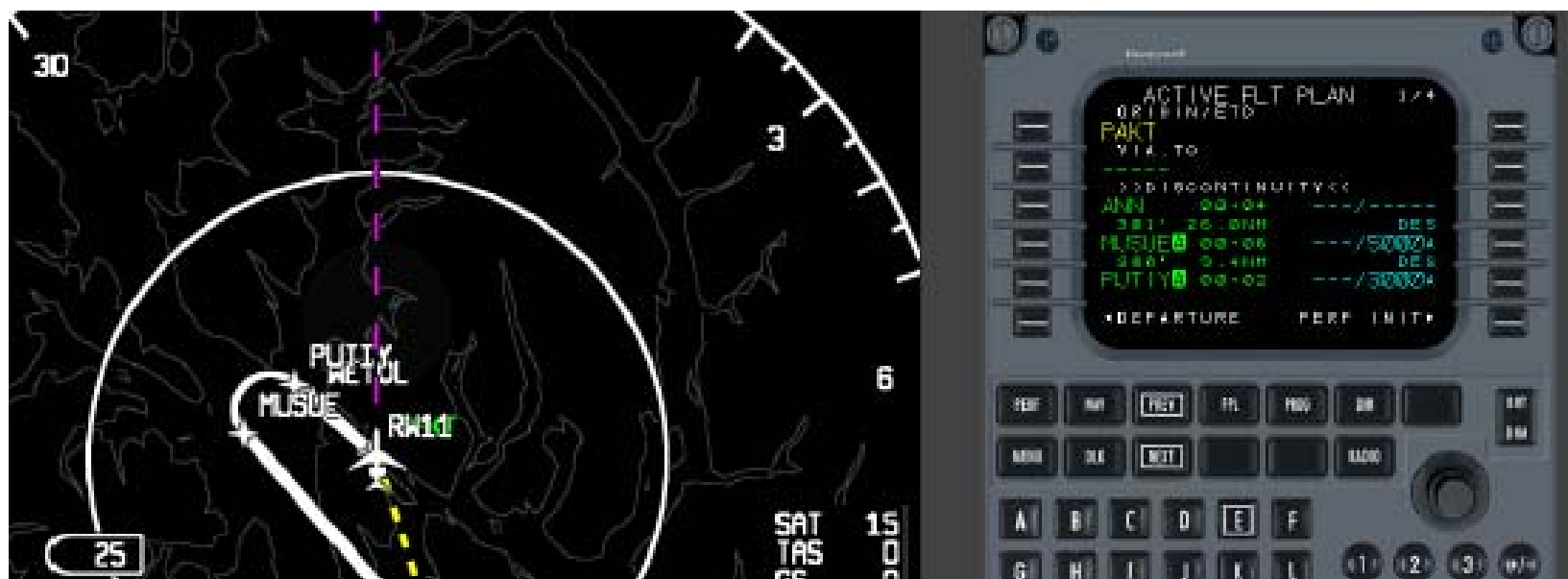
**RNP 特征: 曲线最
后进近航段**

**RNP 特征: 更窄线性
航段和垂直误差积累**

Future RNP Benefits and Applications

RNP RF Leg Turn-To-Final on ILS

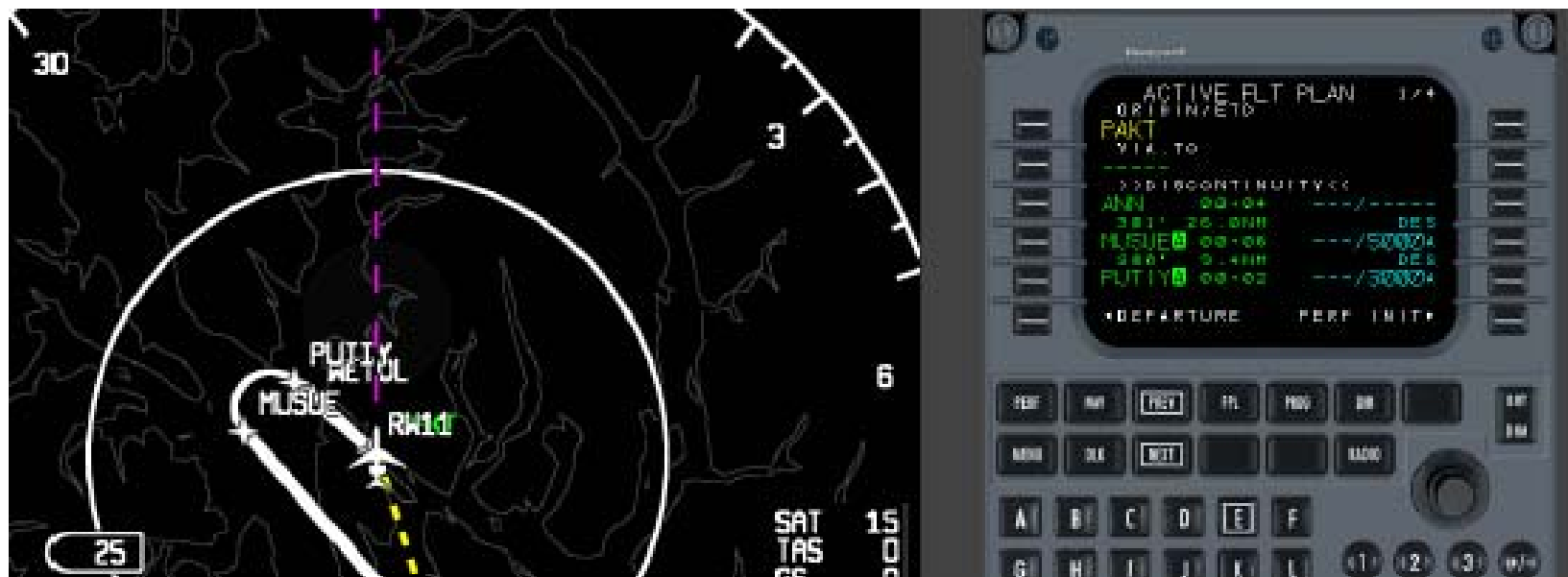
The FAA is looking at adding defined RF leg turns to final for ILS approaches. The following is a test case in Alaska.



未来RNP效益和应用

RNP RF航段转弯接ILS

FAA正关注增加定义的RF航段转至五边去接ILS进近这种方式。以下为Alaska的测试情况。



Getting Operational with RNP AR

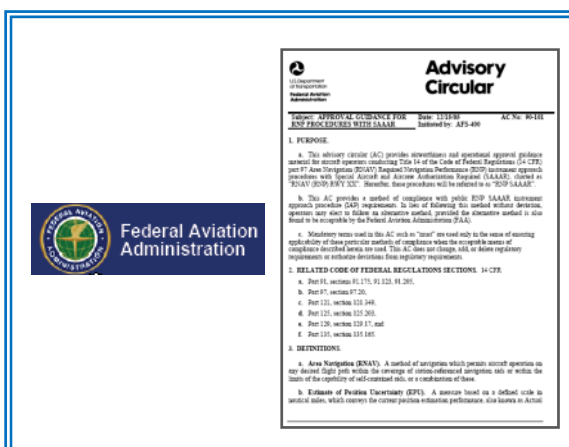
Aircraft Equipage



■ FMS, IRS, GPS, TAWS

- RNP AR 0.3 and <0.3 capability
- RF Legs
- Coupled VNAV
- Single IRS
- Dual GPS

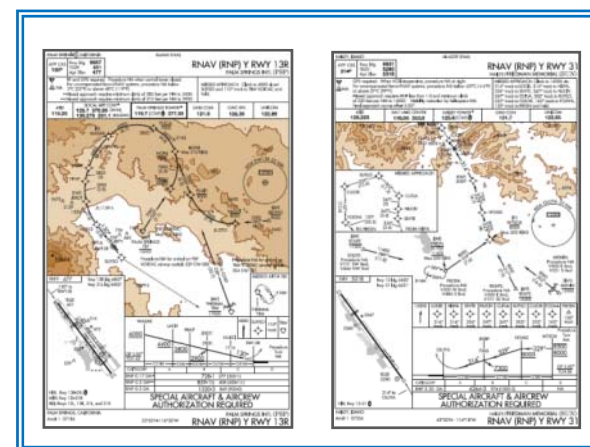
Operational Approval



■ Consultancy Services

- Operational approval submittal package for AMC 20-26 compliance & EASA coordination
- Timely and efficient integration of requirements into current flight operations
- 13 operators approved under FAA RNP AR in US

RNP Operations



■ Procedure and Database Validation

- Initial validation of all RNP AR procedures
- Data validation every 28 day cycle

Honeywell Go Direct helps operators get Operational Approval for RNP AR

获得RNP AR运行资格

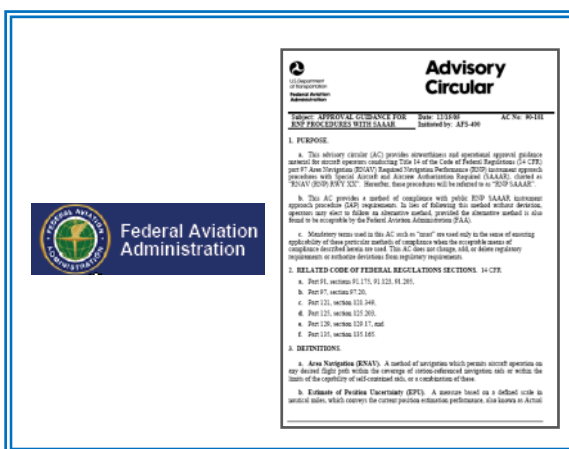
机载设备



■ FMS, IRS, GPS, TAWS

- RNP AR 0.3 和 <0.3 能力
- RF 航段
- 耦合 VNAV
- 1套IRS
- 双套GPS

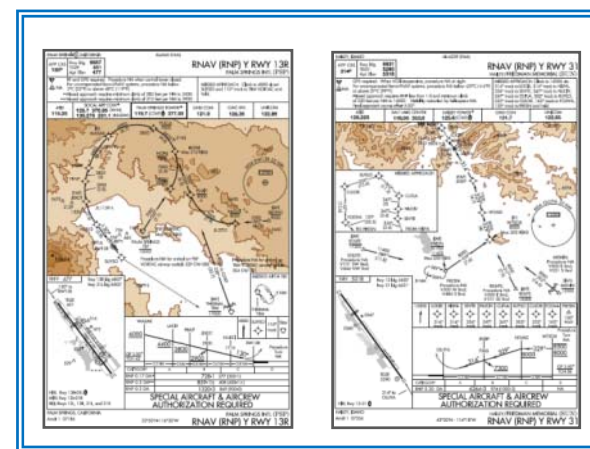
运行批准



■ 咨询服务

- AMC 20-26符合性和EASA等效的运行批准申请包
- 尽早和有效整合需求到现在飞行运行中
- 没有FAA批准了13家公司RNP AR运行

RNP 运行



■ 程序和数据验证

- 所有RNP AR程序初始验证
- 每28天一个周期验证数据

Honeywell直接帮助公司获得RNP AR运行批准

AC 90-101A RNP AR Requirements

The AC is comprised of 7 Appendices:

- Appendix 1 - RNP AR Instrument Approach Procedures
 - Appendix 2 - Aircraft Qualification } **OEM Responsibility**
 - Appendix 3 - Navigation Data Validation
 - Appendix 4 - Operational Considerations
 - Appendix 5 – Training
 - Appendix 6 - RNP Monitoring Program
 - Appendix 7 – Validation Requirements
- Operator Responsibility
Go Direct™ Services**

AC 90-101A RNP AR 要求

该咨询通告包括7个附件

- Appendix 1 - RNP AR 仪表进近程序
- Appendix 2 – 航空器合格证

} OEM负责

- Appendix 3 – 导航数据库验证
- Appendix 4 – 运行注意事项
- Appendix 5 – 培训
- Appendix 6 - RNP 监控程序
- Appendix 7 – 验证要求

} 公司责任
Go Direct™ 服务

Appendix 1 – RNP AR Instrument Approach Procedures

- RNP AR approach design criteria
 - FAA Order 8260.52
- Characteristics of RNP AR Approaches
 - RNP values
 - Radius to a Fix (RF) legs
 - Missed Approach RNP values less than 1.0
 - Non-standard speeds/climb gradients
 - Temperature limits
 - Aircraft using barometric vertical navigation (Baro VNAV) without temp comp or alternate means of vertical guidance
 - Authorization can vary with aircraft size

RNP AR are titled RNAV (RNP) Rwy x

附件1 – RNP AR 仪表进近程序

- RNP AR进近设计标准
 - FAA Order 8260.52
- RNP AR 进近的特点
 - RNP 值
 - RF航段
 - 复飞RNP 值小于1.0
 - 无标准速度/爬升梯度
 - 温度限制
 - 航空器使用气压垂直导航源，垂直导航无温度补偿或其它备用手段
 - 航空器尺寸不同，审批不同

RNP AR 命名方式为RNAV (RNP) Rwy x

Appendix 2 – Aircraft Qualification

- Minimum performance standards for RNP AR
 - Lateral & Vertical Accuracy
 - Airspace Containment
 - System monitoring requirements
 - Position Estimation
 - Sensor specific
 - Path Definition
 - Path Steering
 - Flight Technical Error (FTE)
 - FMS functionality
 - Displays
 - Navigation database

附件2 – 飞机合格证

- RNP AR最低性能标准
 - 水平和垂直精度
 - 空域容量
 - 系统监控要求
 - 位置估计
 - 传感器规章
 - 路径定义
 - 路径跟踪能力
 - 飞行技术误差 (FTE)
 - FMS功能性
 - 显示
 - 导航数据库

Appendix 2 – Aircraft Qualification (cont'd.)

- Requirements for using lines of minima less than RNP 0.3 and/or for missed approach less than RNP 1.0
 - Dual equipage
 - “No single point of failure can cause loss of guidance compliant with the RNP value of the approach.”
 - Autopilot, flight director, GPS, FMS, air data systems
 - Continuous LNAV Flight Guidance Mode after TOGA
 - Reversion to IRU after GPS failure

附件2-飞机合格证（续）

- 低于RNP0.3进近和/或低于RNP1.0复飞的最低标准要求
 - 双套设备
 - 单一设备失效不会造成失去指引，也能达到进近所需的RNP值
 - AP, FD, GPS, FMS, 大气数据系统
 - TO/GA后连续的水平导航飞行指引
 - GPS失效后恢复到IRU

Database and Procedures Validation (Appendix 3)

Rigorous requirements for Database Validation of RNP AR procedures:

- Visual comparison of the source database to the FAA 8260
- A “fly-ability” validation through use of aircraft or simulators
- Documentation for each aircraft required with complete list of validated procedures
- Process for Database Validation must be FAA approved

All Procedures must be validated prior to use

数据库和程序验证（附件3）

RNP AR 程序对数据库验证有严格要求:

- 与FAA8260可视化比较源数据库
- 用飞机或模拟机验证“可飞性”
- 要求附每架飞机验证程序的完整清单文档
- 数据库验证处理必须经FAA批准

所有程序在使用前必须验证

Operational Considerations (Appendix 4)

1. Minimum Equipment List
2. Autopilot and flight director
3. Dispatch RNP assessment
4. NAVAID exclusion
5. Navigation database currency
6. Flight plan modification restrictions
7. Documented list of equipment (quick reference guide)
8. RNP management procedure
9. GNSS updating crew verification
10. Radio updating requirements
11. Approach procedure confirmation
12. Monitoring track deviations
13. Pilot system crosscheck
14. Use of RF legs
15. Use of temperature compensation
16. Altimeter setting and crosschecks
17. Non-standard climb gradients
18. Engine-out procedures
19. Go around missed approach Requirements
20. Contingency procedures and failures en route and on approach

运行考虑（附件4）

1. 最低设备清单（MEL）
2. 自动驾驶仪（AP）和飞行指引仪（FD）
3. 签派RNP评估
4. 拒选导航台
5. 导航数据库
6. 飞行计划修改限制
7. 设备目录(快速检查指南)
8. RNP 管理程序
9. GNSS 更新机组检查
10. 无线电更新要求
11. 进近程序确认
12. 航迹偏离监控
13. 飞行员系统交叉检查
14. RG航段使用
15. 使用气温补偿
16. 高度表拨正和交叉检查
17. 非标准爬升梯度
18. 单发程序
19. 复飞要求
20. 航路和进近失效应急程序

RNP Training Requirements (Appendix 5)

Requirements:

- Each pilot is required to attend an approved RNP AR course per requirements specified in AC 90-101A appendix 5
- Recurrent training required annually

RNP 培训要求 (附件5)

要求:

- 每位飞行员都要求参加认证的**RNP AR** 课程培训，培训课程内容在**AC 90-101A 附件5**里列出
- 每年都必须进行复训

RNP Monitoring Requirements (Appendix 6)

Requirements:

- The operator must have an RNP monitoring program to:
 - ensure continued compliance with the guidance of the AC
 - to identify any negative trends in performance.
- Details of each RNP AR approach planned or conducted must be documented
 - Approach, RWY
 - Success or failure to complete approach
 - Reason(s) for failures
- Written report to FAA required every 30 days

RNP 监控要求(附件 6)

要求:

- 航空公司必须有一套**RNP**监控程序
 - 确保持续符合**AC**要求
 - 以便发现实施中任何不利趋势
- 规划的**RNP AR** 进近或管理细节都必须归档
 - 进近, 跑道
 - 完整进近成功或失败
 - 失败原因
- 每**30**天需要向**FAA** 写报告

Challenges to Implementing RNP AR

- **Complexity**

- AC 90-101A is challenging and requires many approved processes
- Stringent requirements for Navigation Data Base Validation
- Unfamiliarity with approval process by Operator and FSDO/CMO

- **Cost**

- Cost to get approved
- Manpower, meetings, and travel

- **Timelines**

- Current timelines can be on the order of years for approval

To provide a solution, FAA created the RNP AR Consulting Program.

Honeywell was granted RNP AR Consultant Designation in Nov 2007

实施RNP AR 的挑战性

- 复杂性

- AC 90-101A 具有挑战性，需要很多批准程序
- 对导航数据库的验证要求苛刻
- 航空公司和FSDO/CMO不熟悉审批流程

- 成本

- 能接受的成本
- 人力资源、会议和差旅

- 时间表

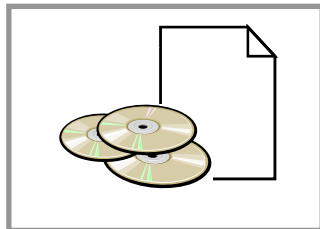
- 当前批准时间以年记

为解决方按, **FAA** 建立了 **RNP AR** 咨询程序.
2007年11月, Honeywell公司被授为**RNP AR**顾问

Honeywell Go Direct™ Services



Operational Approval Consulting for LOA's



Database and Procedure Validation

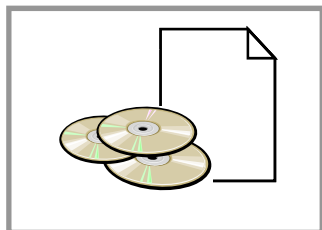


RNP Monitoring Program

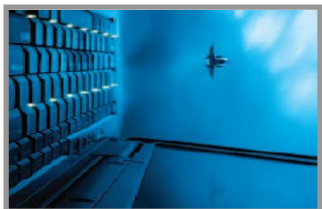
Honeywell Go Direct™ 服务



运行批准LOA咨询



数据库和程序验证



RNP 监控程序

Operational Approval Consulting

Go Direct offers a range of consulting services that include:

- RNP AR Orientation Class
- Review of all company manuals
 - Perform GAP analysis – provide recommendations to comply with AC 90-101A
- Writing of application for LOA
- Developing validation test and prepare operator
- Coordinating with all three levels of FAA on operator's behalf
- Letter of recommendation for FAA approval

运行批准咨询

Go Direct提供一系列咨询服务，包括：

- RNP AR 介绍等级
- 所有公司手册回顾
 - 进行差异性（**GAP**）分析– 提供建议以遵循AC 90-101A
- 为LOA写申请
- 验证测试开发和操作员准备
- 符合FAA关于操作员的三个层次
- FAA批准推荐信

Database and Procedure Validation Service

Honeywell provides a FAA-approved navigation database validation service that meets the requirements of AC 90-101A, Appendix 3:

- Visual comparison of the source database to the FAA 8260
- A “fly-ability” validation through use of Honeywell FMS simulator
- Documented list of validated procedures for each aircraft
- Procedures validated in cycle

数据库和程序验证服务

Honeywell所提供已获得**FAA**批准的导航数据库验证服务，并满足**AC 90-101A**, 附件**3**的要求：

- 与FAA8260可视化比较源数据库
- 通过Honeywell FMS模拟器来验证“可飞性”
- 为每架飞机建立了验证程序列表文档
- 每个周期验证程序