AIXM 5 Concepts

Washington D.C. | October 10 - 11, 2007

AIXM Class | 2007

Presentation Topics

- Requirements
- AIXM Design Components
- Design Concepts
  - UML
  - ISO 19100 standards
  - Geography Markup Language (GML)
  - Temporality
- Conceptual Model Packages

Presentation Topics

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Requirements

- Based on global aeronautical data requirements
  - ICAO standards and practices
  - RTCA/EUROCAE Airport Mapping Databases
  - PANS-Ops and TERPS Terminal Procedures
  - Airport Layout Plans (AirMAT)
  - NATO and Military requirements
- Support for current and future AIM Information System Requirements
  - Aeronautical Information Publication (AIP)
  - Integrated Digital NOTAMs
  - Aerodrome Mapping Databases and Applications
  - Charts
  - Procedure Design
  - Situational displays
  - Industry requirements

Presentation Topics

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AIXM Design Objectives

Technical Design Decisions

ISO19100 series

UML

GML 3.2

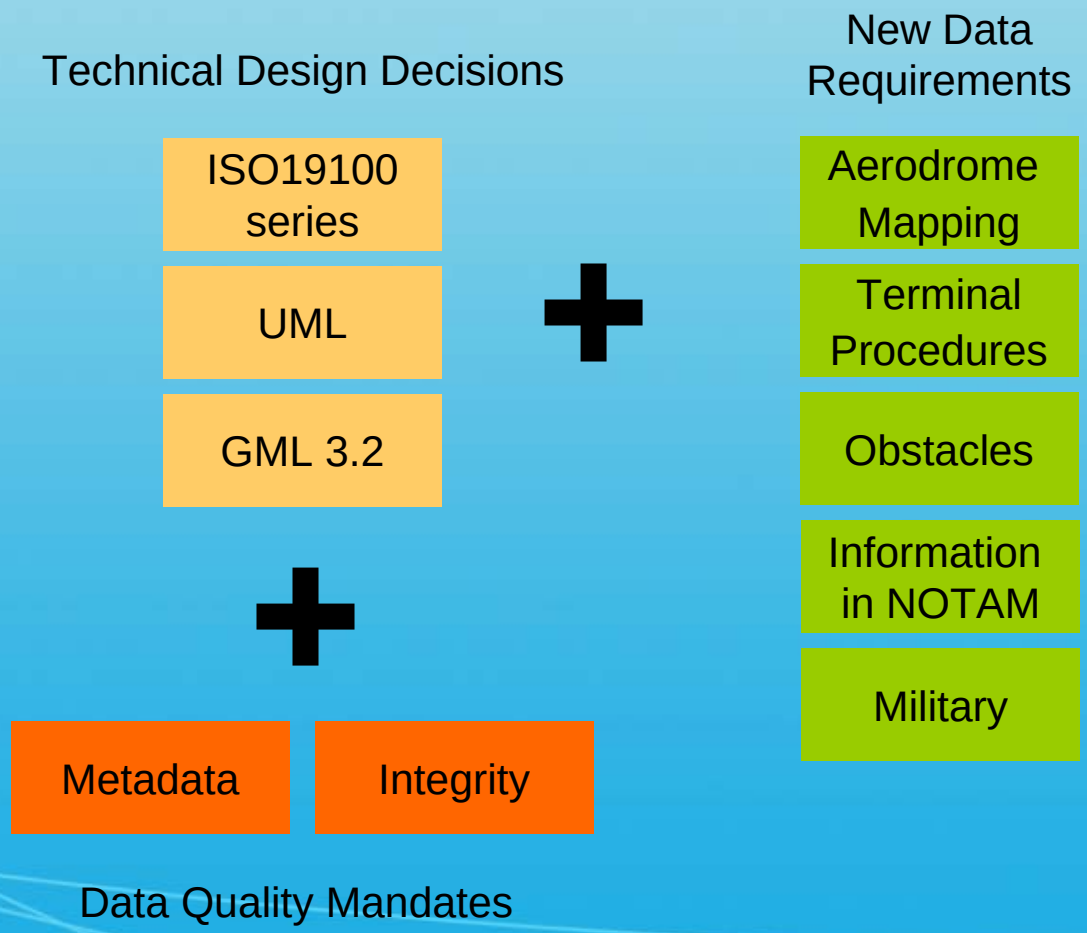
+

Metadata

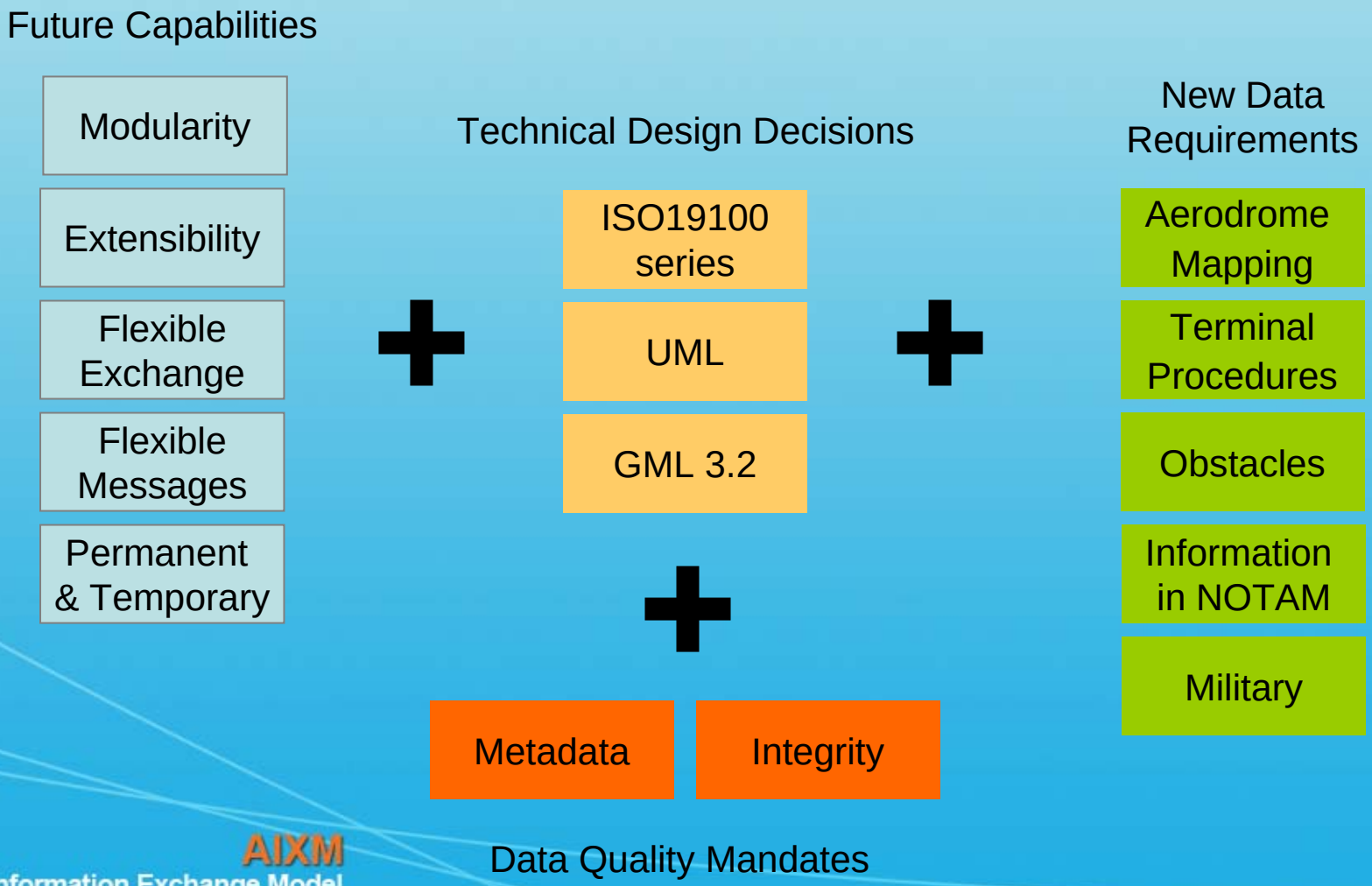
Integrity

Data Quality Mandates

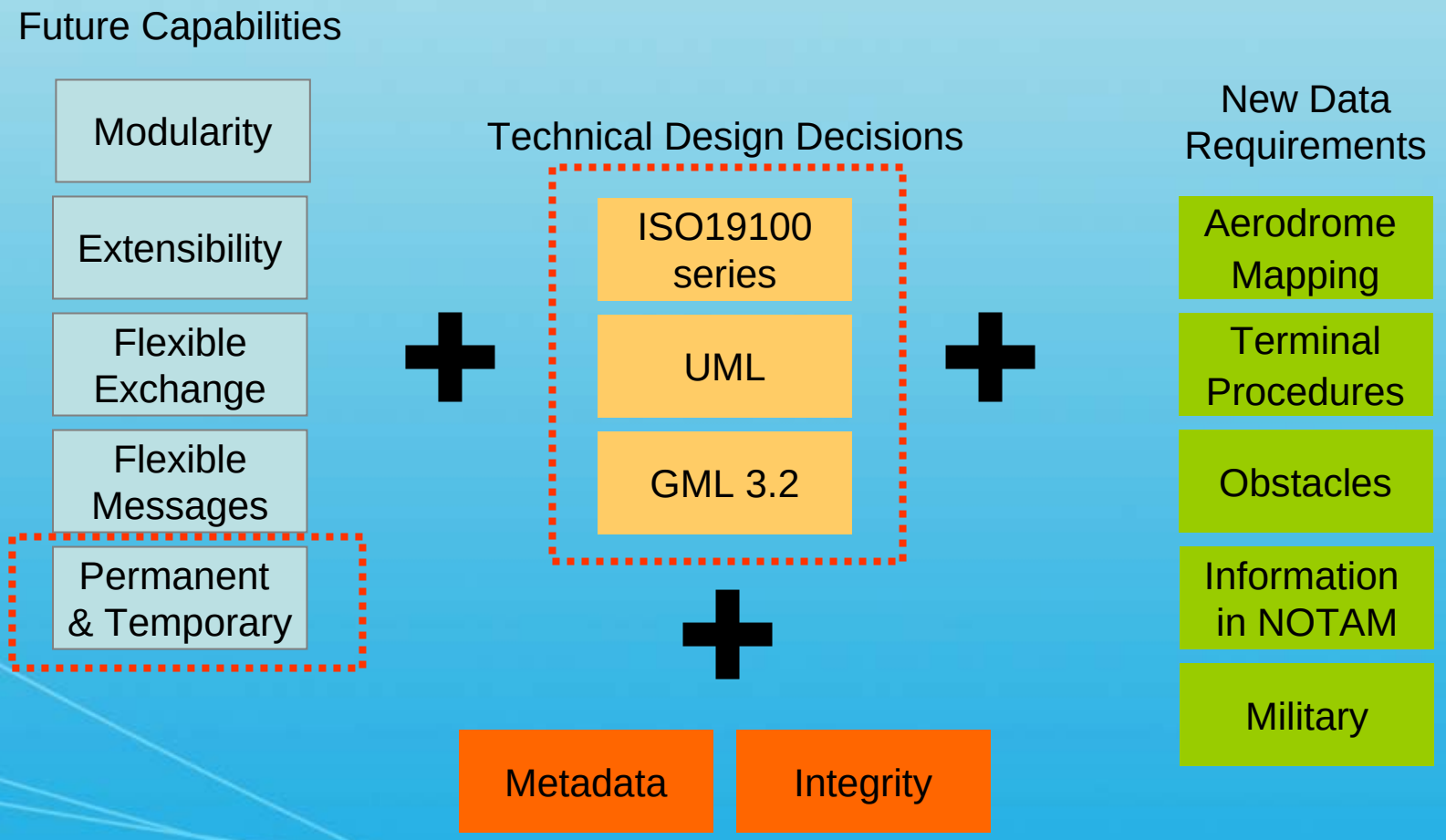
AIXM Design Objectives



AIXM Design Objectives



AIXM Design Objectives



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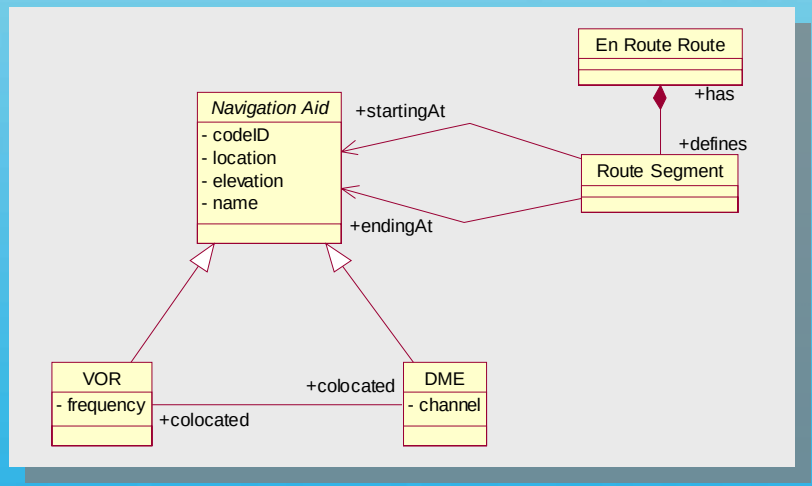
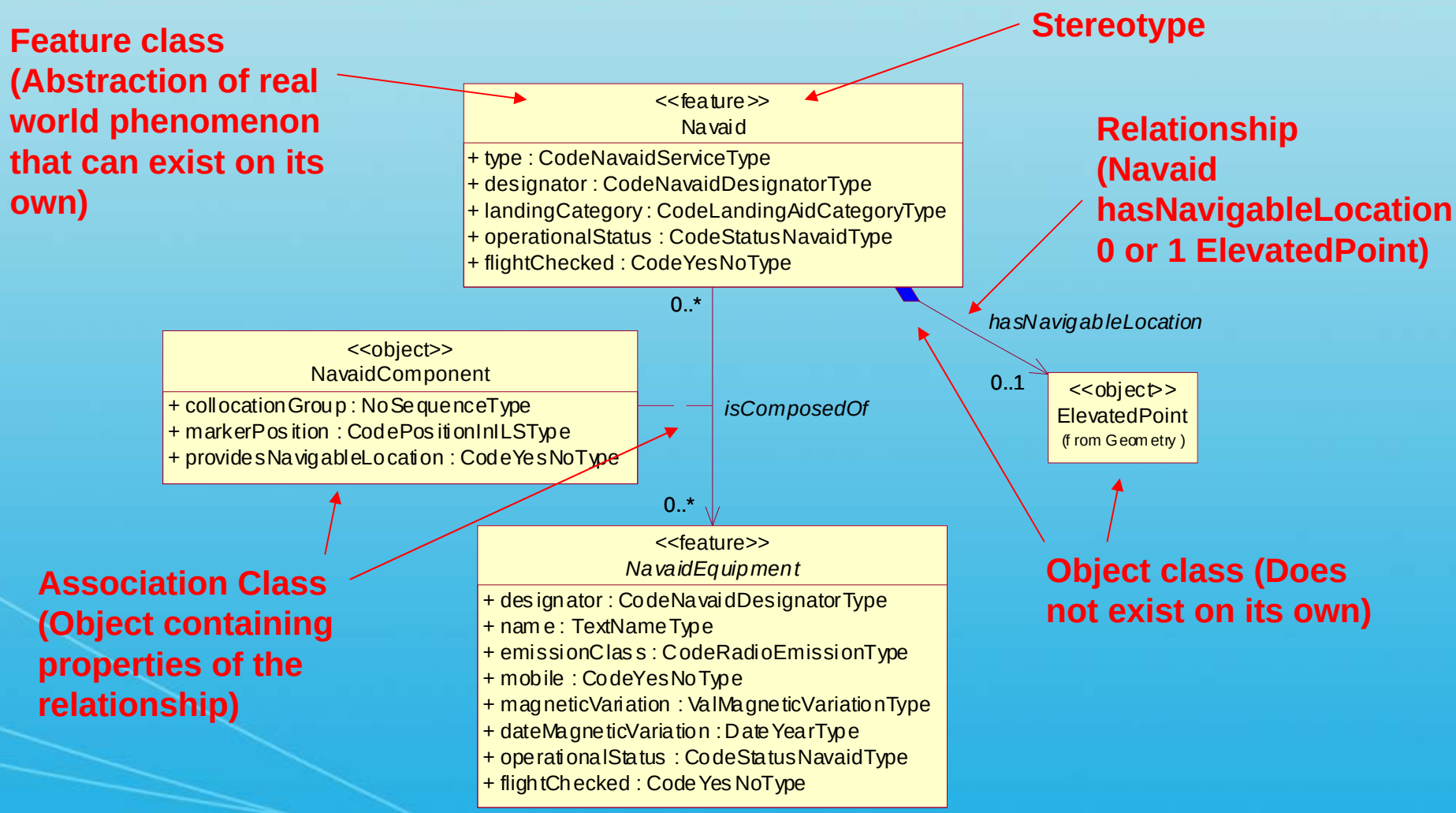
Unified Modeling Language (UML)

- Visual language for capturing relationships, behavior and high-level ideas
- Originally intended for Software Engineering
- Today also used for
  - Business process modeling
  - Data modeling
  - Requirements modeling
  - Others…

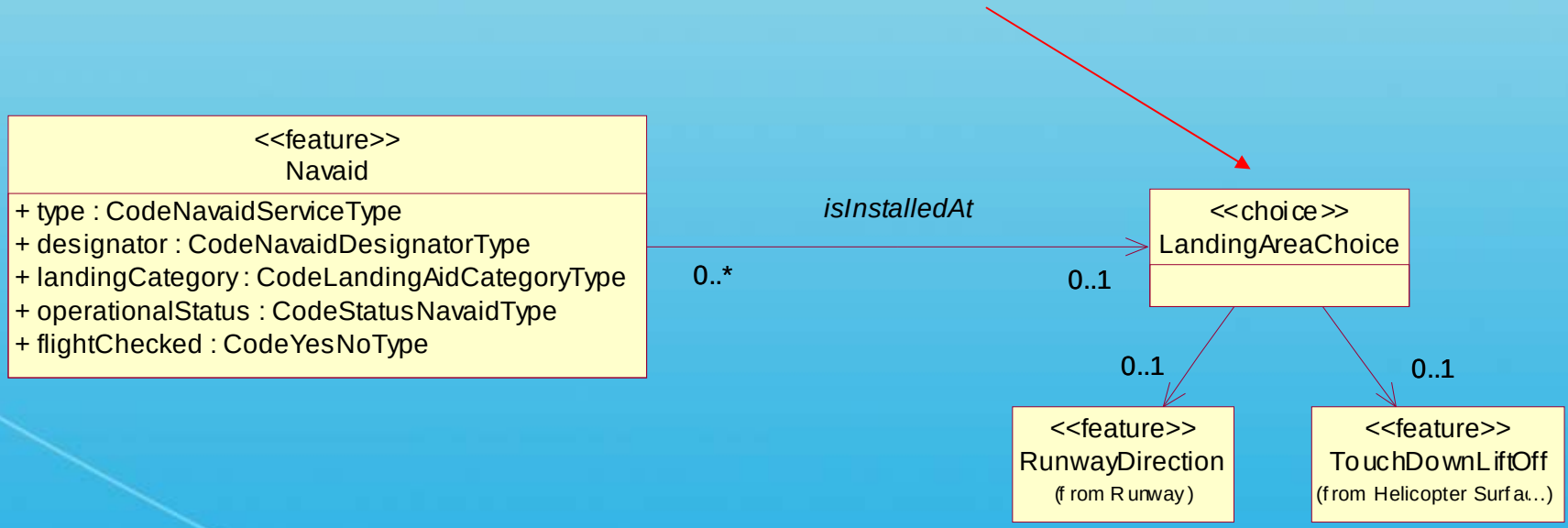


Unified Modeling Language (UML)



Unified Modeling Language (UML)

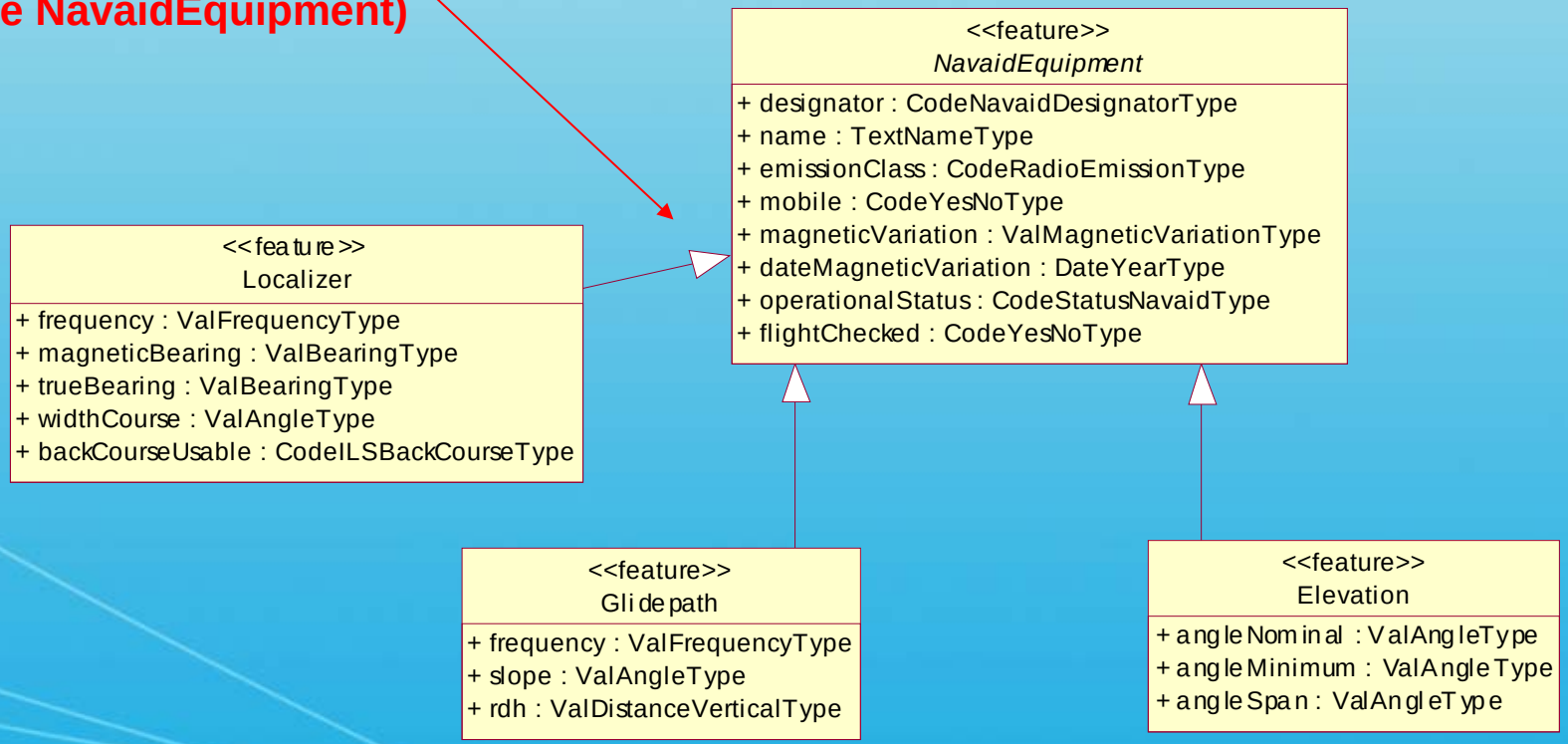
Choice class
(Indicates exclusivity property can be one of many values)
(Navaid isInstalledAt either RunwayDirection or TouchDownLiftOff)



Unified Modeling Language (UML)

Abstract class (Cannot be instantiated in an instance document)

Inheritance (Localizer inherits properties of the NavaidEquipment)



ISO19100 series framework

- Internationally developed standards for expressing geographical data
  - Features - Airports, Runways, Airspace
  - Metadata - Data originator, Status, Published Date
  - Temporality - Start and end dates
  - Geometry - Point, Line, Polygon
- Helps us organize information for the aeronautical domain
  - Feature data dictionaries, feature catalogs, registries and application schemas
- Well-established
  - Geography Markup Language (GML)
  - Widely adopted and implemented by vendors and governments

ISO 19100 standards used in AIXM

AIXM Conceptual Model (UML)

- Geometry ISO 19107
- Temporality ISO 19108
- Metadata ISO 19115

AIXM Exchange Model (XML)

- GML ISO 19136
- Metadata ISO 19139

Documentation

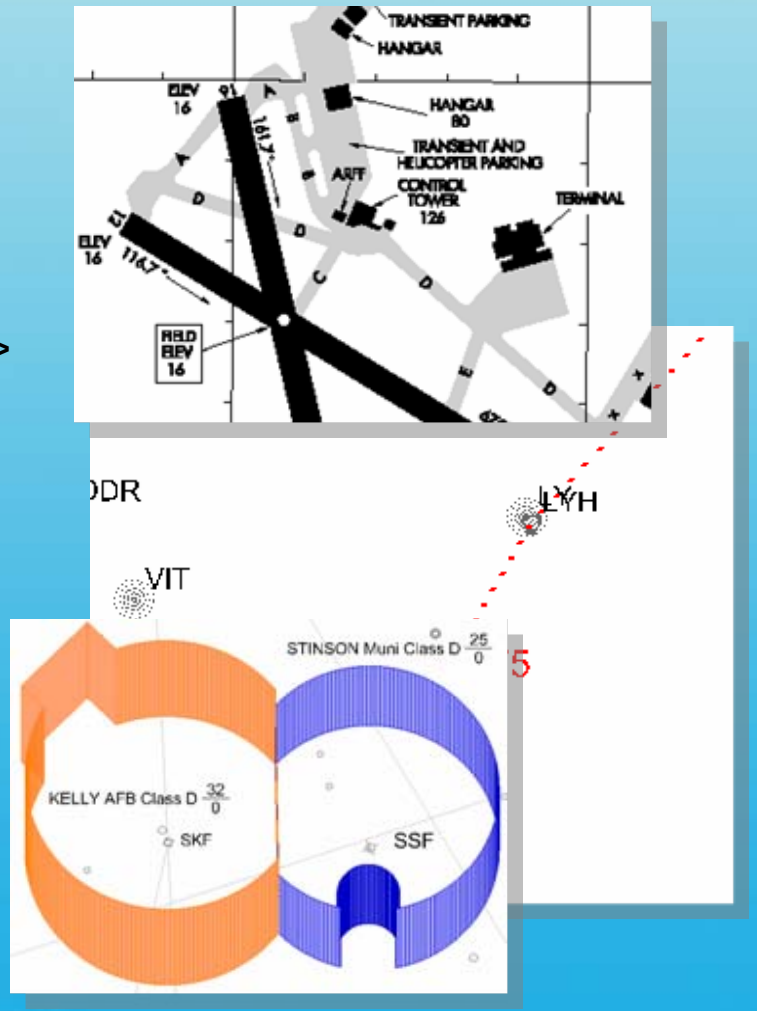
- Feature Catalog ISO 19126

What is GML?

- ISO exchange format for geographical features encoding
  - Based on XML Schema
  - Open GIS Consortium

```
<gml:Point>
    <gml:pos>46.90278 0.08111</gml:pos>
</gml:Point>
```

- Good industry adoption by Geographic Information System (GIS) vendors
  - Commercial Off the Shelf Software



GML structures the AIXM Exchange Model

- Object-Property Model
  - Objects have properties
  - Properties are simple values or other objects
- Geometry
  - Points, Lines, Polygons
- Temporality
  - Timeslices describing feature state over a time period
- Metadata
  - Based on ISO 19139

Temporality Model

- Definition
  - A model that incorporates the concept of time
- Key assertions
  - All features are temporal with start of life and end of life
    - Example, A new air traffic control sector
  - All features change over time
    - Example, A VOR is out of service for a day
- AIXM Temporality Model
  - Relates features to the time extent in which they are valid
  - Provides various means to describe the time extent

AIXM TimeSlice Model

TimeSlice created every time one or more feature properties change

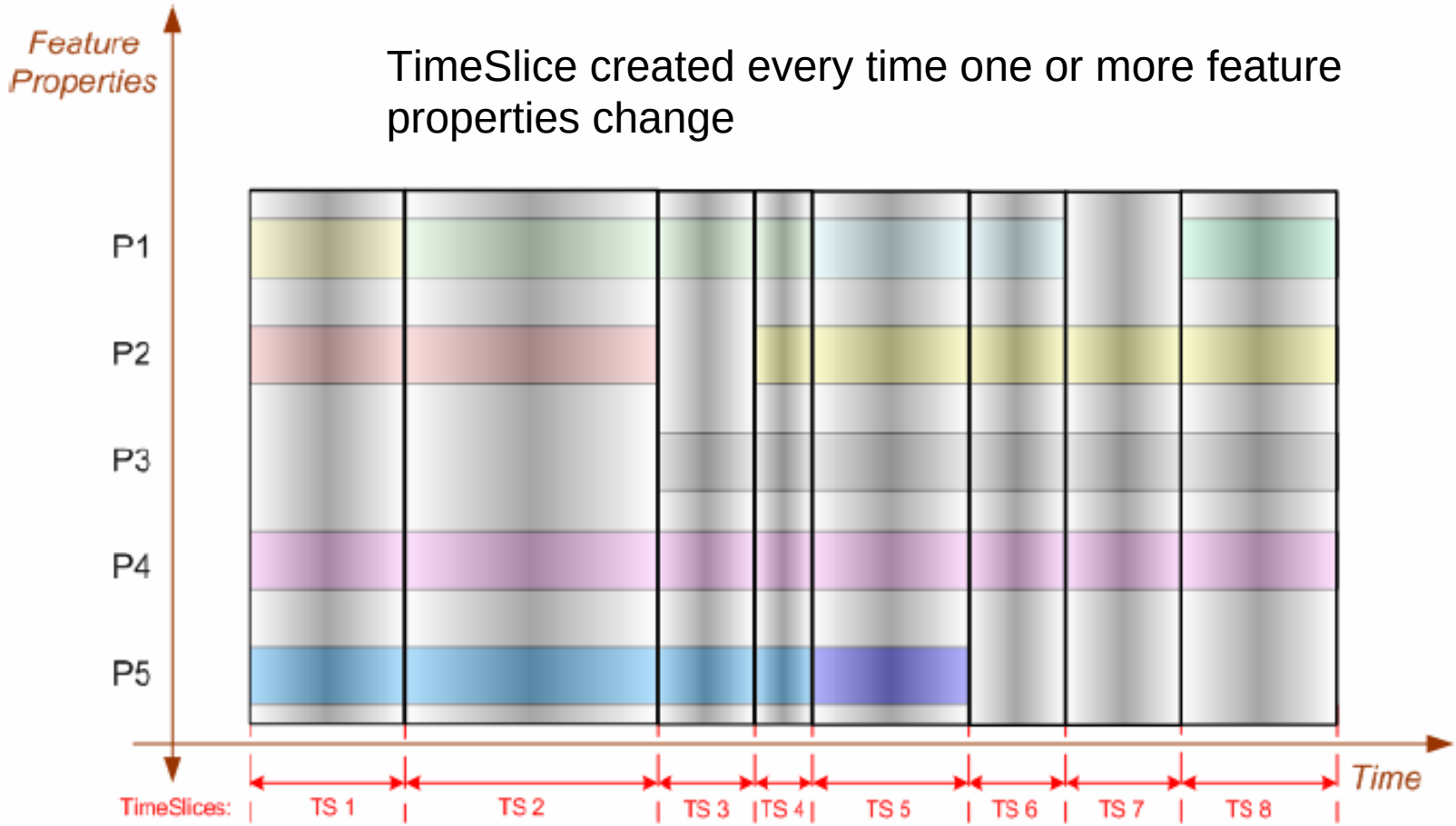
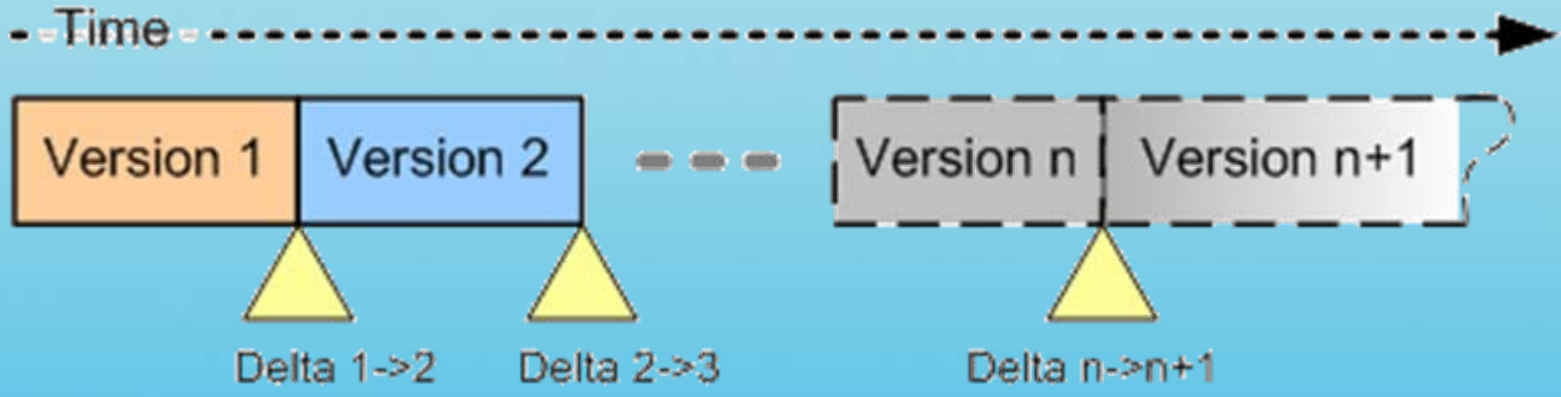


Figure 2

TimeSlice – Version and Delta



- Version – The state of a feature and value of its properties over a time period between two changes.
- Delta – Difference between two consecutive versions.

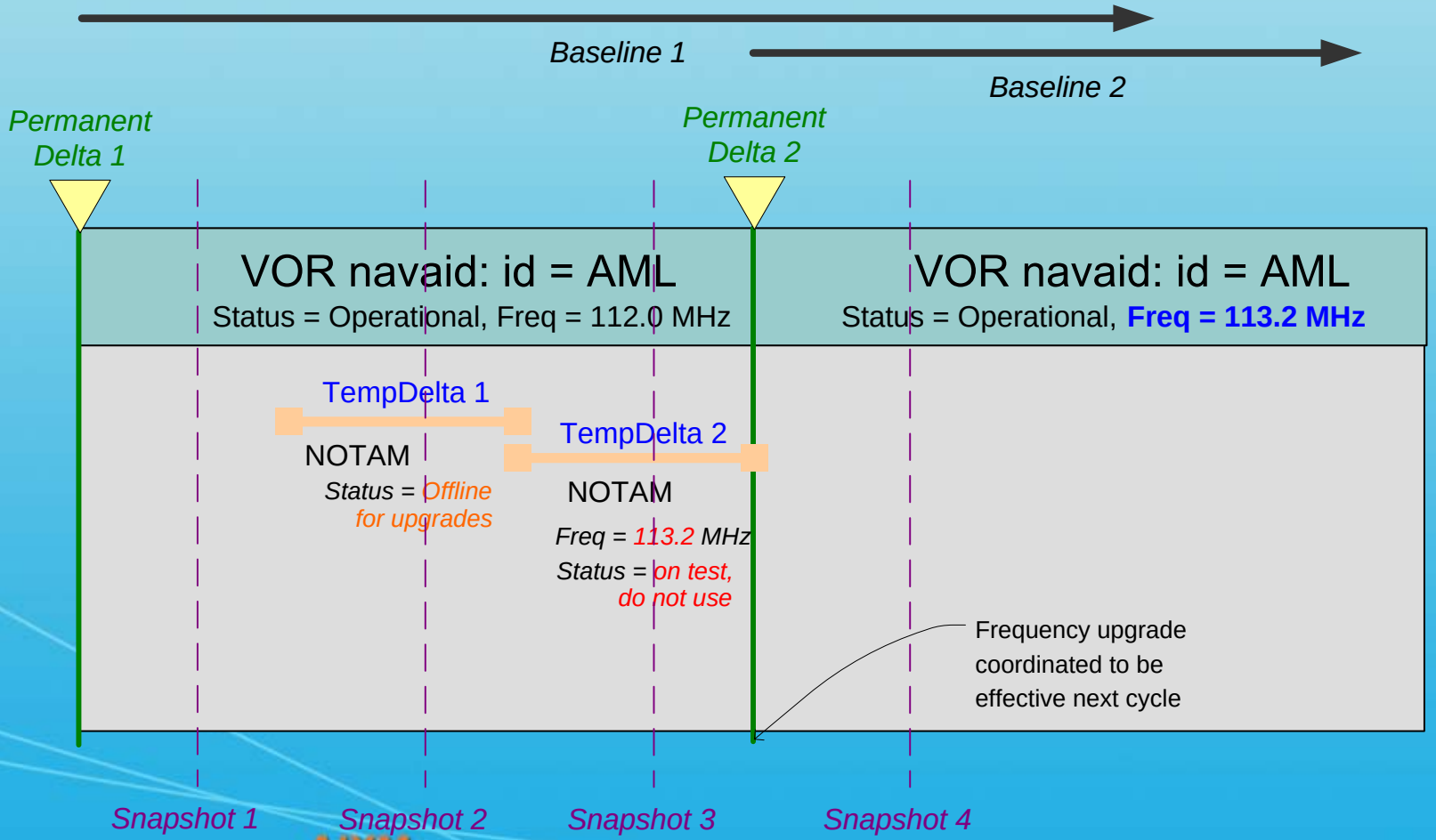
An Example: Navaid frequency change

Imagine that AML Navaid undergoes an upgrade that changes its frequency from 125 MHz to 132.5 MHz…

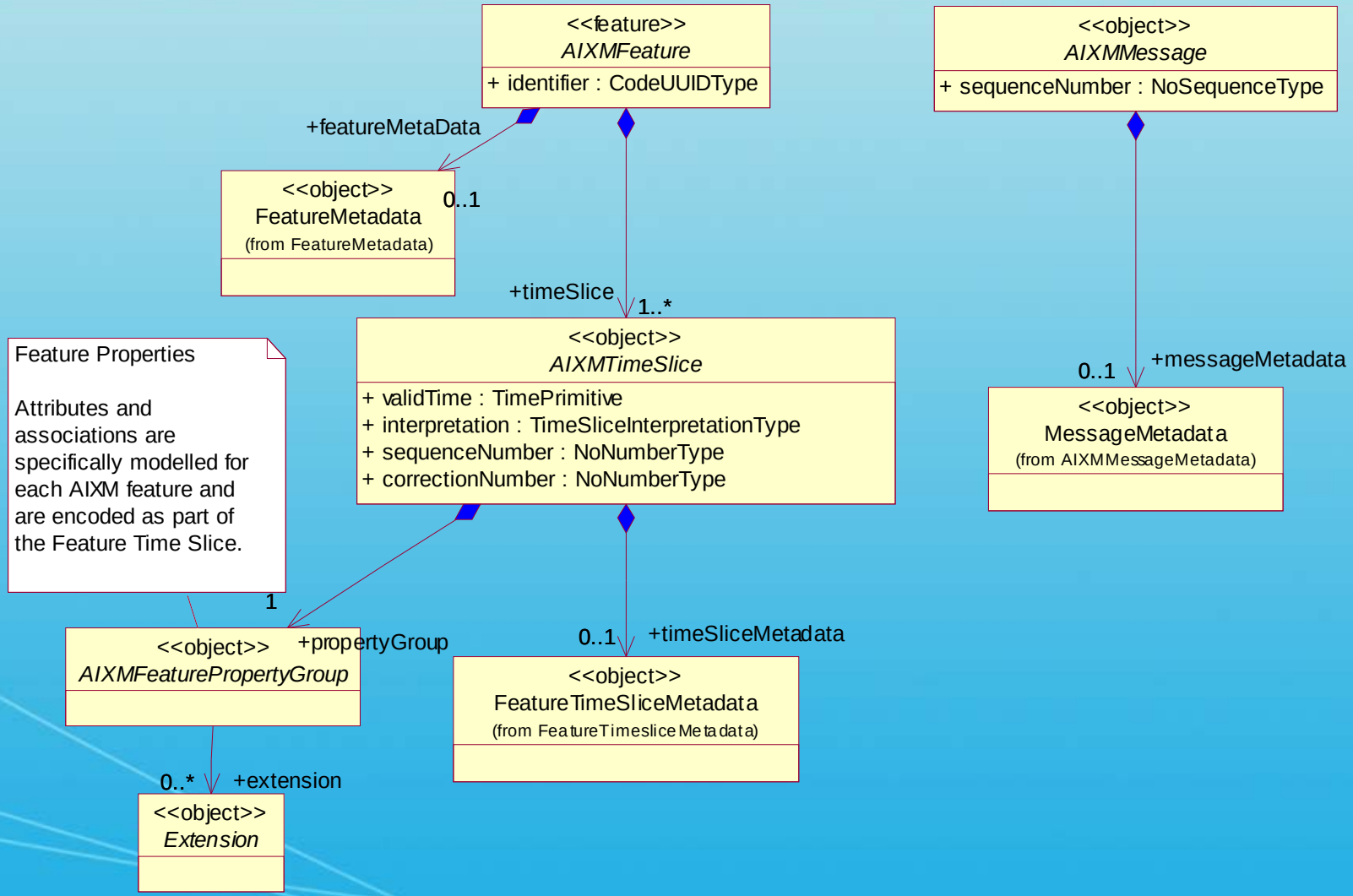
1. Schedule permanent change to coincide with update cycle
2. Shutdown AML before the upgrade
3. Perform the upgrade
4. Start AML in test mode to evaluate change

An Example: Navaid frequency change

Imagine that AML Navaid undergoes an upgrade that changes its frequency from 125 MHz to 132.5 MHz…



Basic Structure of AIXM



AIXM Structure and Application

- AIXM provides the standard foundation for describing aeronautical information
  - Features: Runway, En route Route, Airspace
  - Properties: Valid time, Location
  - Data Types: code list of airspace types
  - Metadata: Data originator
- AIXM can be used to build compliant application schemas
  - Enable real-world implementation
  - Digital NOTAMs
  - Procedure Design
  - Automated Charting
- Enables maximum flexibility while remaining ISO compliant
  - Examples this afternoon and tomorrow

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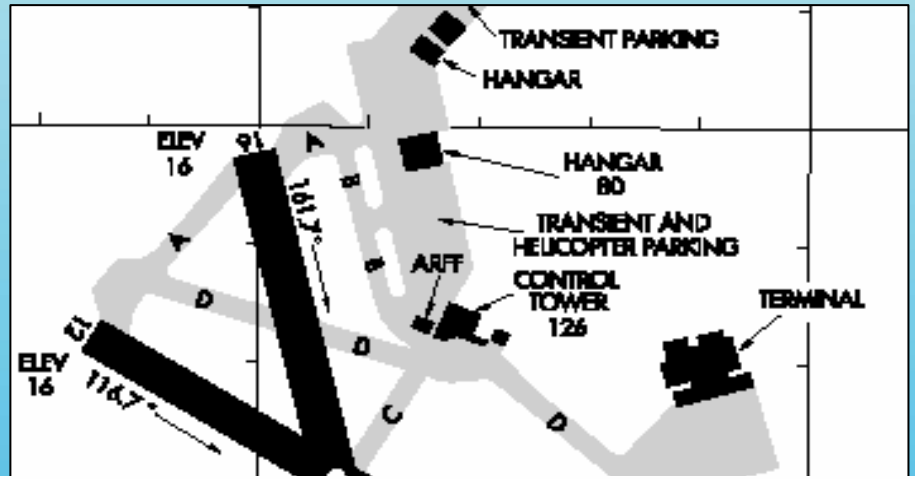
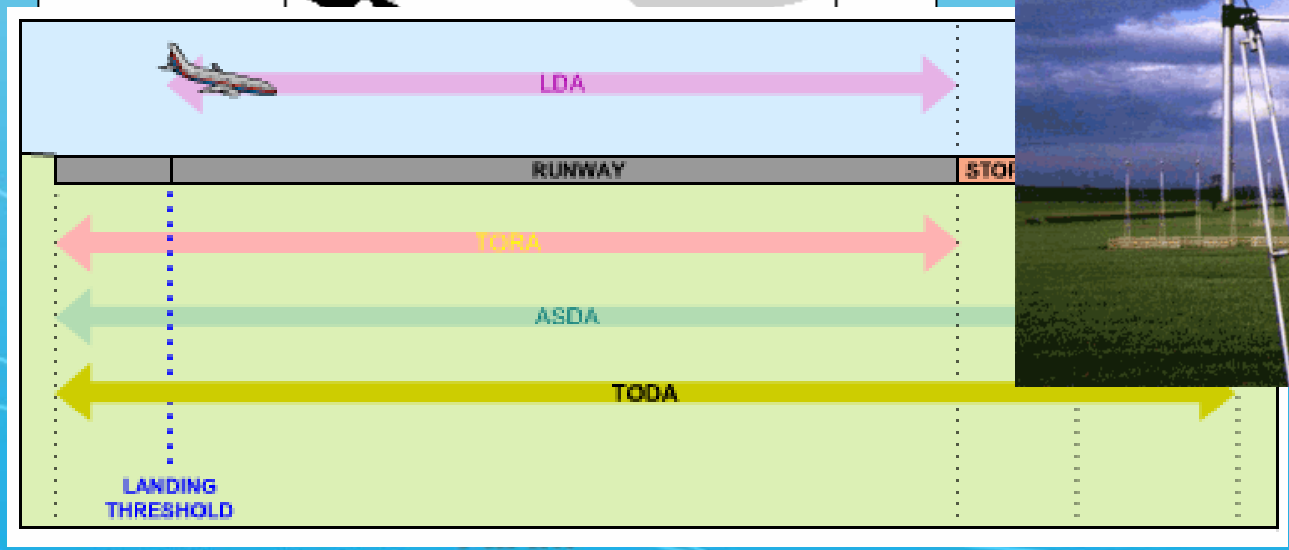
AIXM Coverage

- Aerodrome/Heliport
- Aerodrome/Heliport Facilities
- Airspace
- Holding
- Navaids and Points
- Obstacles
- Organizations
- Procedures
- Routes
- Services

Shared Components
- Geometry
- Notes
- Time Management
- Aircraft

Aerodrome and Heliports





- Aerodromes
- Heliports
- Movement Areas
- Distances, Services, Lights

Aerodrome and Heliports

- Data necessary to support aerodrome mapping applications (RTCA DO-272A, EUROCAE ED-99A)

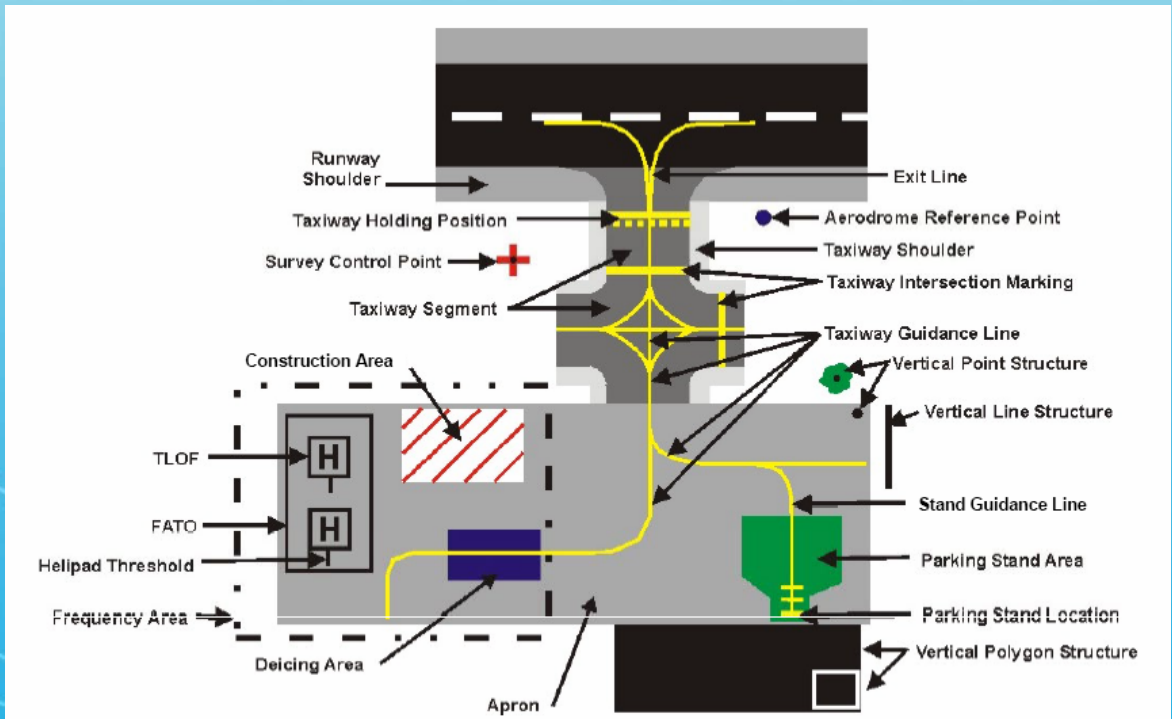


FIGURE 4-1 : AERODROME FEATURES

- Movement area geometries
- Intersections
- Markings

Aerodrome and Heliport Facilities

- Fuel
- Oil
- Oxygen
- Passenger Facility

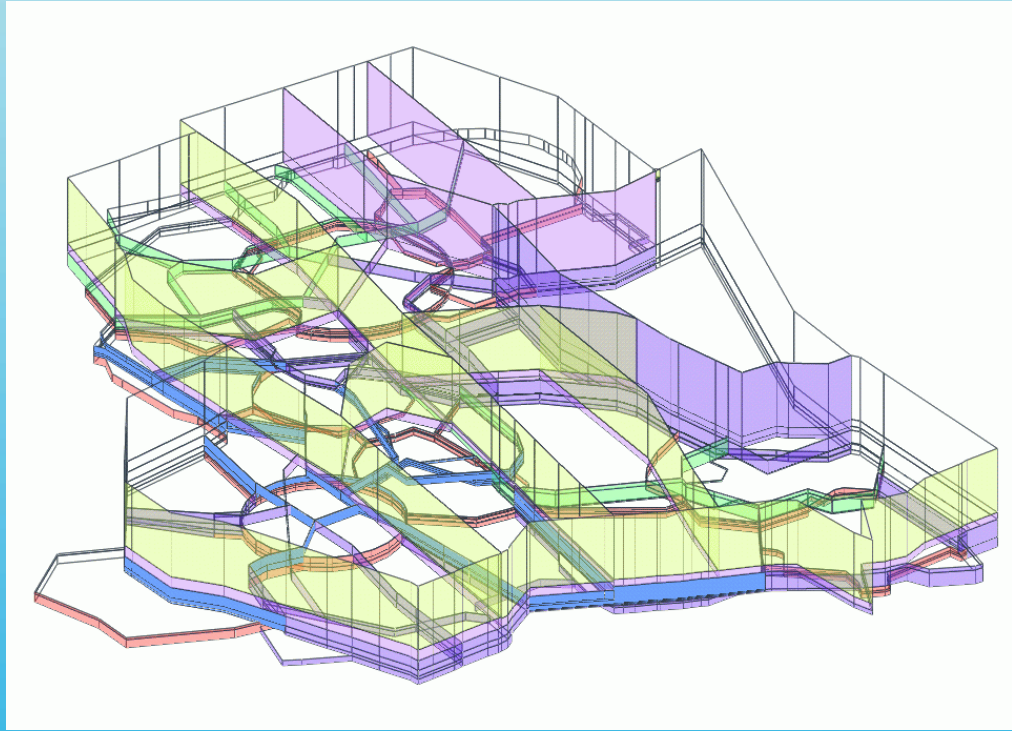
- Ground Services
  - Repair
  - Fire fighting
  - Other…

ETNW AD 2.6 RESCUE AND FIRE FIGHTING SERVICES

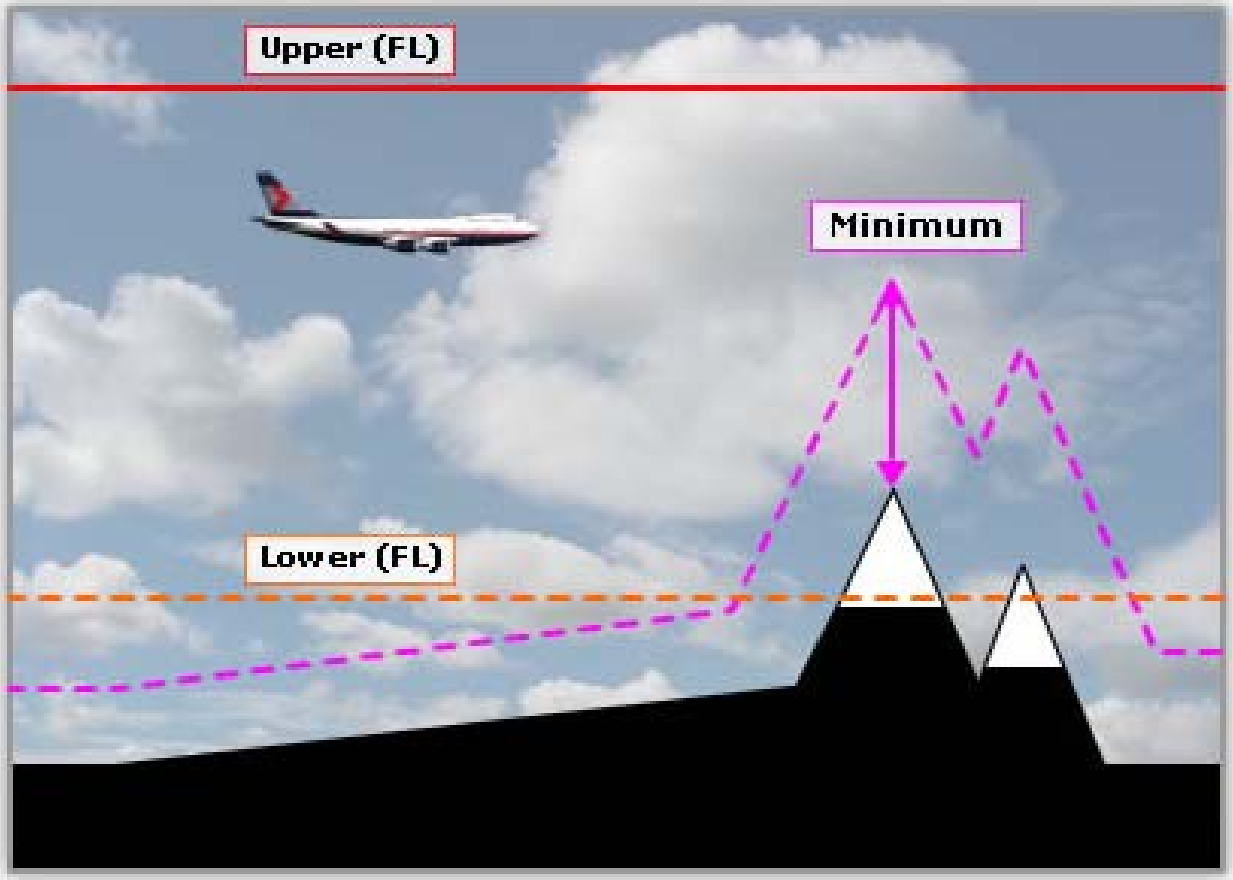
1	*AD category for fire fighting*	CAT 9
2	*Rescue equipment*	1 crash vehicle
3	*Capability for removal of disabled aircraft*	3 cranes
4	*Remarks*	

Airspace

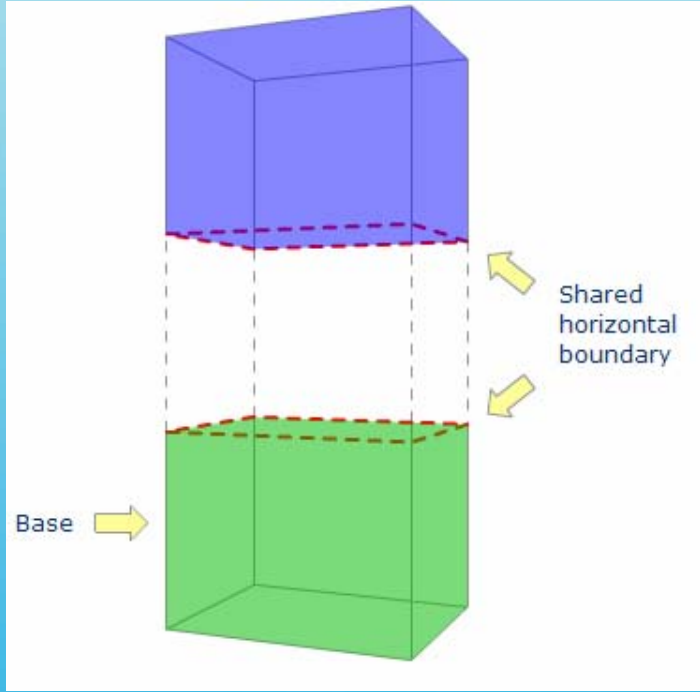
- Represents
  - ICAO Regions
  - Areas
  - Zones
  - Sectors
- Airspaces used in/by
  - Air traffic services
  - Special regulated airspace
  - Client defined airspace
  - Various ‘limited’ airspace



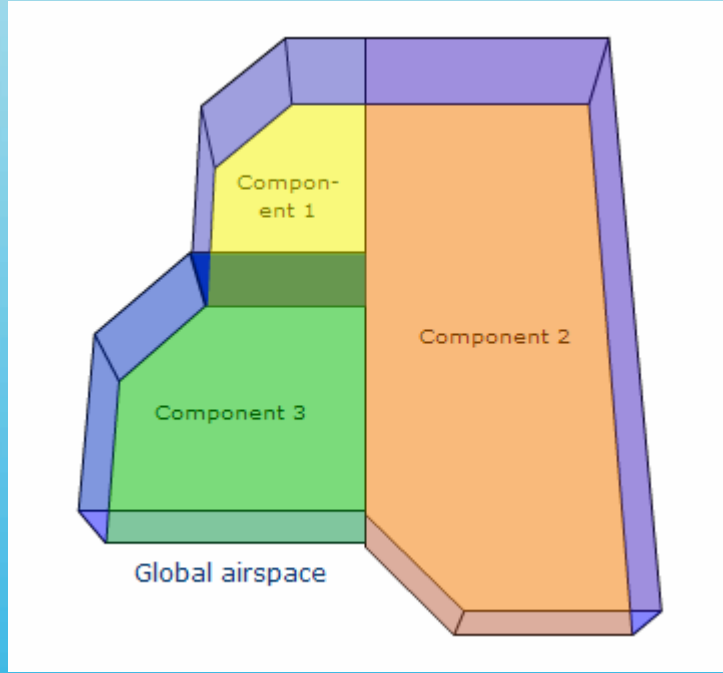
Airspace Altitudes



Derived Airspace

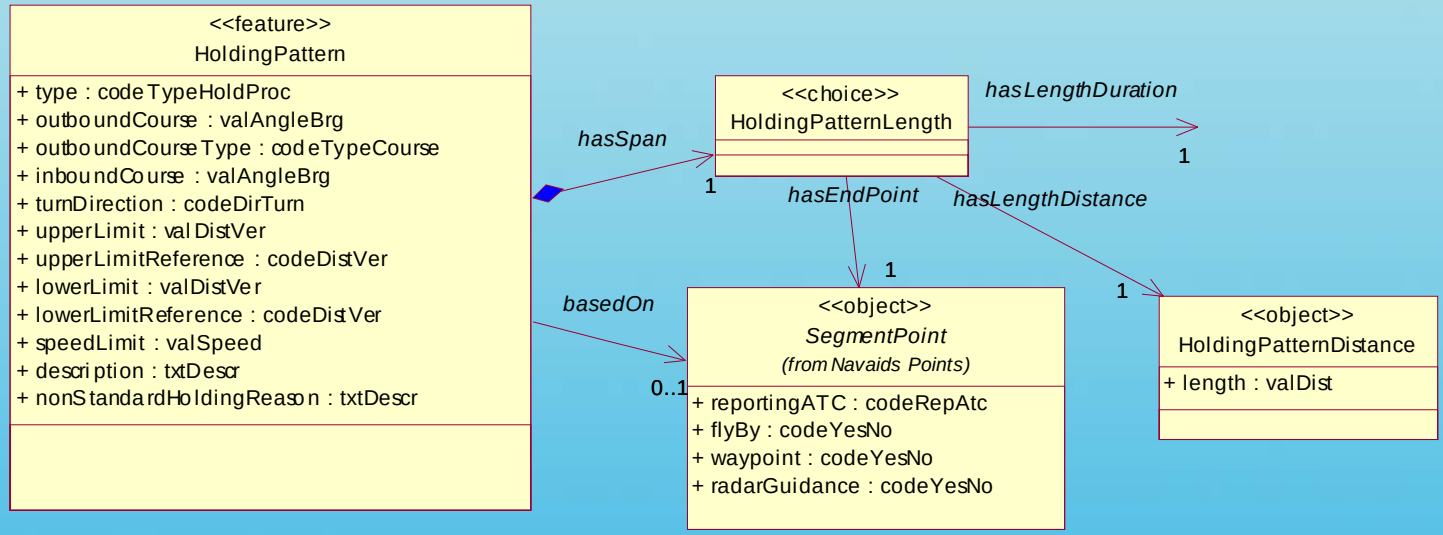


Airspaces with same horizontal border



Airspace *derived* from aggregation of parts

Holding



- En route and terminal holding
- Planned and Unplanned
- Segments by length or time
- Integrated with procedure conceptual area

Navaids and Points

Significant Points

Used for Navigation

Navaids

Navigation Service based on Equipment

DME, VOR, TACAN, Azimuth, and so on

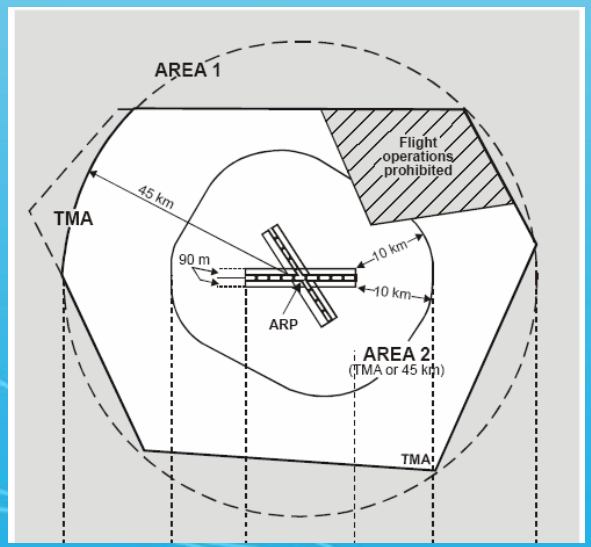
Designated Points

Points not associated with equipment

Fixes and waypoints

Obstacles

- ICAO Annex 4, 14, 15 & DOC 8126
- RTCA /EUROCAE DO-276A/ED-98A
- IATA

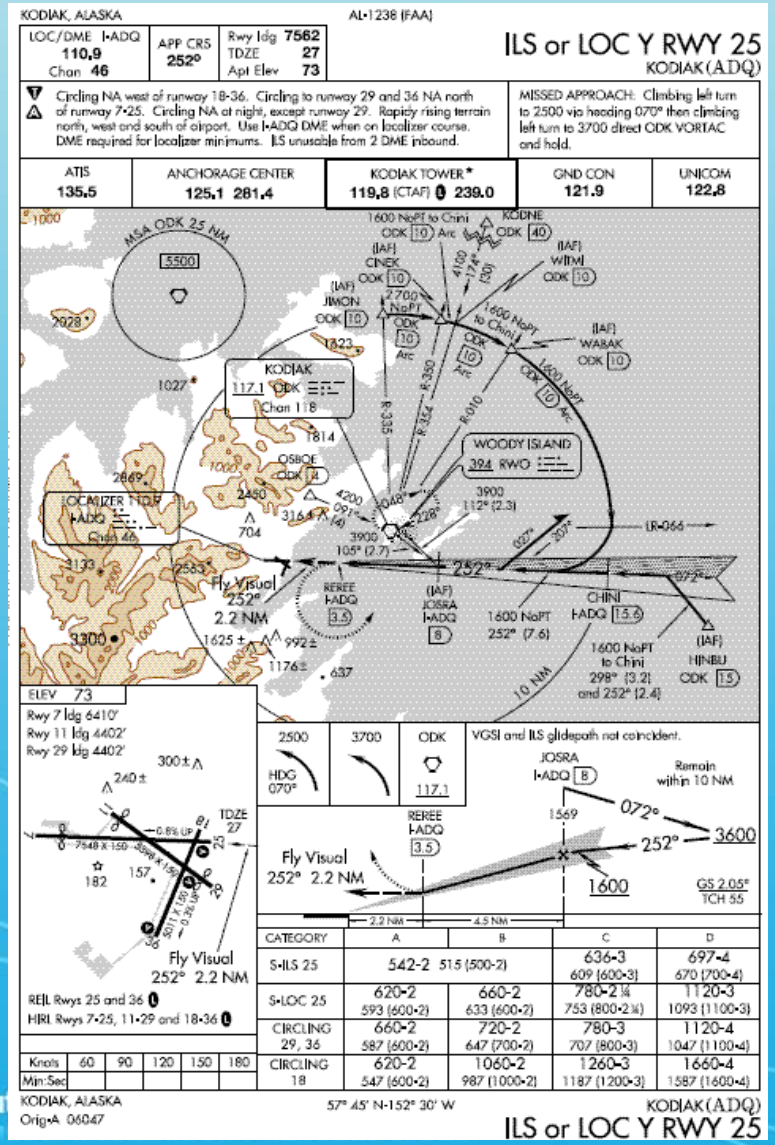


- Lighting
- Schedule
- Area 1, 2, 3
- Point, Line, Polygon

Organizations and Units

- Organization Authority
  - “Model organizations and authorities”
  - ATS organizations (IATA), Aircraft Operators (United), States (Argentina), Groups of States (NATO Members)
- Unit
  - “’Unit’ that provides services”
  - Approach Control, Military, Tower, ARTCC

Terminal Procedures



- Coverage
  - PANS-OPS, TERPS
  - Arinc 424
  - Conventional and GPS
- Describes
  - Procedures
  - Segment Legs
  - Minima
  - Circling
  - Protection Areas
  - Design Surfaces

Routes

RoutePortion

Standard flight levels
Minimum Altitudes
Change over points
DME usage (RNAV)

RouteSegment

Flight Levels
Track Length
Track Width
Track Direction
Flight Rules and Use

EnRouteRoute

- Describe En route structure
- Conventional and GPS
- Minimum clearance altitudes
- Usage restrictions

Services


Unit
Service
Unit provides service
Airspace
Route
Aerodrome/Heliport
Route
Holding
Procedure
…
Provided On
Communication
Flight Information
Air Traffic Control
Meteorological
Radar
…
Service is