



ESTABLISHMENT OF Performance Based Navigation (PBN) APPROACH PROCEDURES





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AIRPLANE PICTURES



Civil Aviation & Meteorology Authority (CAMA)



HISTORY

- In the early days of aviation, the earliest form of navigation was DEAD RECKONING (DR; calculating current position by using a previously determined position, or fix, and then incorporating estimations of speed, heading, and course over elapsed time.
- Adverse weather led to a large number of accidents (*Controlled Flight into Terrain (CFIT), disorientation, hitting obstacles*)

HISTORY

- Efficient methods of navigation were required ,which led to the second form of navigation: Radio Navigation, emission/reception of electro-magnetic signals (waves) between an aircraft and a ground station .
- VOR-DME more advanced ILS etc.... However, it was complicated to calibrate and expensive.
- More efficient methods of navigation were still required which led to area navigation, PBN. PBN aims to ensure global standardization of RNAV and RNP specifications and to limit the proliferation of navigation specifications in use world-wide.

PBN CONCEPT

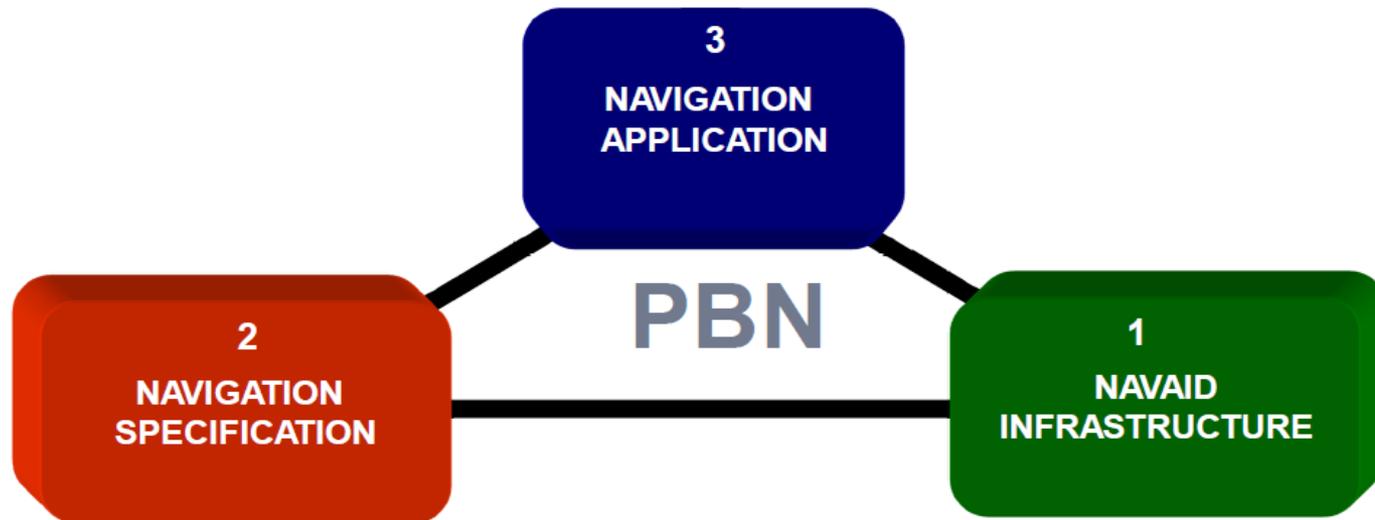
- What is the PBN concept?
- PERFORMANCE-BASED NAVIGATION CONCEPT.
- PBN specifies SYSTEM PERFORMANCE. REQUIREMENT for aircraft operating on air traffic routes or instrument approach procedures, in a designated airspace.
- The performance requirements are defined in term of. accuracy, integrity, continuity and availability

PBN COMPONENTS

The PBN Concept is comprised of three components:

- The Navigation Specification, the Navaid Infrastructure and
- The Navigation Application.
- The Navigation Specification prescribes the performance requirements in terms of accuracy, integrity, continuity for proposed operations in a particular Airspace

COMPONENTS OF PBN CONCEPT

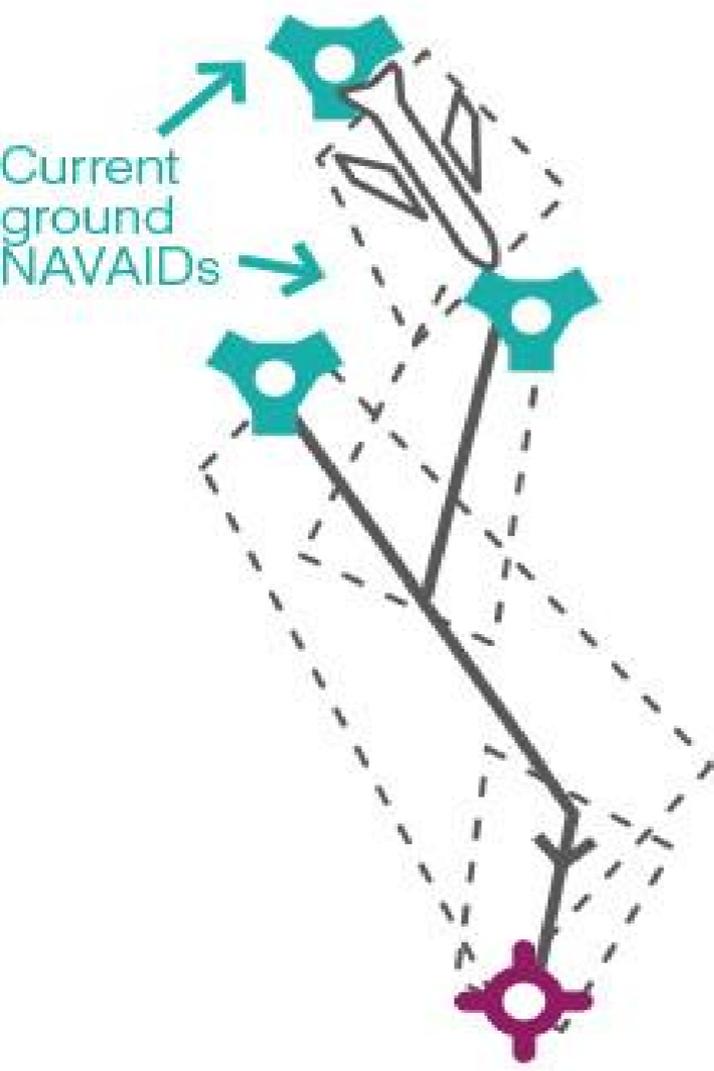


Background

- It is a new concept based on the use Navigation (RNAV) systems.
- The implementation of Performance-Based Navigation, or PBN, is presently the global aviation community's highest Air Navigation priority.
- It is key to the implementation of ICAO's Aviation System Block Upgrades (ASBU) and is an enabler for Continuous Descent and Continuous Climb operations

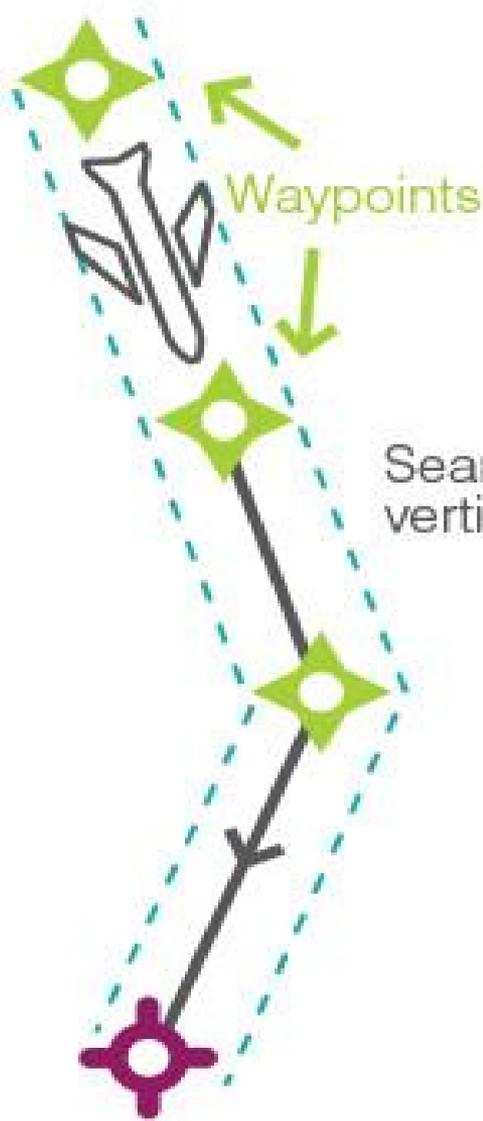
Conventional

Limited design flexibility



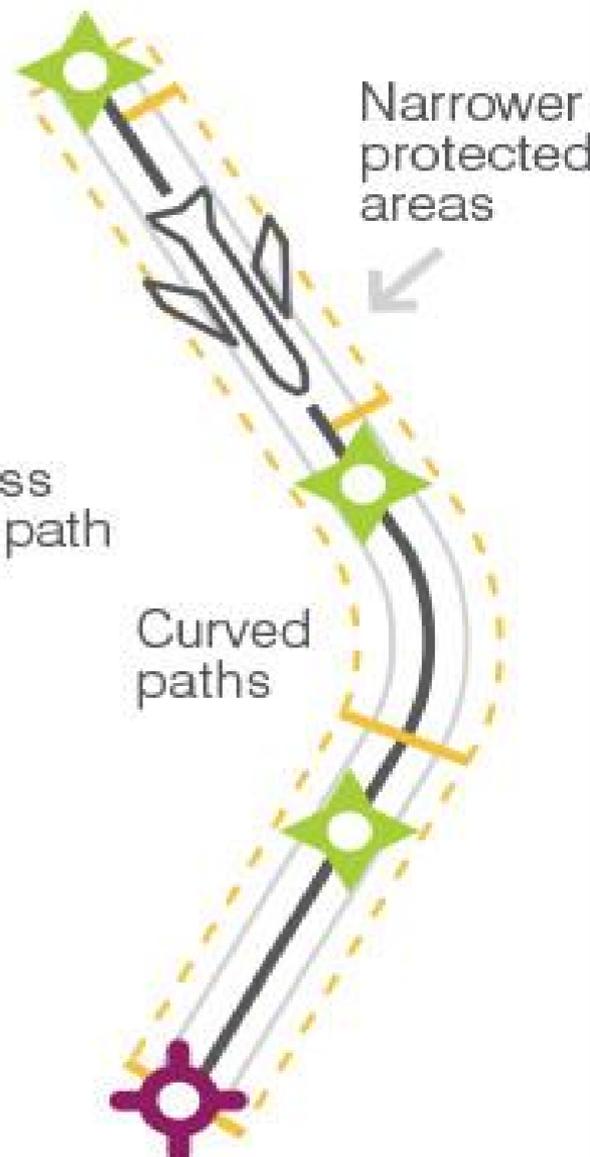
RNAV

Increased airspace efficiency

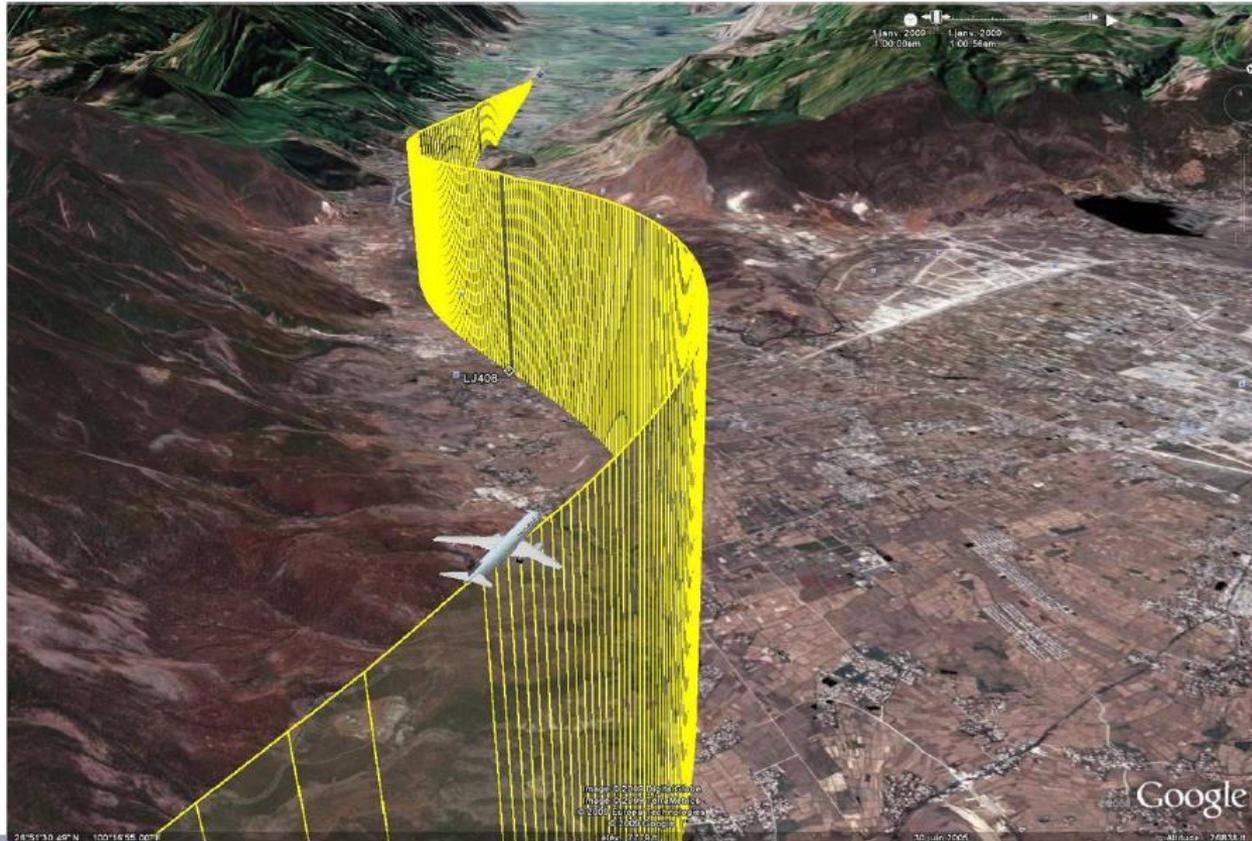


RNP

Optimised use of airspace



PBN APPROACH - FLEXIBILITY IN DESIGN



Slide 23

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CHANGE FROM SENSOR-BASED TO PERFORMANCE-BASED

- PBN marks a significant change from sensor-based to performance-based navigation, and it has several advantages over the sensor-specific way of defining airspace and obstacle clearance criteria.



PBN Benefits for Operator

- Improves Safety ÿ Reduces CFIT
- Consistent predictable flight paths
- Stabilized approach paths .
- Improves Operating Returns
- Reduces fuel costs
- Reduces investment in ground-based systems
- Reduces time in flight through more direct routes
- Increases Airspace Capacity
- More efficient direct routes
- Reduces airspace conflicts Is Environmentally Friendly

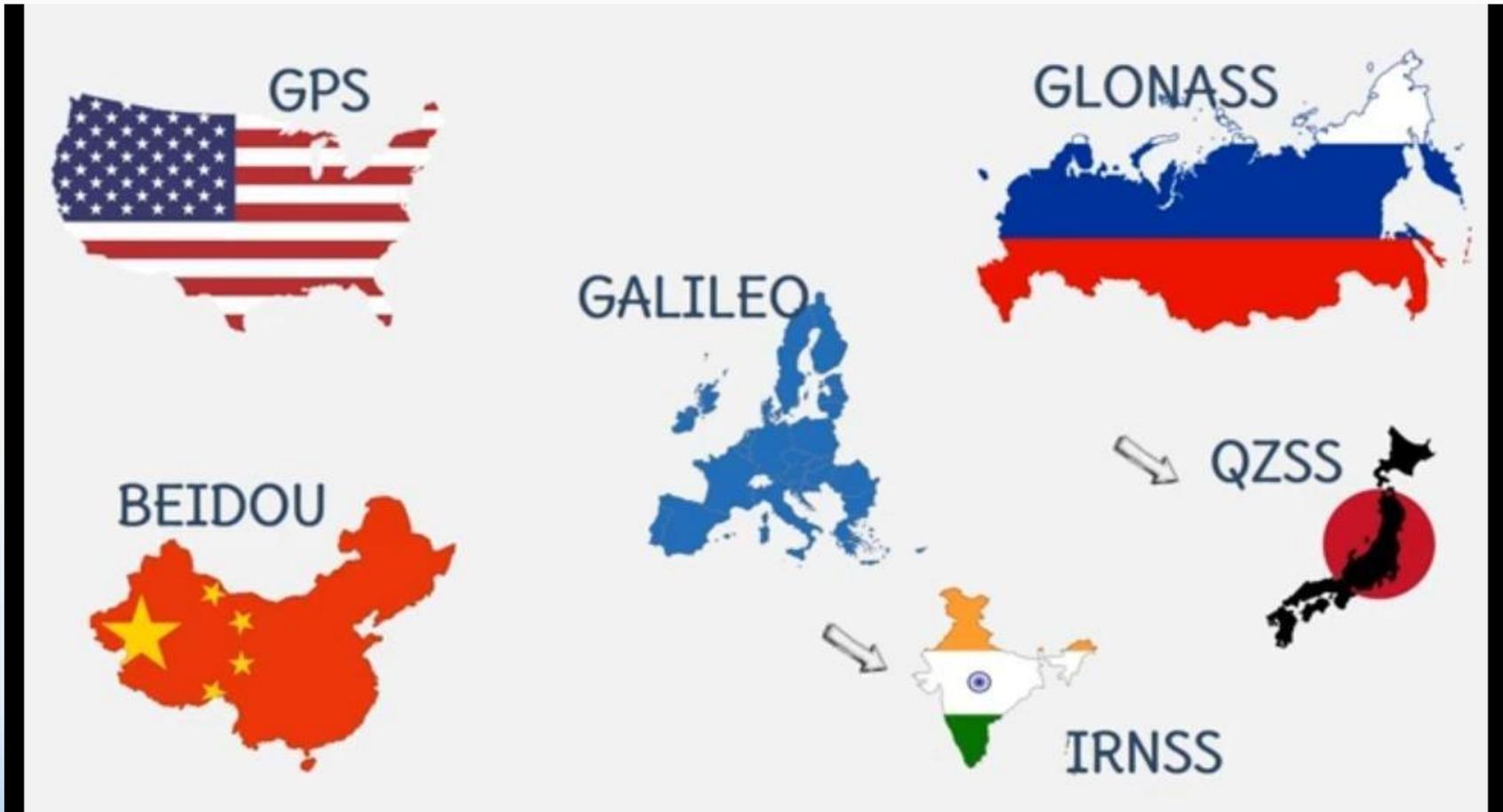


PBN Benefits For ATC

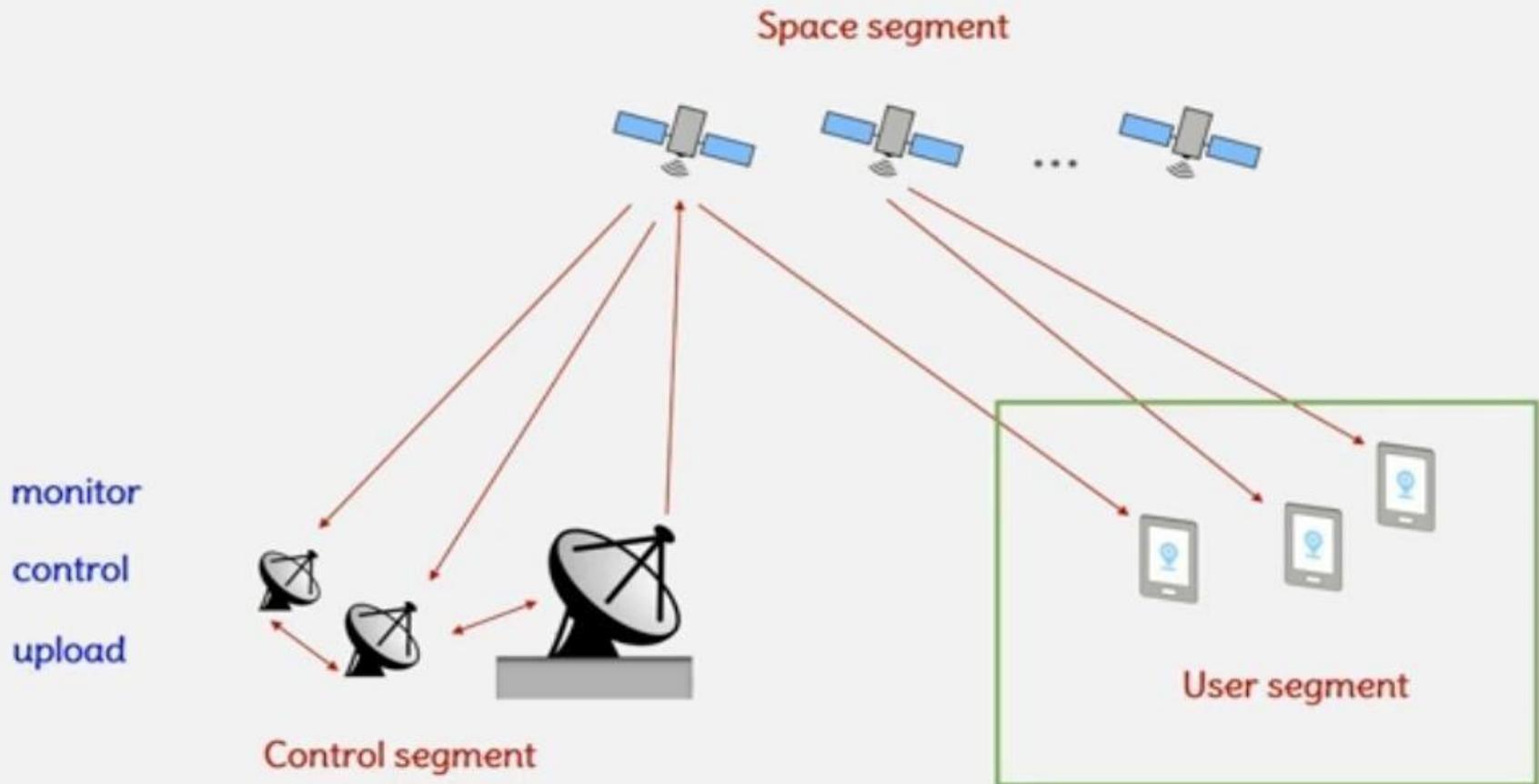
- Benefits in terms of ATC
 - Safety culture
 - Fewer radio transmissions
 - Less chance of readback/hearback errors
 - Greater predictability
 - Airspace Containment
 - Fewer go-arounds
 - Less transit occupancy time in airspace
 - Changing Roles and Responsibilities
 - Best practices involving stakeholders in design



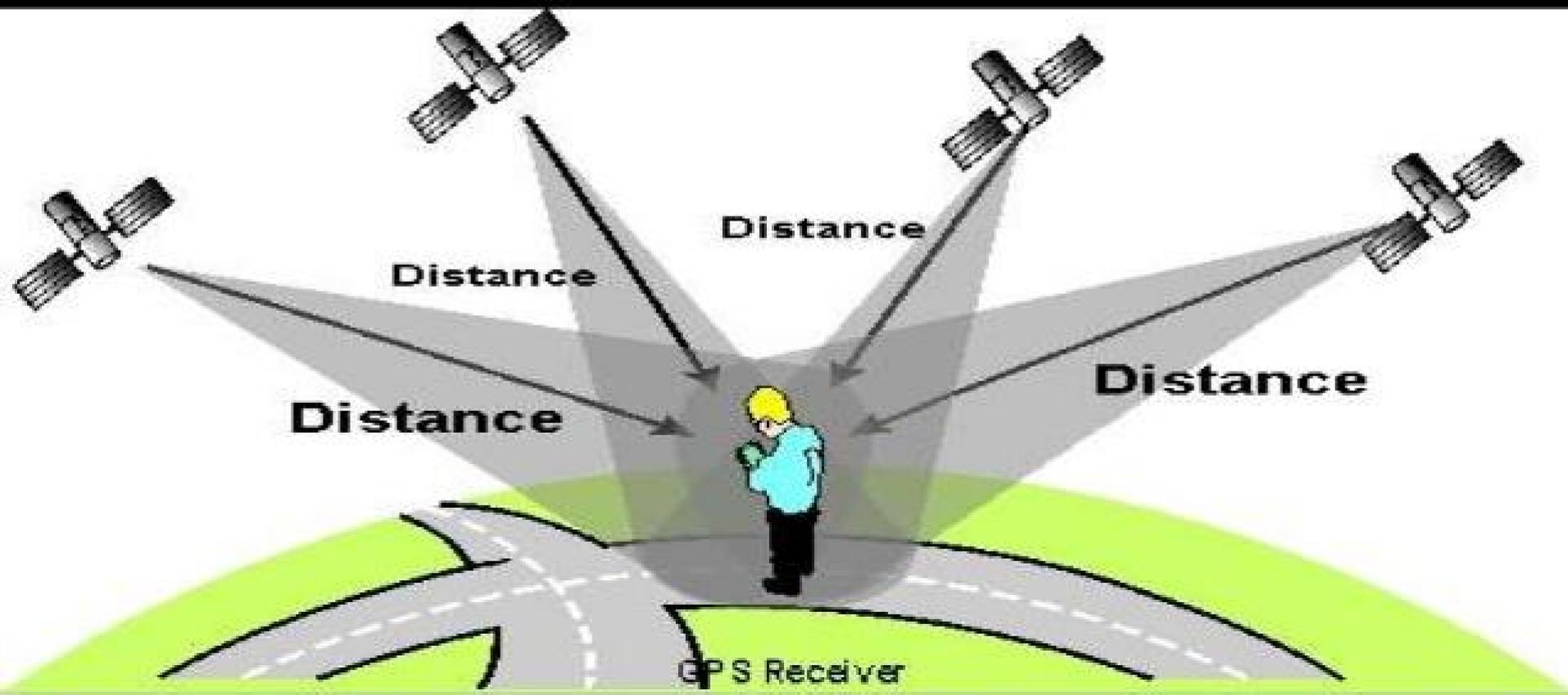
As air travel has evolved, methods of navigation have improved to give operators more flexibility



Each navigation system is comprised of three segments. The space segment, the control segment and user segment



- Mostly four nearest GPS satellites send information to the GPS receiver. GPS satellites use the method of TRILATERATION to find out the receiver's position.



PBN EFFICIENCY

- PBN decreases the expense of maintaining sensor-specific routes and procedures; prevents the requirement to build sensor-specific operations with each new evolution of navigation systems, which would be prohibitively expensive;
- Provides for more efficient use of airspace (route placement, fuel efficiency, and noise abatement); defines how RNAV and RNP systems are employed; and simplifies the operational approval procedure for operators by providing a small set of global navigation criteria



ADEN INTEL. AIRPORT (OYAA)

- The instrument approach procedures (RNP) have been designed for Aden International Airport and are currently in the process of publishing the procedures that would guide the aircraft during the approach phase until landing and ensure safety for flight operation.
- The advantage of these procedures is that they do not require energy, spare parts or maintenance, however their operation is very economical.



AL GAYDAH INTL. AIRPORT (OYGD)

- The instrument approach procedures (RNP) was designed and published as trial procedures that would guide the aircraft during the approach phase until landing and ensure the safety of flight.
- These procedures have the advantage of requiring no energy, spare parts, or maintenance and are very cost effective



TRANSITION ALTITUDE
13000

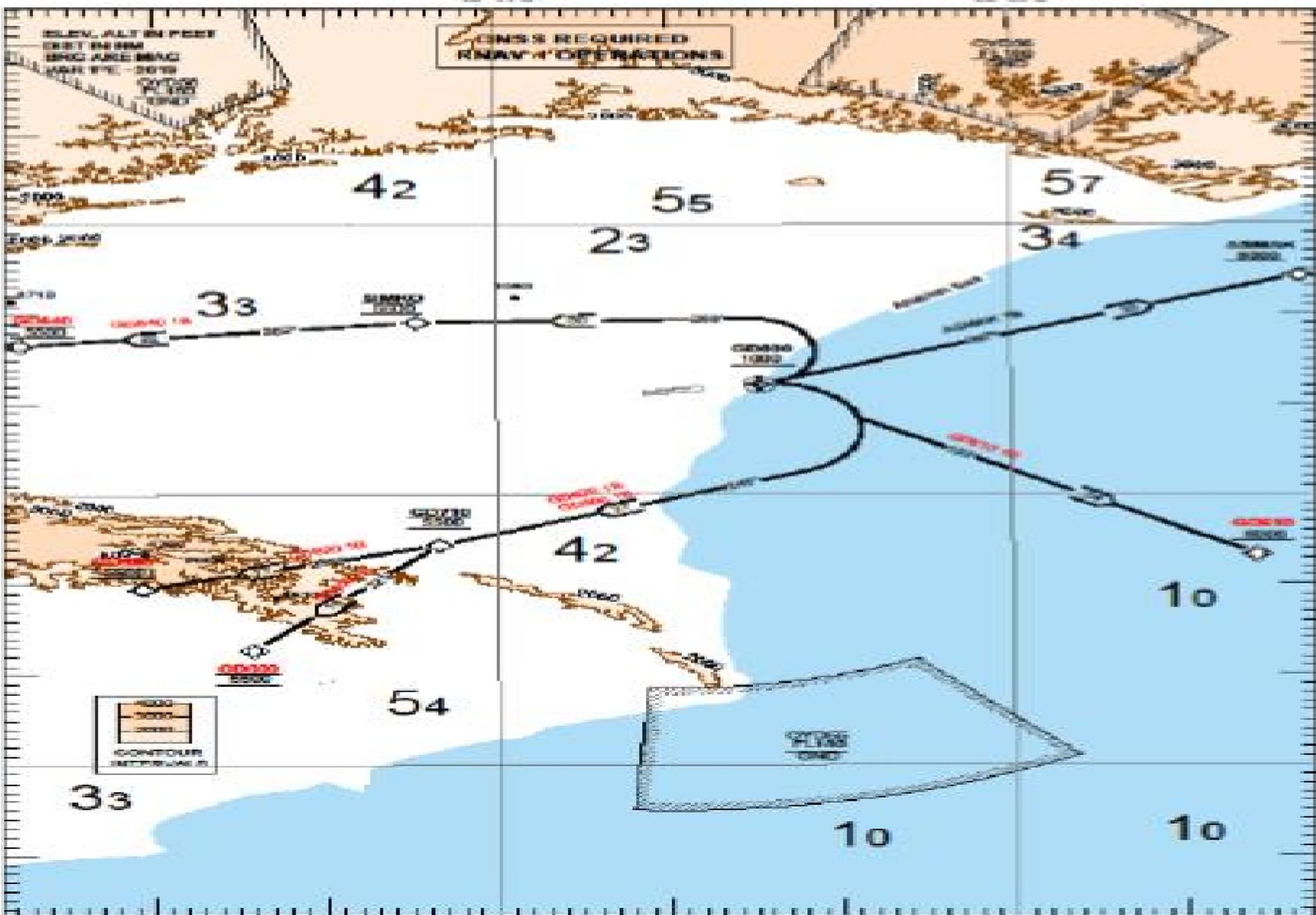
TIME 11200
QNH: 121.60

ALL DIMENSIONS GIVEN IN METERS (FOOT)
EFTY 60
ALOMAK 10 - 00000 10 - 00000 10
00000 10 - 00000 10
MFL 307E

107 00'E

107 00'E

107 30'E



ELEV. ALT IN FEET
DST IN NM
DPO AGL IN METERS
DPO AGL IN FEET

GNSS REQUIRED
RNAV OPERATIONS

1000
2000
3000
CONTOUR
INTERVAL

42

55

57

33

23

34

42

10

54

10

10

33

SAYUN INTL. AIRPORT (OYSY)

- The instrument approach procedures (RNP) for Sayun Airport was designed and published as final which would guide the aircraft during the approach phase until landing and ensure flight safety.
- These procedures have the benefit of not requiring energy, spare parts, or maintenance, but instead are extremely cost-effective to operate.



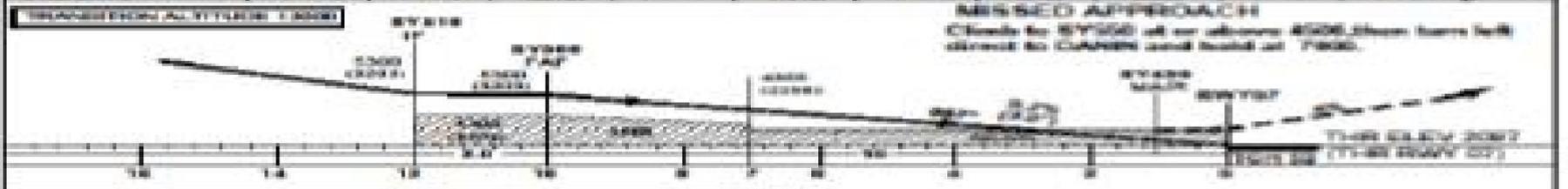
RETURNS
APPROACH
CHART 1000

AERODROME ELEV 2007 M
HEIGHTS RELATED TO
THE RWY# 17 ELEV 2007 M

TWR: 115.40
QND: 121.90

SATURN (approx loc. (01517))

RSP 5017



ACFT CAT		A	B	C	D
Straight-in Approach	OCA (ft)	2570 (773)			
	visibility	1000 m			
Circuit	MSLA (ft)	2000 (1762)	2000 (2702)		
	visibility	2000m	4000m		

NOTE:
This chart is for use only at SATURN (01517).

Distance from RWY	100	200	300	400	500	600	700	800	900	1000
Altitude (ft)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Altitude (m)	457	457	457	457	457	457	457	457	457	457

- Remarks: MAPS at 5 NM from RWY.

Establishment of RNP APCH for other airports

- The establishment of RNP approach procedures for SOCTRA and Ryan Intel. Airports are under study.
- CAMA is keen to establish RNP approach procedures
- for all airports as it will ensure safe operation of aircraft and continuous operations of airports under any circumstances.



PBN Documents:

- Doc 9613 – Performance-based Navigation Manual
- Doc 9931 – Continuous Descent Operations (CDO) Manual
- Doc 9992 – Manual on the Use of Performance-based Navigation (PBN) in Airspace Design
- Doc 9993 – Continuous Climb Operations (CCO) Manual
- Doc 9997 – Performance-based Navigation (PBN) Operations Approval Manual
- advance copies restricted to States on ICAO-net
<http://www.icao.int/safety/pbn/Pages/default.aspx>





LESSON LEARNED

- Trans World Airlines Flight 514 crashed
- The NTSB determined that the probable cause of the accident was the pilots' decision to descend to 1,800 feet before the plane had reached the approach segment where the minimum altitude applied.



