Established with PBN new route as a Civil Military Cooperation

- Y711 & Y722, the 8NM lateral separation -

MOLIT
Ministry of Land, Infrastructure and Transport

KOREA OFFICE OF CIVIL AVIATION

Outline

1 PBN Road Map

2 Airspace Concept

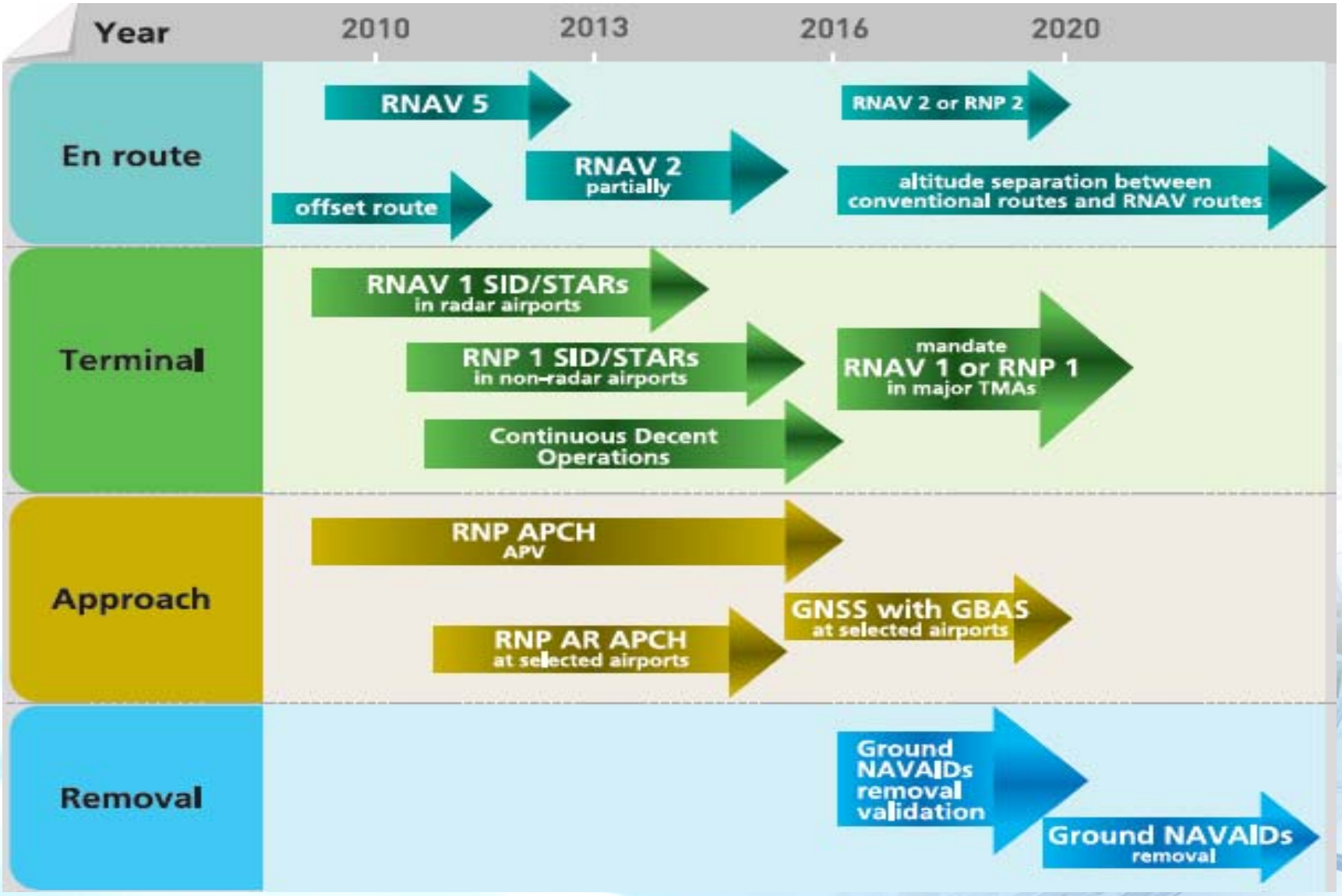
3 Design Concept

4 Implementation

5 Safety Assessment

6 Cost-Benefit Analysis

1 PBN Road Map

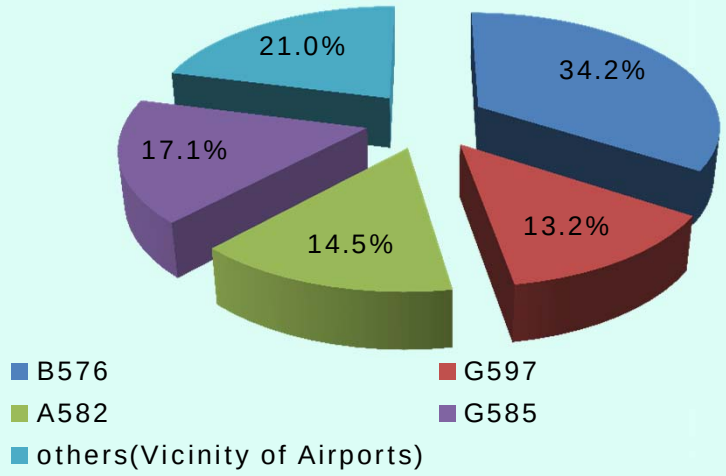


2-1 Airspace Concept -1

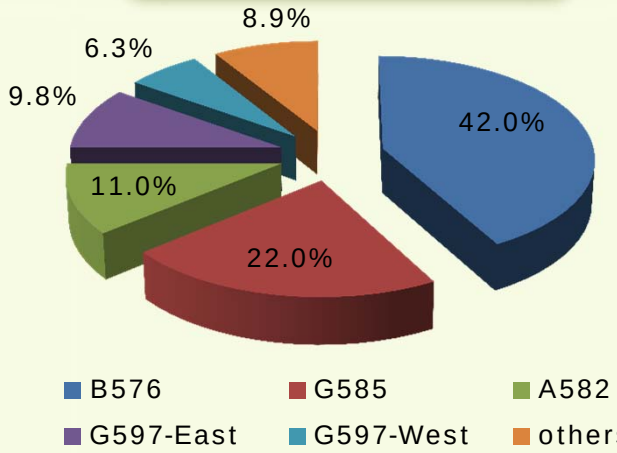
Status of B576

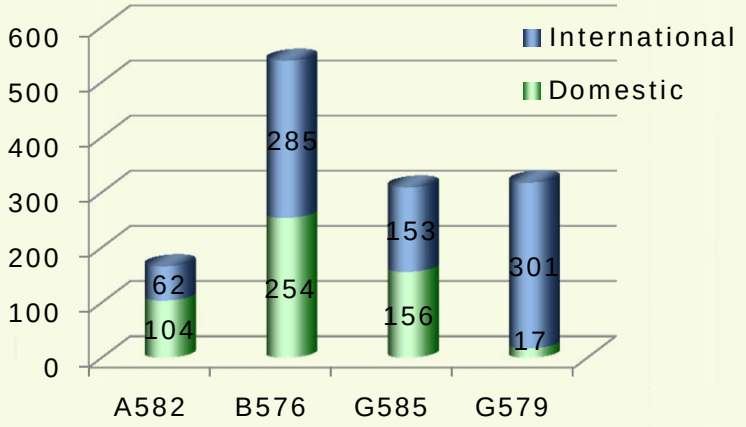
Why ? B576

- The most congested route
- Traffic Volume : 42%
- The largest ACAS Occurrence rate

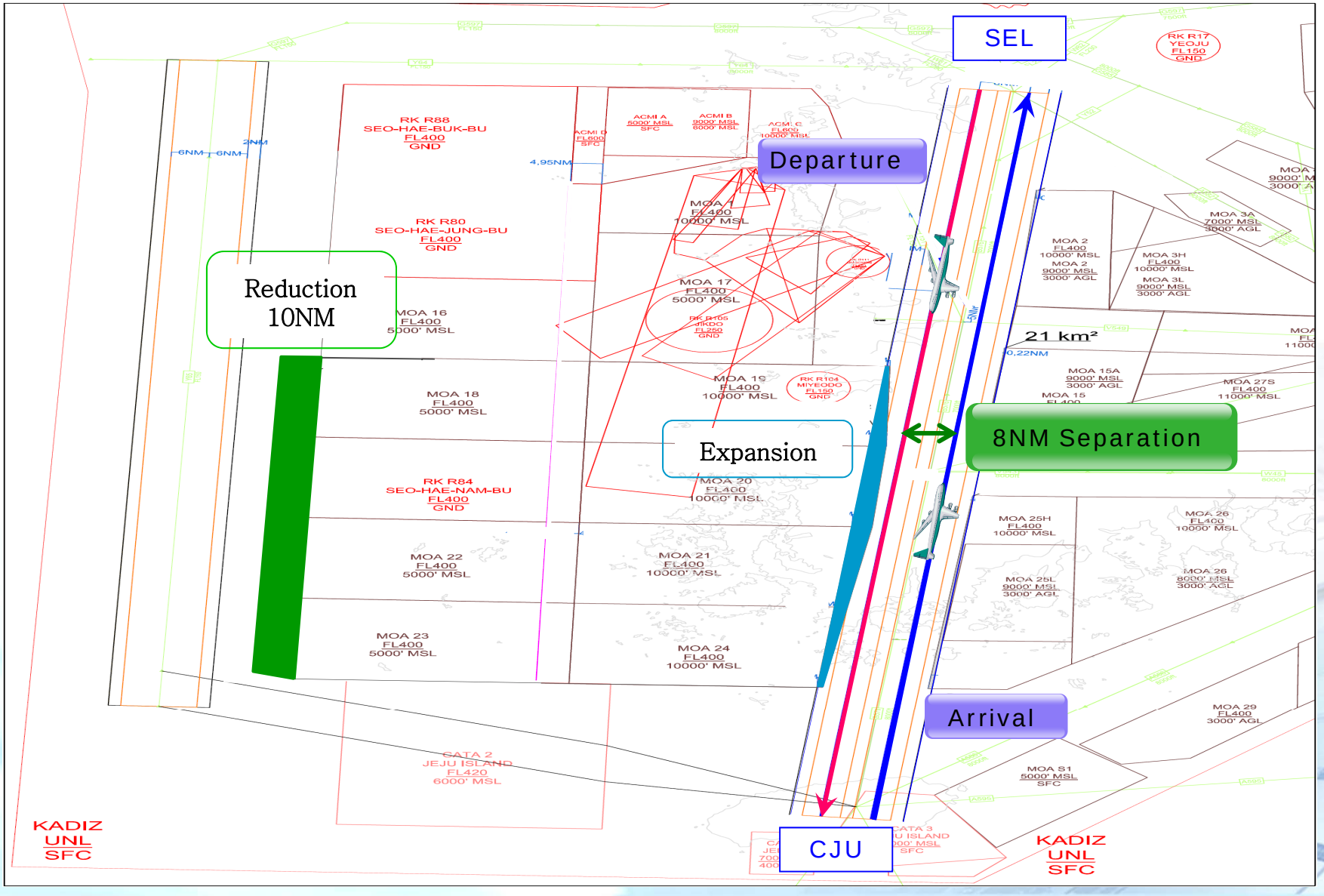


Traffic Volume - Airways -





2-2 Airspace Concept - 2

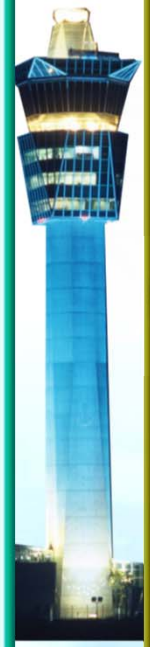


3-1 Design Concept -1

ICAO Criteria – Doc.9613

" For both RNP and RNAV designations, the expression "X" (where stated) refers to the lateral navigation accuracy (TSE) in nautical miles, which is expected to be achieved at least 95 per cent of the flight time by the population of aircraft operating within the airspace, route or procedure "

- ICAO Doc.9613 PBN Manual

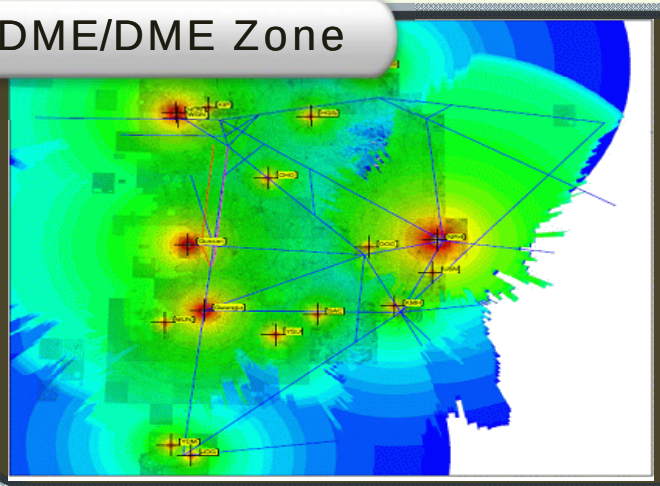


ATS Requirements

Incheon FIR

- NAV : RNAV 2 infrastructures (GNSS, DME/DME)
- COM : Direct VHF controller/ pilot voice communication
- SUR : Radar surveillance

DME/DME Zone



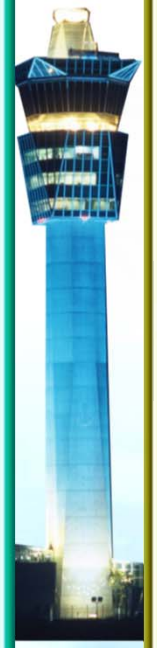
3-2 Design Concept – 2

ICAO Criteria – Doc.8168

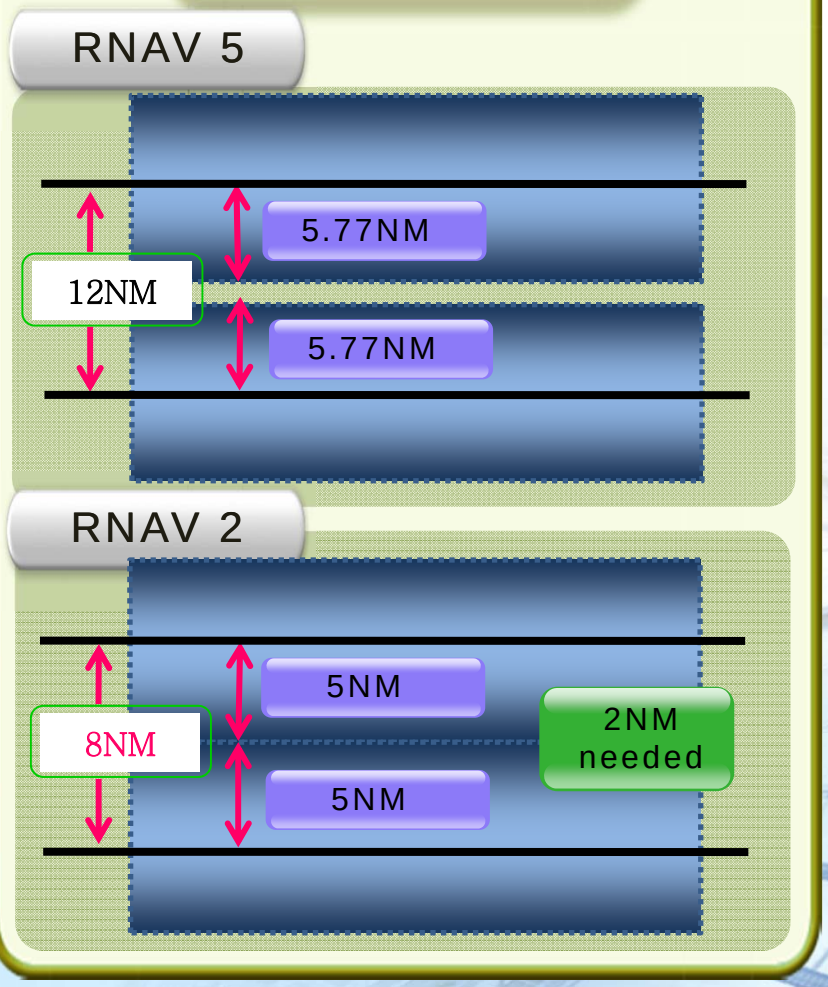
For PBN Procedures

- ½ W = XTT *1.5 + BV
- 2δ(95%) = XTT, 3δ(99.7%) = XTT*1.5
- ½ W = 5NM for RNAV 2 and 5.77 NM for RNAV 5 is needed

NAV	XTT(NM)	
	RNAV 5	RNAV 2
GNSS	2.51	2.00
DME/DME	3.30	1.51



Routes Spacing



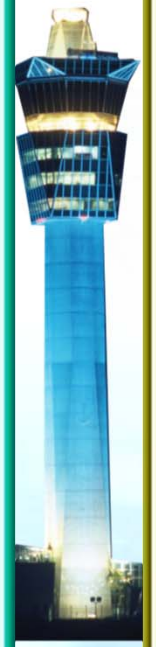
4-1 Implementation - 1

Upper Segment RNAV 2

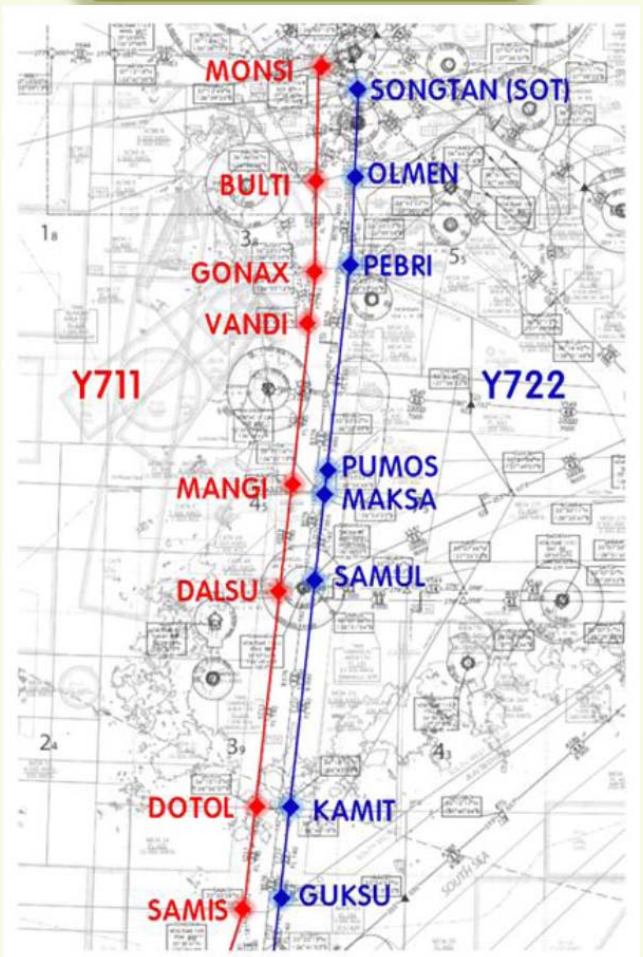
Segments

- **MONSI~PANSI(Y711)**
- **SOT~SOSDO(Y722)**

- Separation Distance : 8NM
- Navigation Requirement
  - RNAV 2
- Required Equipment
  - DME/DME/IRU, GNSS

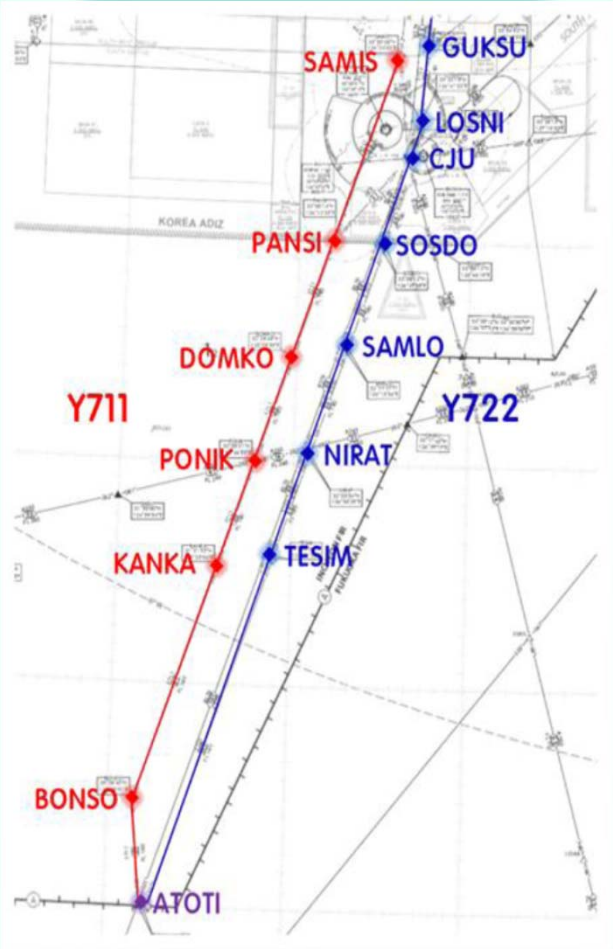


Design Concept



4-2 Implementation - 2

Design Concept



Lower Segment RNAV 5

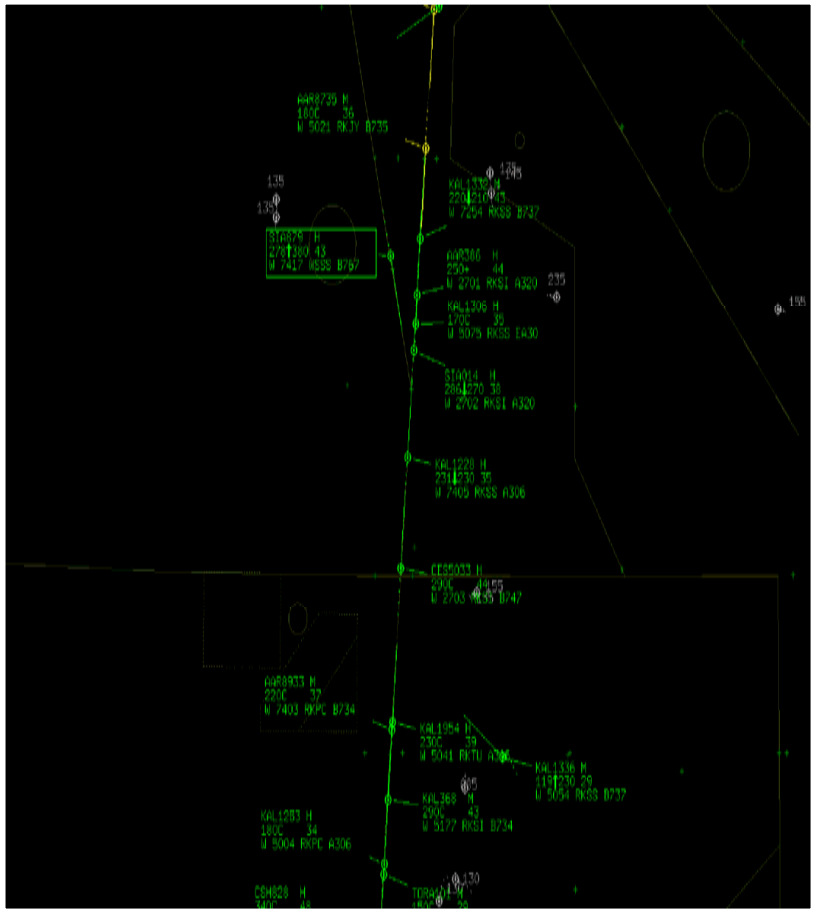
Segments

- **PANSI~BONSO(Y711)**
- **SOSDO~ATOTI(Y722)**

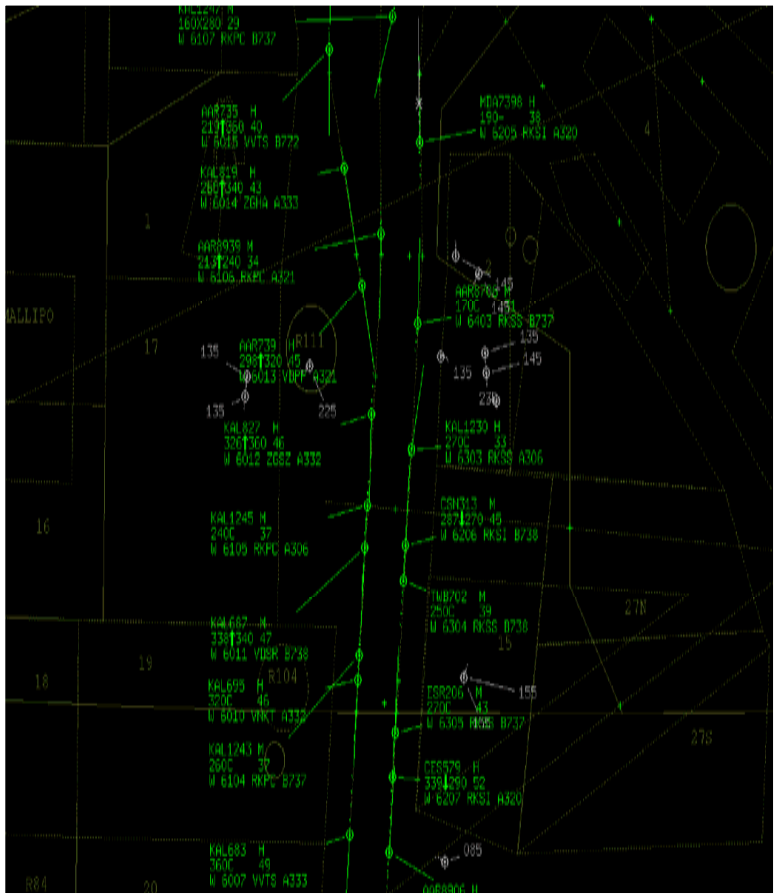
- Separation Distance : 12NM
- Navigation Requirement
  - RNAV 5
- Required Equipment
  - INS/IRU, GNSS

4-3 Implementation - 3

Before



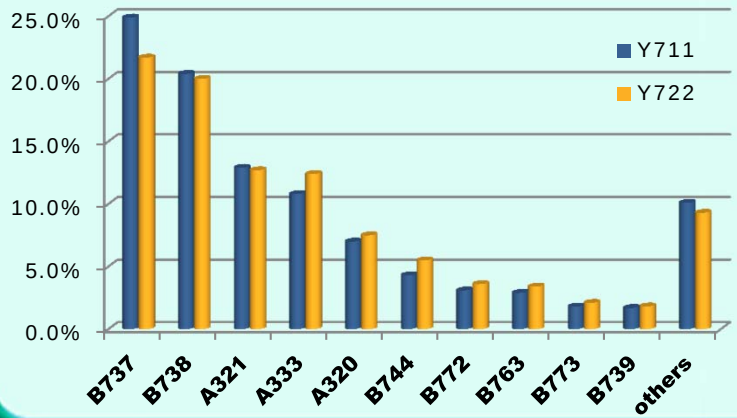
After



5 Safety Assessment of RNAV 2

Collected Data

- **Period of Traffic Sample data**
  - **1 July 2012 to 31 December 2012**
- **Altitude : Above 14,000 ft**
- **Total Flight : 80,280**
- **Type of Aircraft**
  - **A333, B737, B738, A321**



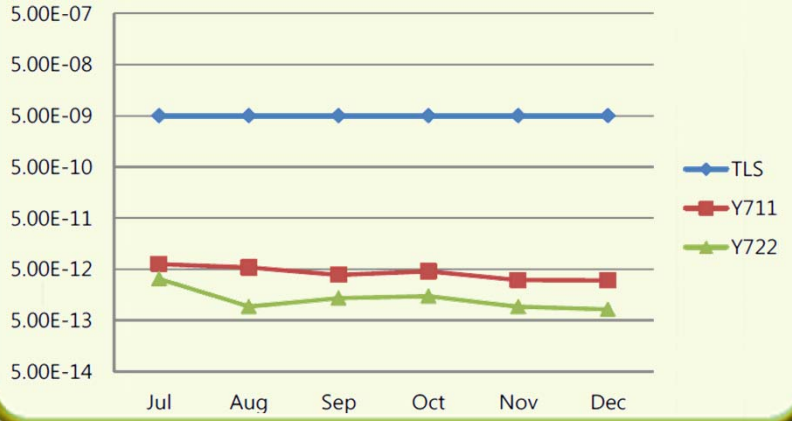
Estimate of Collision Risk

Collision Risk Estimate

Route	Y711 (RNAV 2)	Y722 (RNAV 2)
Estimate	4.33E-12	1.45E-12

- **Estimate satisfies ICAO' TLS 5.0 x 10-9**

Trends of Collision Risk Estimate



6-1

Cost-Benefit Analysis
- Traffic Sample Data

Traffic Sample Data of ATS routes

Status	Pre-Implementation	Post-Implementation
Period of TSD	1 - 31 May 2012	1 - 31 July 2012
Altitude	Above FL 140 (total 725 flights)	Above FL 140 (total 864 flights)
Segment of ATS route	B576	Y711 & Y722 (RNAV 2 Segments)

Simulation

- MATLAB : for the database construction of the massive aircrafts trajectory file
- BADA Model : for the prediction of fuel consumption for difference aircraft type and different altitude-velocity per time

6-2 Cost-Benefit Analysis – Outcome of Simulation

Outcome of Simulation

Speed : 17 knots ↑ , Flight time : 1.2 min ↓ , Fuel consumption : 228.4 kg/flight ↓

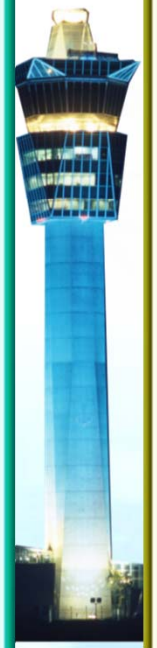
Status	Pre-Implementation	Post-Implementation
Segment of ATS route	B576	Y711 & Y722 (RNAV 2 Segments)
Flight distance	229NM	230NM
Flight speed	408 knots	425 knots
Flight time	33.8 min	32.6 min
Fuel consumption	4173.7 kg/flight	3945.3 kg/flight

6-3 Cost-Benefit Analysis – Result of Analysis

The end of 2013

- Type and estimated benefits

- **Reduced airlines direct operating costs**
  - **$ 19.13 million**
- **Environmental benefits from reduced aircraft emission(CO2)**
  - **$ 0.37 million**
- **Passenger value of time**
  - **$ 8.16 million**
- **Total estimated cost-benefit**
  - **$ 27.66 million**



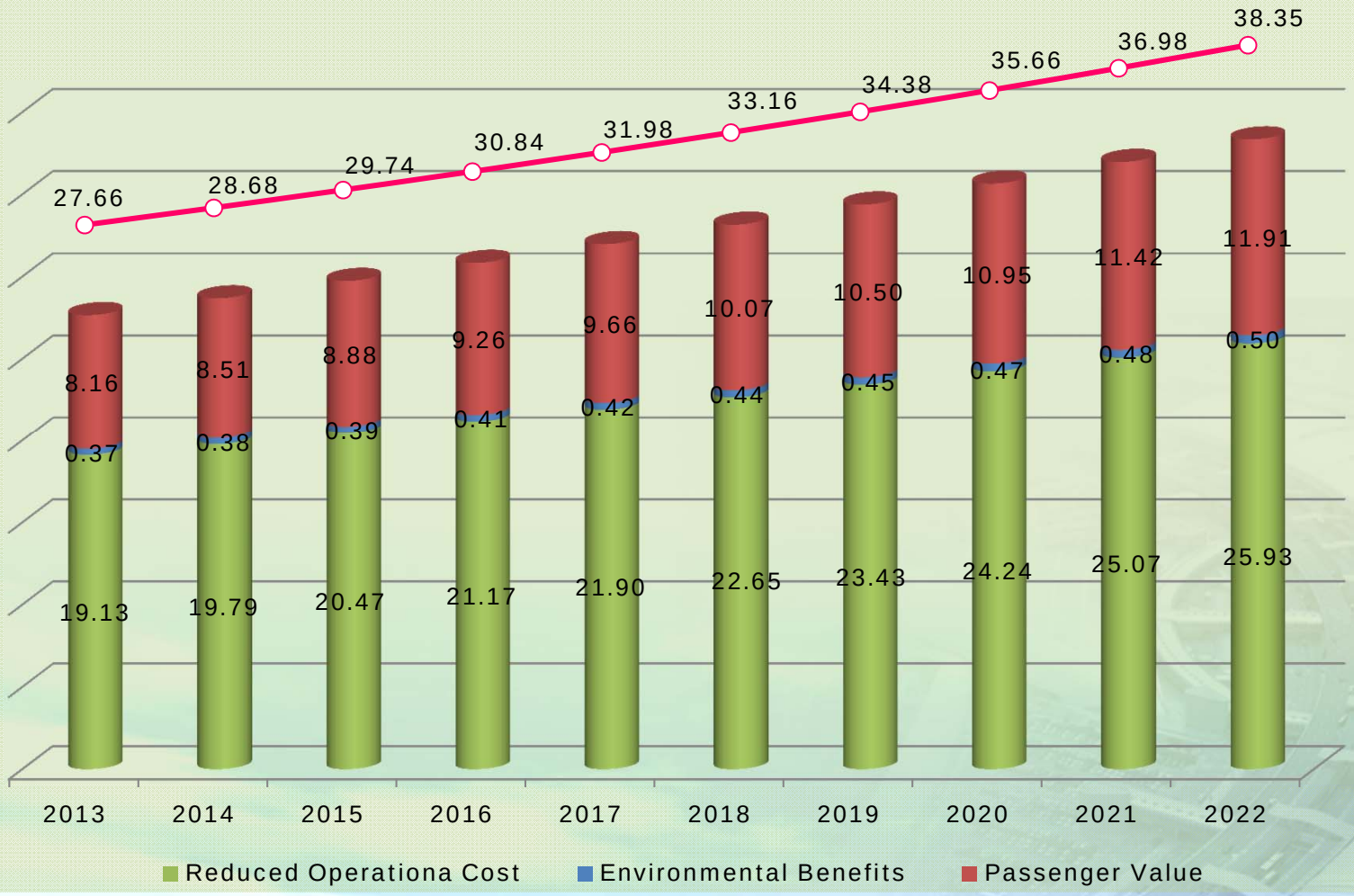
From 2013 through 2022

- Type and estimated benefits

- Reduced airlines direct operating costs
  - **$ 223.77 million**
- Environmental benefits from reduced aircraft emission(CO2)
  - **$ 4.31 million**
- Passenger value of time
  - **$ 33.33 million**
- Total estimated cost-benefit
  - **$ 327.41 million**

6-4

Cost-Benefit Analysis
- Estimated benefits(2013~2022)




THANK YOU