



Global Air Navigation System

~ Economic Analysis ~

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**Workshop on the Development of
National Performance Framework
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Presentation outline

- **CEANS outcome**
- **Costs**
- **Benefits**
- **Funding**
- **Cost recovery**
- **Organizational format**
- **Legal issues**

Economic and organizational aspects related to implementation of Global ATM Operational concept (CEANS 2008 Outcome) ...

- **States should strive for the efficient and cost-effective implementation of the global ATM operational concept, using the GANP as the implementation planning document, through international cooperation and collaboration within the ATM community; and**
- **States should consider facilitating implementation of the global ATM operational concept by adopting, where appropriate, a regional approach in order to enhance transparency, efficiency, fairness, comparability and predictability of the costs of air transport infrastructure**

Economic and organizational aspects related to implementation of Global ATM Operational concept (CEANS 2008 Outcome)

- **ICAO should continue to monitor developments in economic and organizational aspects related to the global ATM operational concept and the GANP, in order to determine whether additional policies and guidance on this subject will be necessary in the future; and**
- **ICAO should undertake a case study on the provision of certain services by private third-party providers and develop a draft service level agreement for possible use by NSPs, to ensure that private third-party providers perform in line with recognized safety and performance requirements.**

Air Navigation infrastructure to Support ATM Operational Concept

System elements:

- ATM
- CNS
- AIM
- AGA
- MET

Identification of costs in establishing CNS/ATM systems infrastructure ...

Equipage (Hardware/Software)	Capital Costs	Recurring Costs
<i>Communication</i> Ground-ground data and voice communication (such as VSAT network) VHF data/voice digital radio HF data link AMSS data/voice link ATN (end-systems, gateways, routers)		

Identification of costs in establishing CNS/ATM systems infrastructure ...

Equipage (Hardware/Software)	Capital Costs	Recurring Costs
<i>Navigation</i> GNSS (GPS/GLONASS/GALELEO) ABAS GBAS (monitoring station including data link) SBAS (master station, monitoring station GEO overlay uplink)		

Identification of costs in establishing CNS/ATM systems infrastructure

Equipage (Hardware/Software)	Capital Costs	Recurring Costs
<i>Surveillance</i> SSR Mode A/C SSR Mode S ADS –C situation display ADS-B Multilateration		
<i>Air traffic management</i> Decision support systems		

Allocation of costs ...

Cost/ Benefit Item	CAA	Aircraft Operators	Passengers	Totals
Costs of CNS/ATM Systems				
Equipment costs			—	
Ground	X			
Aircraft		X		
Training	X	X	—	
Purchases from intermediate service providers	X	X	—	
TOTAL	C1	C2		C

Allocation of Costs

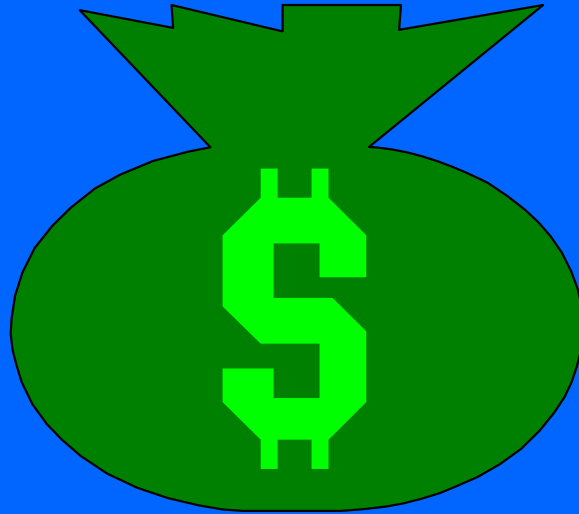
- Resolution A32-19 provides guidelines.
- Cost allocation issues
 - multi-modal services
 - allocation options
- Allocation of costs
 - Aeronautical and non-aeronautical
 - Airport and en-route operations
 - Commercial and non-commercial users
- ICAO to continue its efforts in this area with a more comprehensive study

Capital investment

Who is responsible?

- **States**
- **Service providers**
- **Airspace users**

Again, how much?



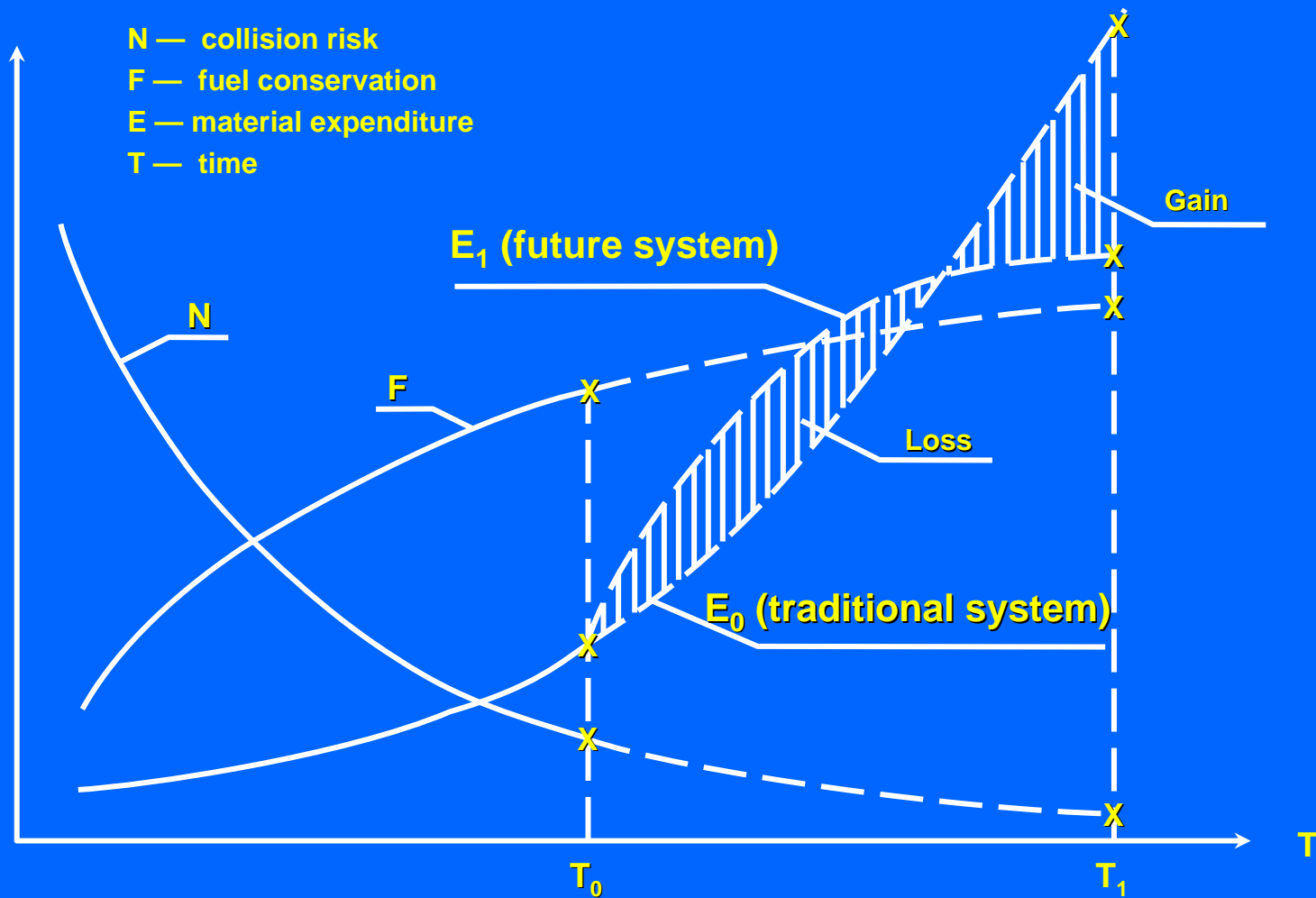
*Depends on the
implementation options!*

Global economics – CNS/ATM systems (FANS report)

Capital cost — US \$ 6.5 billion

**Operating cost — US \$ 1.0 billion
per annum**

**Benefit/Cost ratio ranging
from 5.2 to 6.6**

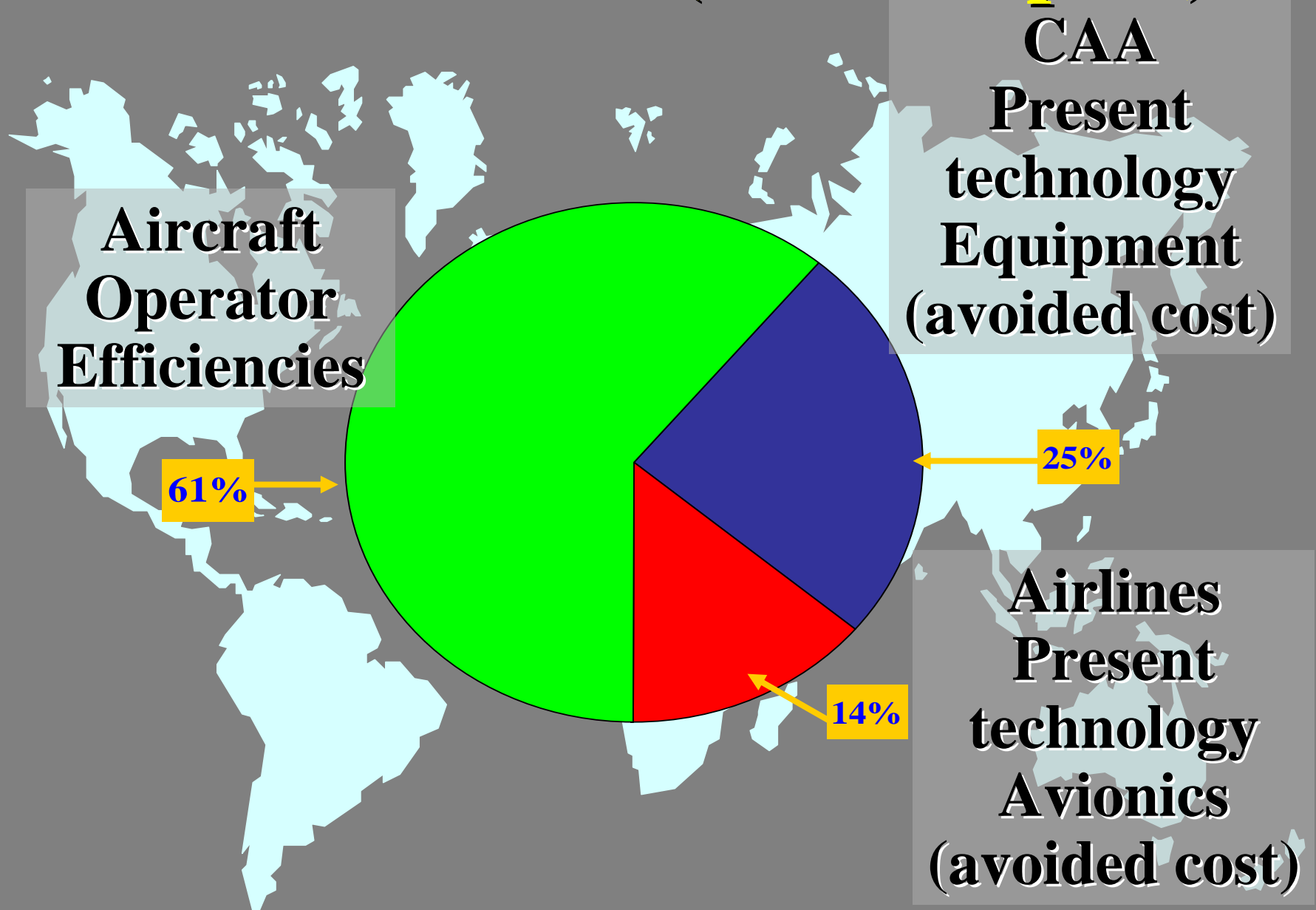


**General trend in the variation
of the main factors of the ATM system**

Allocation of benefits

Cost/Benefit Item	CAA	Aircraft Operators	Passengers	Totals
Benefits of CNS/ATM				
Avoided equipment costs (Present technology)				
Ground	X	—	—	
Aircraft	—	X	—	
Efficiency improvements	X	X	—	
Passenger time savings	—	—	X	
TOTAL	B1	B2	B3	B

Benefit shares (FANS report)



Airline benefits

- **Route optimization (time, fuel)**
- **Optimum altitudes**
- **Dynamic aircraft route planning**
- **More alternate airports**
- **Reduced contingency fuel**
- **Possible reduced crewing**
- **Increased aircraft utilization**
- **Greater payload capability**
- **Greater revenue generation**

State benefits

- **Improved level of service**
- **Consolidation of facilities**
- **Reduced maintenance costs**
- **Avoided capital costs**

Airports benefits

- Increased airports capacity
- Improved airside management
- Decrease in diversions in instrument meteorological conditions
- Enhanced revenues
- Happy passengers

Cost/Benefit studies ...

- **The study to address the following:**
 - **financial viability**
 - **implementation options**
(operational/technical/organizational)
- **Guidance material for Business case model for CNS/ATM is available on ICAONET**

Cost/Benefit studies

- **Measure of economic viability**
 - **Net present value (preferred option)**
 - **Cost-effective**
 - **Least cost**
 - **Snapshot**
 - **Utility value**
 - **Pay-off period**
- **Sensitivity analysis**
 - **Analysis to ensure wide fluctuations in changing data conditions are taken into account**
- **Validate the model using the best judgment**
(Refer to ICAO Circular 257 and Circular 278 for more information)

Who should perform cost/benefit studies?

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- A stylized world map in shades of gray serves as the background for the slide. The map shows the outlines of continents and major landmasses.
- **Global evaluation**
 - **States**
 - **Service providers**
 - **Users (aircraft operators)**

Funding...

➤ Sources of financing include:

- **Contribution from governments (national or foreign)**
- **Commercial sources (debt financing)**
- **Accumulated excess of revenues over costs (profits)**
- **Bonds**
- **Equity financing (share capital)**
- **Leasing**

Funding ...

- Investment recovery through the medium of user charges
- Revenues from airport and air navigation charges to be applied solely towards defraying the airport and air navigation facilities
- Financial institutions are encouraged to extend preferential funding through:
 - bilateral programmes
 - development banks

Funding

- Regional cooperation among service providers
- To consider funding options such as:
 - ICAO implementation mechanism
 - bilateral and multilateral cooperation programmes
 - international organizations
 - development banks

Cost Recovery

- **Cost allocation and cost recovery principles are set forth in ICAO Document 9082**
- **Methods of cost recovery**
 - **Direct collection from users**
 - **Joint charges collection agency**
 - **Delegation to external agency**

Organizational format for service providers of air navigation systems

Level	Type of Organization
National	Government department Autonomous public sector undertaking Private organization
Multinational/ Subregional/ Regional	Service provided by one government Service provided by group government Organization with own legal responsibility
Global	Service provided by one government Service provided by group government Organization with own legal responsibility

Approach to establishing CNS/ATM systems infrastructure ...

CNS/ATM Systems Elements	National Systems	Multinational/ Subregional/ Regional Systems	Global Systems
<i>COMMUNICATION</i>			
Ground/ground data and voice communication	X	X	
VHF data/voice	X		
HF data			X
AMSS data/voice			X
ATN	X	X	

Approach to establishing CNS/ATM systems infrastructure ...

CNS/ATM Systems Elements	National Systems	Multinational/ Subregional/ Regional Systems	Global Systems
NAVIGATION			
GPS/GLONASS/ GALILEO			X
GNSS Overlay			X
ABAS	X		
GBAS	X		
SBAS	X	X	

Approach to establishing CNS/ATM systems infrastructure ...

CNS/ATM Systems Elements	National Systems	Multinational/ Subregional/ Regional Systems	Global Systems
<i>SURVEILLANCE</i>			
SSR Mode A/C	X		
SSR Mode S	X		
ADS -C	X		
ADS-B	X		
Multilateration	X		

Approach to establishing CNS/ATM systems infrastructure

CNS/ATM Systems Elements	National Systems	Multinational/ Subregional/ Regional Systems	Global Systems
<i>Air Traffic Management</i>			
Airspace management	X	X	
Air traffic control	X	X	
Air traffic flow management	X	X	
Decision support systems	X		

Legal issues ...

- It has been generally agreed that there is no legal obstacle to the implementation of CNS/ATM systems and that there is nothing inherent in CNS/ATM systems that is inconsistent with the Chicago Convention

Legal issues

- It is generally concluded that:
 - GNSS shall be compatible with international law, including the Chicago Convention, its Annexes and the relevant rules applicable to outer space activities
 - the integrity of any legal framework for the implementation and operation of GNSS requires observance of fundamental principles, which should be established in a charter

Final decision by the A35 in October 2004
– A Practical Way Forward on Legal and Institutional Aspects of CNS/ATM Systems (A35-3)

- ***Reaffirms*** that there is no need to amend the Chicago Convention for the implementation of CNS/ATM systems;
- ***Invites*** Contracting States to consider using regional organizations to develop mechanisms necessary, that are consistent with the Chicago convention, to address any legal or institutional issues; and
- ***Directs*** the Secretary General to monitor and, where appropriate, assist in the development of contractual frameworks to which parties may accede.

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