Workshop on the Performance Enhancement of the ANS through the ICAO ASBU framework

Dakar, Senegal, 18-22 September 2017
presented by Emeric Osmont
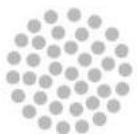
The Aviation Community
Indra

The Aviation Community

Driving Economic Recovery
Aviation's Global Impacts
Source: ATAG, ICAO

$2.4 trillion
Contributed to global GDP annually
(direct, indirect and induced, 2012)

3.3 billion
Passengers annually
(carried on scheduled traffic, 2014)

$6.4 trillion
Value of air cargo annually
(2012)

GANP 2016–2030

2017–2019 Strategic Objectives

A. **Safety**
   Enhance global civil aviation safety.

B. **Air Navigation Capacity and Efficiency**
   Increase capacity and improve efficiency
   of the global civil aviation system.

C. **Security and Facilitation**
   Enhance global civil aviation security and facilitation.

D. **Economic Development of Air Transport**
   Foster the development of a sound and economically-viable
   civil aviation system.

E. **Environmental Protection**
   Minimize the adverse environmental effects
   of civil aviation activities.

Air transport plays a major role in driving sustainable
economic and social development. It directly and indirectly
supports the employment of 58.1 million people,
contributes over $2.4 trillion to global Gross Domestic
Product (GDP), and carries over 3.3 billion passengers and
$6.4 trillion worth of cargo annually.

THE 2016–2030 GLOBAL AIR NAVIGATION PLAN

- **Obliges States to map their national or regional
  programmes against the harmonized GANP, but provides
  them with far greater certainty of investment.**

- **Requires active collaboration among States through the
  PIRGs in order to coordinate initiatives within applicable
  regional Air Navigation Plans.**

- **Provides required tools for States and regions to develop
  comprehensive business case analyses as they seek to
  realize their specific operational improvements.**

- **Provides a vision of the evolution of the Global ATM
  system and the potential requirements to industry, for
  better anticipation in its products.**

GANP 2016–2030

The 2016–2030 ICAO Global Air Navigation Plan
presents all States with a comprehensive planning tool
supporting a harmonized global Air Navigation system.
It identifies all potential performance improvements
available today, details the next generation of ground and
avionics technologies that will be deployed worldwide, and
provides the investment certainty needed for States and
Industry to make strategic decisions for their individual
planning purposes.

Source: GANP FifhEdition 2016

Indra

Global IT, Defense and Transport & Traffic company

€ 2.7 Bn
Sales 2016

Complete offering for
all industries

40,000
employees

R&D 6-8% of sales
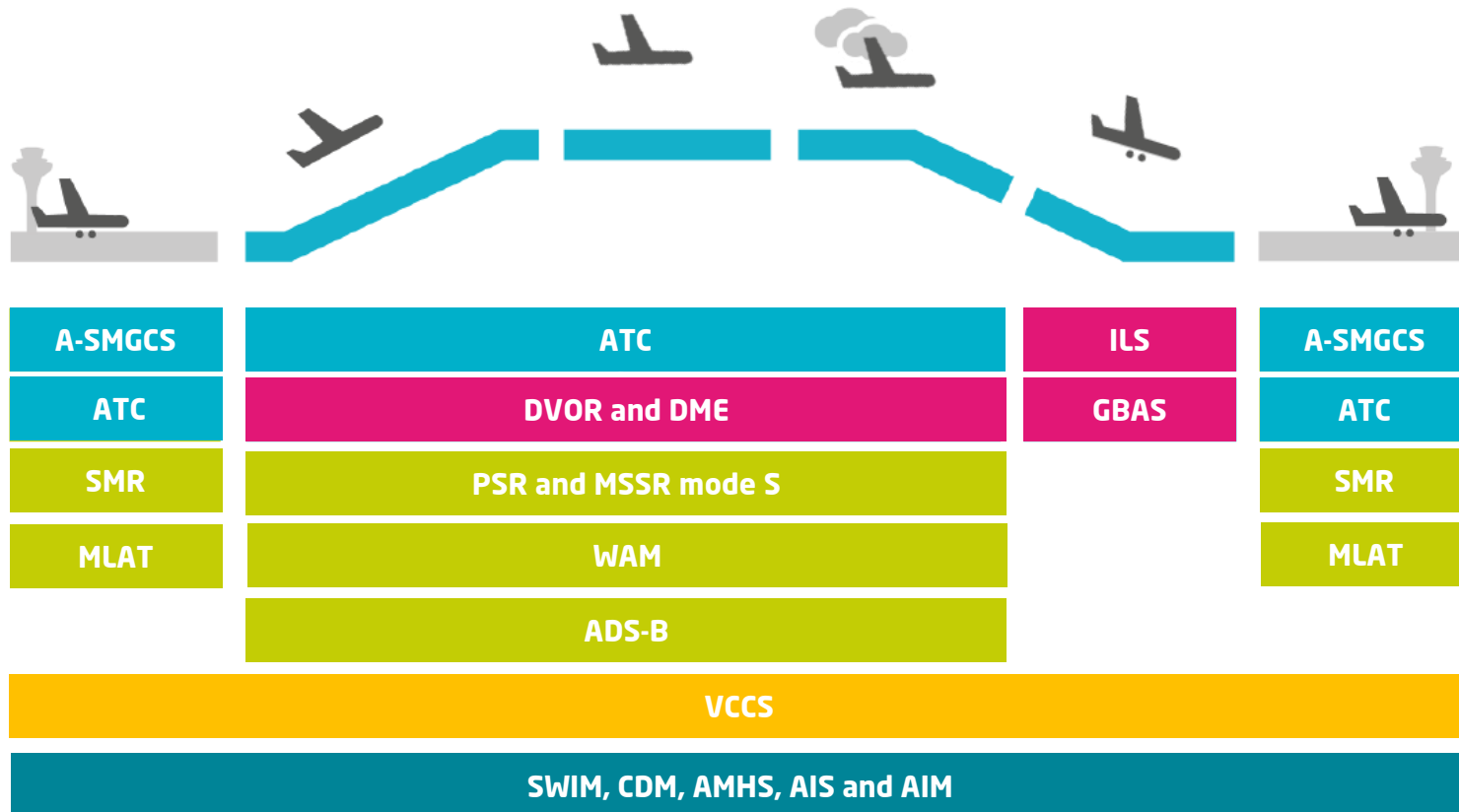+200 deals with research centres
and universities

Projects in
+160 countries

Leading clients
in key geographies and
industries

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CNS / ATM equipments for all flight phases

A-SMGCS	ATC		ILS	A-SMGCS
ATC	DVOR and DME		GBAS	ATC
SMR	PSR and MSSR mode S			SMR
MLAT	WAM			MLAT
	ADS-B			
VCCS				
SWIM, CDM, AMHS, AIS and AIM				

Indra

Committed to globally harmonized ATM

R&D Activities

Research and Innovation:
- Strong involvement in **SESAR**
- Cooperation **SESAR/NEXTGEN**
- Functional evolution
- **Technical:** open systems, interface standards, adv. middleware

Standards & Regulation

Indra contribution in:
- **EUROCAE/RTCA** working groups
- **Eurocontrol/EU** Programmes
- **ICAO/ASBU**

Indra

In all continents

Over **4,000** installations

In over **160** countries

COUNTRIES WITH INDRA'S ATM/CNS SYSTEMS

Date: 25 Jan 2017

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ASBU...WHERE ARE WE?

Indra and ASBU…where are we?

Indra complete **CNS ATM & Airports solutions** covers is included in most of ASBU modules

Indra ATM System already **meets Block 0** and is ready to **meet Block 1 no later than 2018**; whist Block 2 and Block 3 are in the **roadmap** for future implementations.

Performance Based navigation (**PBN**), Continuous Descent Operations (**CDO**), Continuous Climb Operations (**CCO**) and Air Traffic Flow Management (**ATFM**), including runway sequencing capabilities are part of the **core of our products** and in line with **ICAO GANP 2017-2019 Priorities**

Indra is a leading contributor to **SESAR**, iTEC and other global initiatives, where ASBU is followed

"Minimum path to global interoperability and safety":

B0-ACAS This Module is identified as N/A for an ATM System.

B0-APTA (Optimization of Approach Procedures including vertical guidance). This Module is covered by the current solution of Indra ATM System.
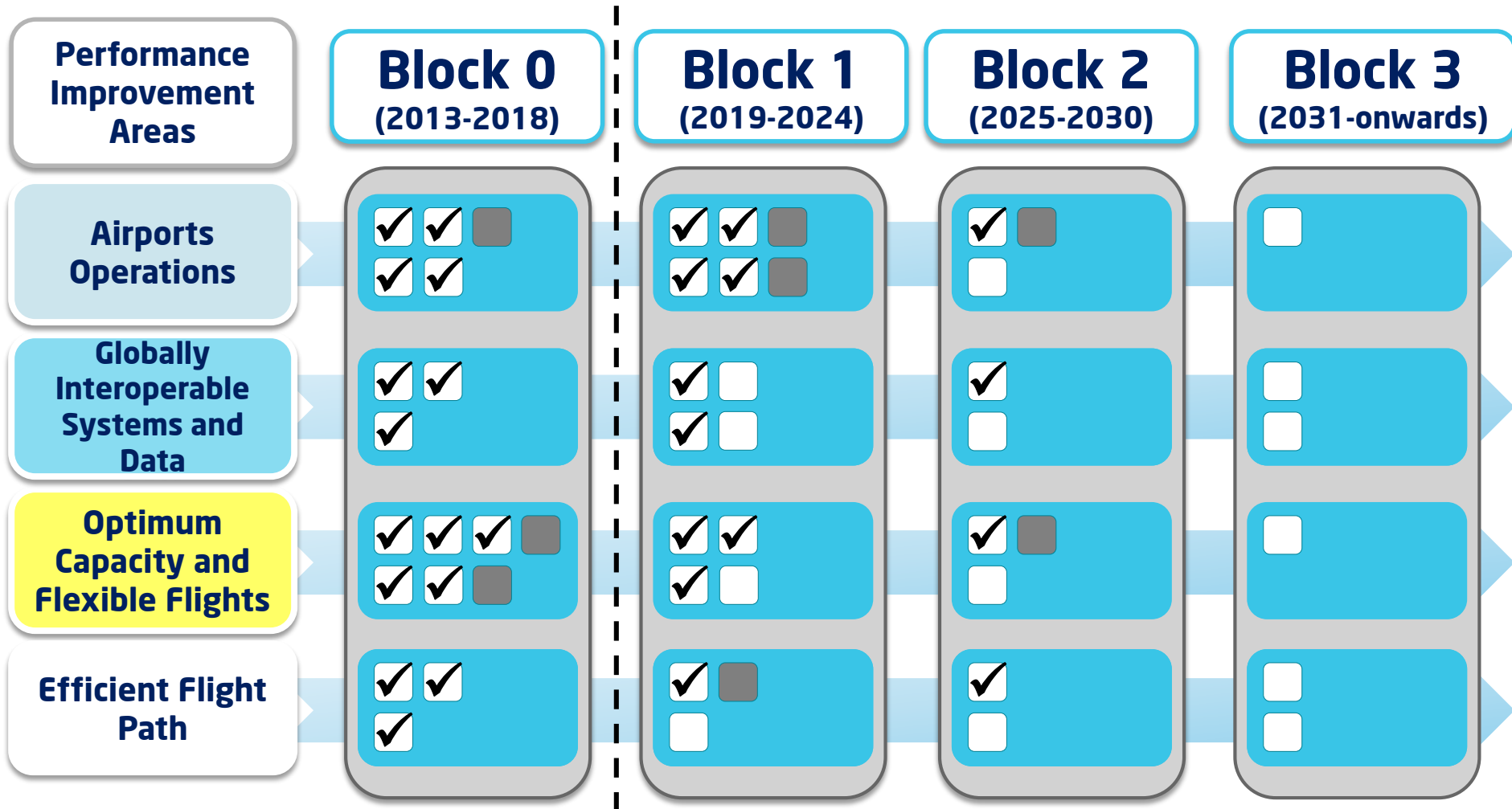
B0-DATM (Service Improvement through Digital Aeronautical Information Management) This Module is covered by the current solution of Indra ATM System.

B0-FICE (Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration) This Module is covered by the current solution of Indra ATM System.

B0-ASUR (ADS-B out and MLAT). This Module is covered by the current solution of Indra ATM System.

Three **Block 1 Modules (B1-FICE, B1-DATM, B1-SWIM)** are expected to be deployed worldwide in the coming years within the concept of "minimum path to global interoperability and safety". Harmonization and interoperability constraints should make them essential, becoming the foundations of the future ATM system. **All these three Modules are covered by the current solution of Indra ATM System.**

Indra ATM (ACC APP TWR) system alignment with ASBUs

Performance Improvement Areas	Block 0 (2013-2018)	Block 1 (2019-2024)	Block 2 (2025-2030)	Block 3 (2031-onwards)
Airports Operations	☑ ☑ ■ / ☑ ☑	☑ ☑ ■ / ☑ ☑ ■	☑ ■ / ☐	☐
Globally Interoperable Systems and Data	☑ ☑ / ☑	☑ ☐ / ☑ ☐	☑ / ☐	☐ / ☐
Optimum Capacity and Flexible Flights	☑ ☑ ☑ ■ / ☑ ☑ ■	☑ ☑ / ☑ ☐	☑ ■ / ☐	☐
Efficient Flight Path	☑ ☑ / ☑	☑ ■ / ☐	☑ / ☐	☐

Legend:
- ☑ Already Implemented
- ☐ In roadmap
- ■ Not applicable

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Indra ATM (ACC APP TWR) system alignment with ASBUs

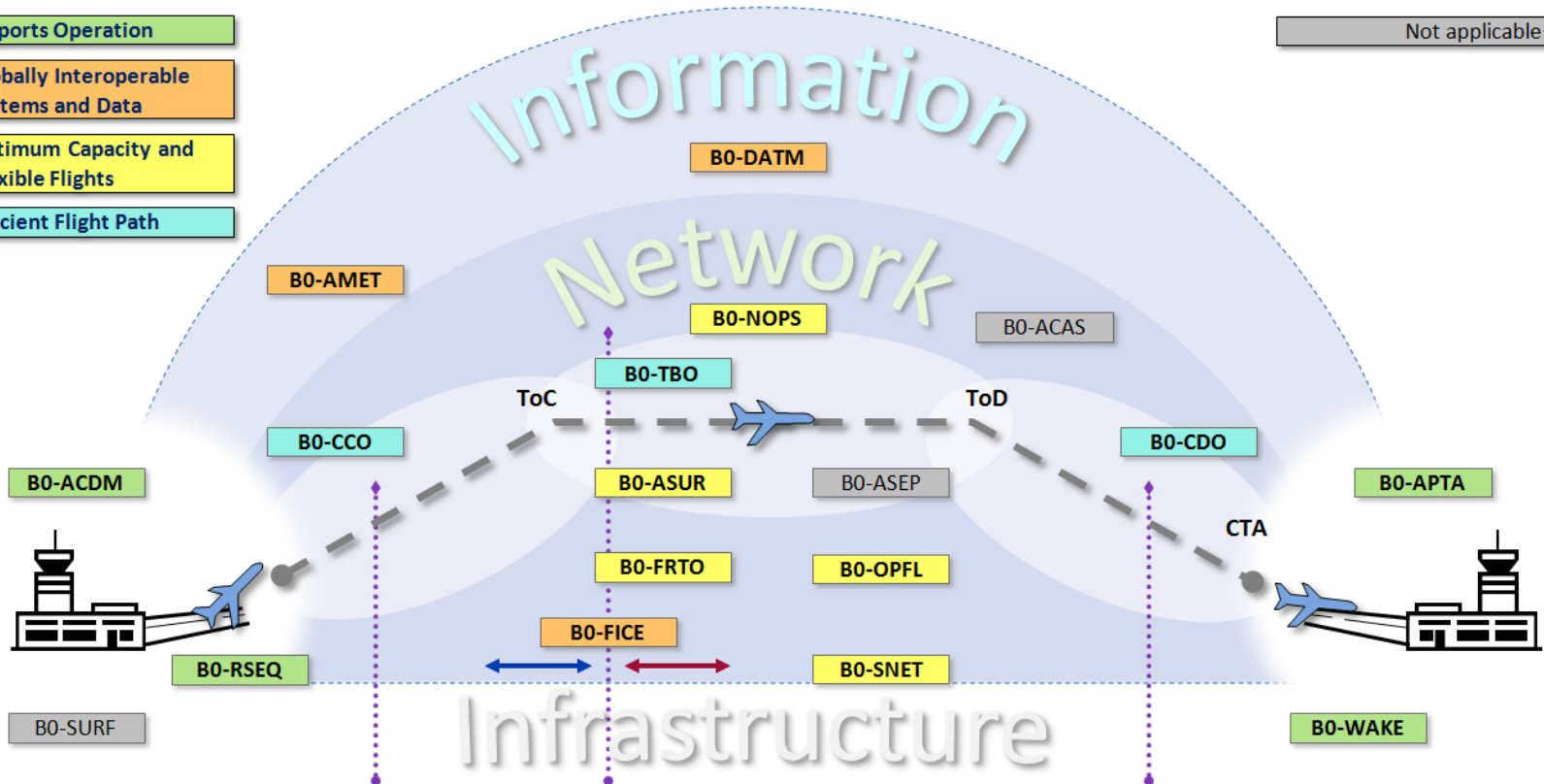Block 0 in perspective

Performance Improvement Areas

- Airports Operation
- Globally Interoperable Systems and Data
- Optimum Capacity and Flexible Flights
- Efficient Flight Path

Not applicable

Information

Network

Infrastructure

B0-DATM

B0-AMET

B0-NOPS

B0-ACAS

B0-TBO

ToC

ToD

B0-CCO

B0-CDO

B0-ACDM

B0-ASUR

B0-ASEP

B0-APTA

CTA

B0-FRTO

B0-OPFL

B0-FICE

B0-RSEQ

B0-SNET

B0-SURF

B0-WAKE

2017 INDRA Implemented ASBU Block 0 Modules: **15/15 (100%)**

Indra ATM (ACC APP TWR) system alignment with ASBUs

Block 1 in perspective

Performance Improvement Areas

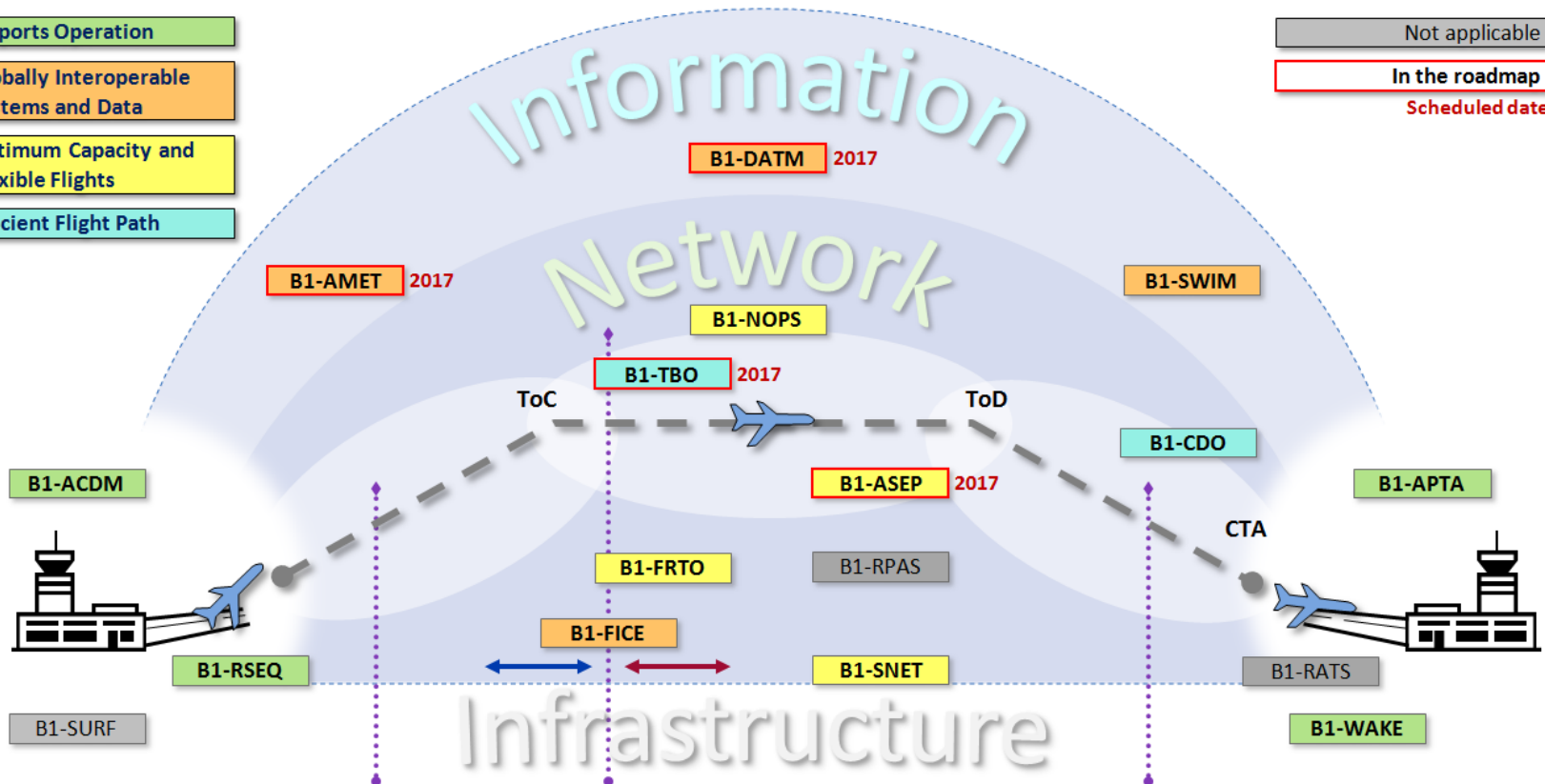- Airports Operation
- Globally Interoperable Systems and Data
- Optimum Capacity and Flexible Flights
- Efficient Flight Path

Not applicable

In the roadmap

Scheduled date

B1-DATM 2017

B1-AMET 2017

B1-SWIM

B1-NOPS

B1-TBO 2017

ToC

ToD

B1-CDO

B1-ACDM

B1-ASEP 2017

B1-APTA

CTA

B1-FRTO

B1-RPAS

B1-FICE

B1-RSEQ

B1-SNET

B1-RATS

B1-SURF

B1-WAKE

2017 INDRA Implemented ASBU Block 1 Modules: **10/14 (71%)**
2019 INDRA Implemented ASBU Block 1 Modules: **14/14 (100%)**

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Indra ATM (ACC APP TWR) system alignment with ASBUs

Block 2 in perspective

Performance Improvement Areas

- Airports Operation
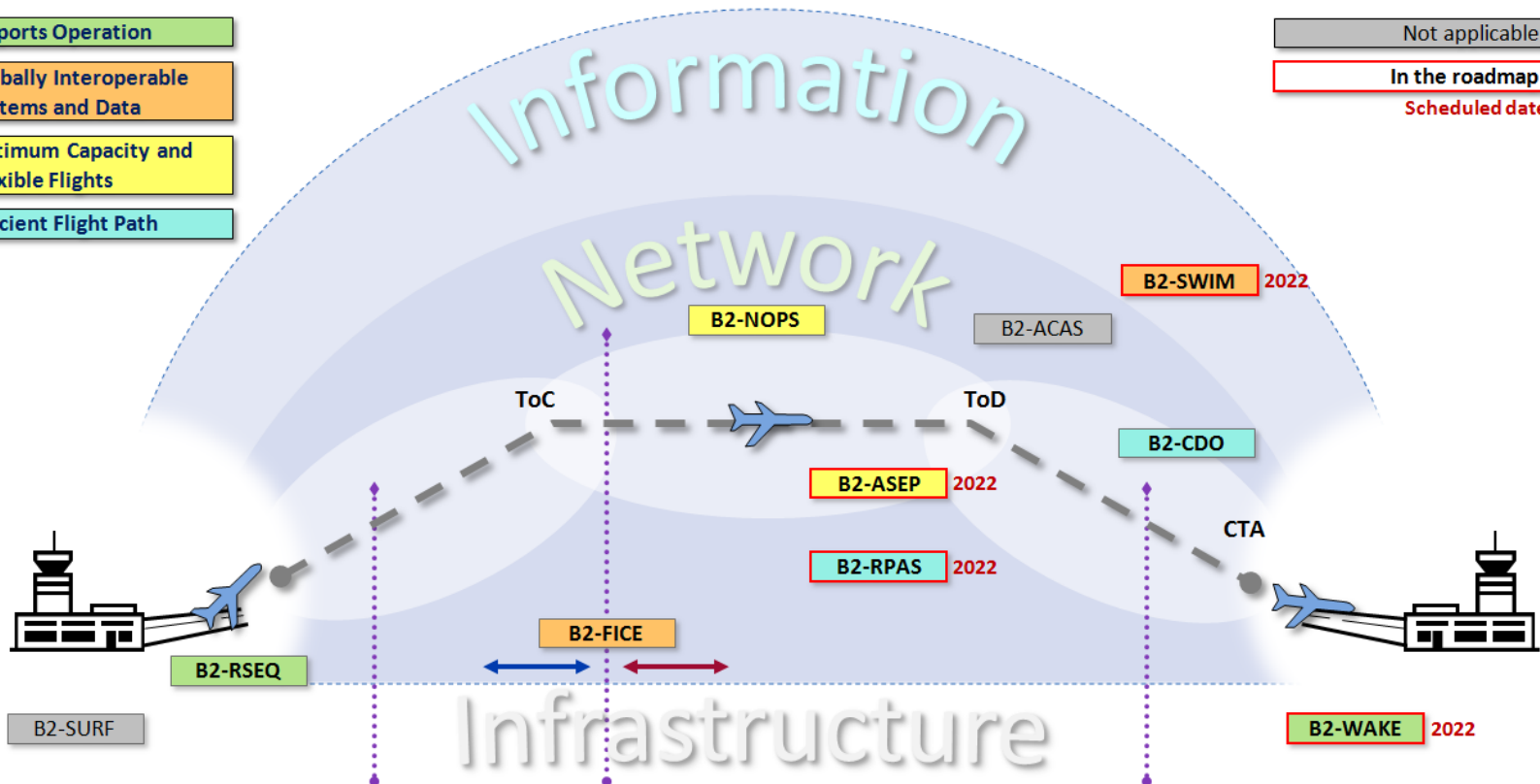- Globally Interoperable Systems and Data
- Optimum Capacity and Flexible Flights
- Efficient Flight Path

Not applicable
In the roadmap
Scheduled date

Information

Network

Infrastructure

B2-SWIM 2022
B2-NOPS
B2-ACAS
ToC
ToD
B2-CDO
B2-ASEP 2022
CTA
B2-RPAS 2022
B2-FICE
B2-RSEQ
B2-SURF
B2-WAKE 2022

2017 INDRA Implemented ASBU Block 2 Modules: **4/8 (50%)**
2025 INDRA Implemented ASBU Block 2 Modules: **8/8 (100%)**

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| 13

Indra ATM (ACC APP TWR) system alignment with ASBUs

Block 3 in perspective

Performance Improvement Areas

- Airports Operation
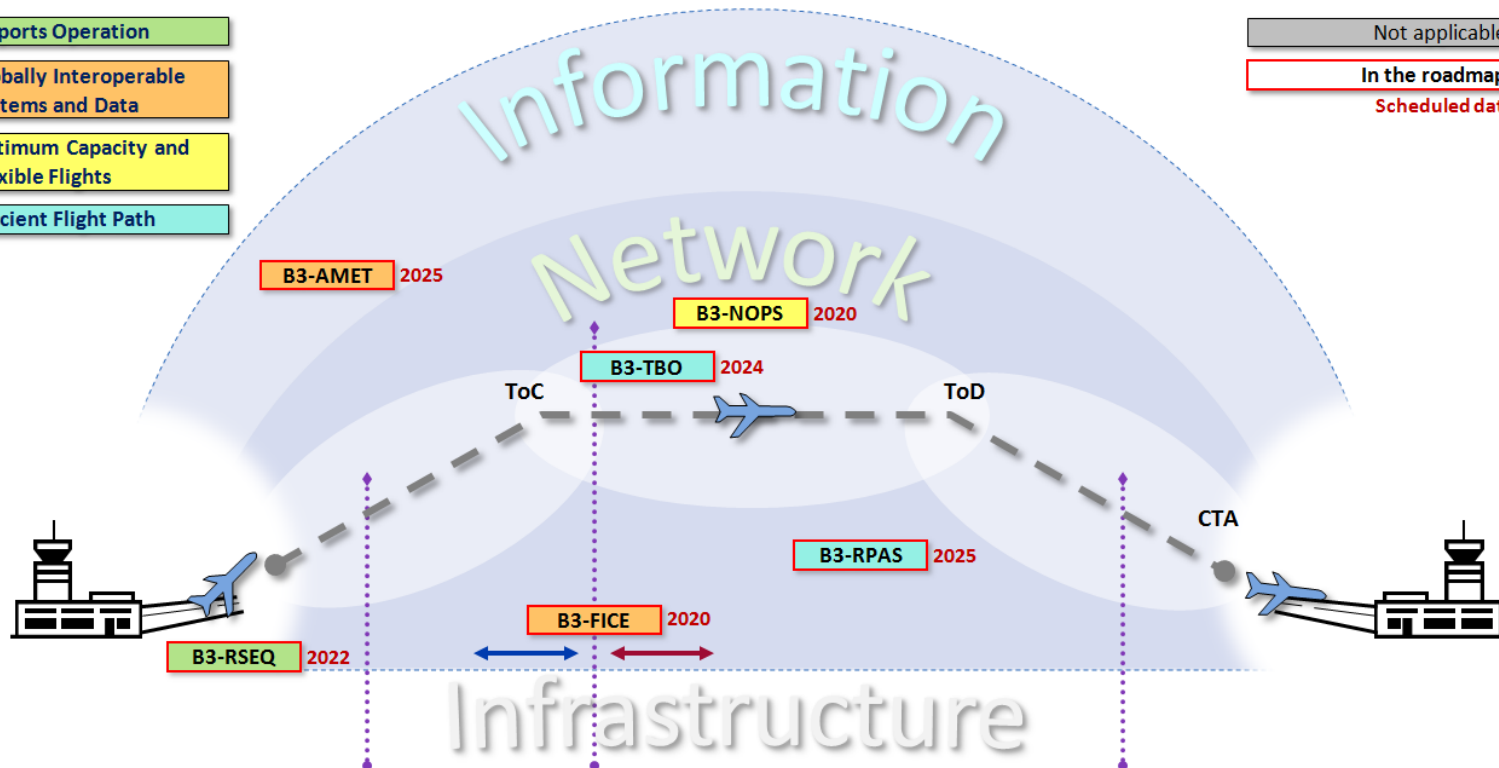- Globally Interoperable Systems and Data
- Optimum Capacity and Flexible Flights
- Efficient Flight Path

Not applicable
In the roadmap
Scheduled date

Information

Network

B3-AMET 2025

B3-NOPS 2020

B3-TBO 2024

ToC

ToD

CTA

B3-RPAS 2025

B3-FICE 2020

B3-RSEQ 2022

Infrastructure

2017 INDRA Implemented ASBU Block 3 Modules: **0/6 (0%)**
2031 INDRA Implemented ASBU Block 3 Modules: **6/6 (100%)**

Indra ATM (ACC APP TWR) system alignment with ASBUs

Performance Improvement Areas (PIA)	Thread	Block 0 2013-2018 01-17	Block 1 2019-2024	Block 2 2025-2030	Block 3 2031+
PIA 1: Airport Operations	Airport Accessibility (APTA)	B0-APTA	B1-APTA		
	Wake Turbulence Separation (WAKE)	B0-WAKE	B1-WAKE	B2-WAKE	
	Runway Sequencing (RSEQ)	B0-RSEQ	B1-RSEQ	B2-RSEQ	B3-RSEQ
	Surface Operations (SURF)	N/A	N/A	N/A	
	Airport Collaborative Decision Making (ACDM)	B0-ACDM	B1-ACDM		
	Remote Air Traffic services (RATS)		N/A		
PIA 2: Globally Interoperable Systems and Data	Flight and Flow Information FF/ICE (FICE)	B0-FICE	B1-FICE	B2-FICE	B3-FICE
	Digital Air Traffic Management (DATM)	B0-DATM	B1-DATM		
	System Wide Information Management (SWIM)		B1-SWIM	B2-SWIM	
	Advanced Meteorological Information (AMET)	B0-AMET	B1-AMET		B3-AMET
PIA3: Optimum Capacity and Flexible Flights	Free-Route Operations (FRTO)	B0-FRTO	B1-FRTO		
	Network Operations (NOPS)	B0-NOPS	B1-NOPS	B2-NOPS	B3-NOPS
	Alternative Surveillance (ASUR)	B0-ASUR			
	Airborne Separation (ASEP)	N/A	B1-ASEP	B2-ASEP	
	Optimum Flight Levels (OPFL)	B0-OPFL			
	Airborne Collision Avoidance Systems (ACAS)	N/A		N/A	
	Safety Nets (SNET)	B0-SNET	B1-SNET		
PIA 4: Efficient Flight Path	Continuous Descent Operations (CDO)	B0-CDO	B1-CDO	B2-CDO	
	Trajectory-Based Operations (TBO)	B0-TBO	B1-TBO		B3-TBO
	Continuous Climb Operations (CCO)	B0-CCO			
	Remotely Piloted Aircraft Systems (RPAS)		N/A	B2-RPAS	B3-RPAS
Applicable ASBU Modules to ATM System		15	14	8	6
Implemented ASBU Modules at January 2017		15 (100%)	10 (71%)	4 (50%)	0 (0%)
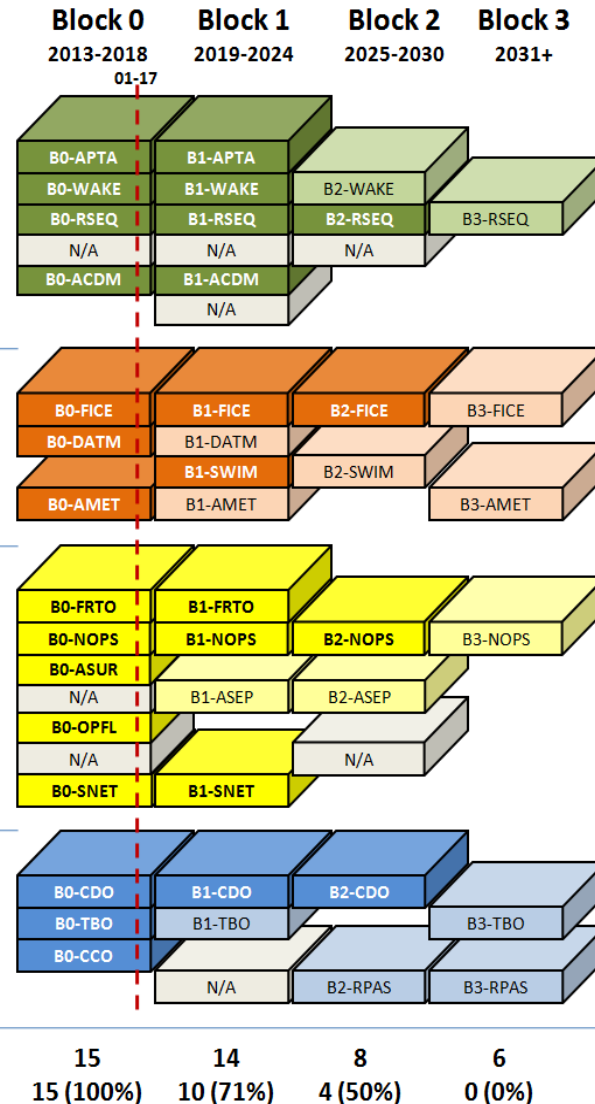
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Indra Avitech (AMHS AIS AIM) alignment with ASBUs

Block 0   2013 - 2018

Airport Operations

		Avitech				
B0-APTA	Optimization of Approach Procedures including vertical guidance	AIM	ATM			
B0-SURF	Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2)	AIM				
B0-ACDM	Improved Airport Operations through Airport-CDM	AIM	ATM	MET	MHS	SWIM

Globally Interoperable Systems and Data

B0-FICE	Increased Interoperability, Efficiency and Capacity though Ground-Ground-Integration	ATM	SWIM	
B0-DAIM	Service Improvement through Digital Aeronautical Information Management	AIM	SWIM	
B0-AMET	Meteorological information supporting enhanced operational efficiency and safety	ATM	MET	SWIM

Efficient Flight Paths

B0-CDO	Improved Flexibility and Efficiency in Descent Profiles (CDOs)	AIM	ATM
B0-CCO	Improved Flexibility and Efficiency in Departure Profiles - Continuous Climb Operations (CCOs)	AIM	ATM

Block 1   2019 - 2024

Airport Operations

B1-APTA	Optimized Airport Accessibility	AIM	ATM			
B1-SURF	Enhanced Safety and Efficiency of Surface Operations - SURF, SURF IA and Enhanced Vision Systems (EVS)	AIM				
B1-ACDM	Optimized Airport Operations through Airport-CDM	AIM	ATM	MET	MHS	SWIM
B1-RATS	Remotely Operated Aerodrome Control	ATM				

Globally Interoperable Systems and Data

B1-FICE	Increased Interoperability, Efficiency and Capacity though FF-ICE, Step 1 application before Departure	ATM	SWIM	
B1-DATM	Service Improvement through Integration of all Digital ATM Information	AIM	SWIM	
B1-SWIM	Performance Improvement through the application of System Wide Information Management (SWIM)	SWIM		
B1-AMET	Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-Term Service)	MET	SWIM	

Efficient Flight Paths

B1-CDO	Improved Flexibility and Efficiency in Descent Profiles (CDOs) using VNAV	AIM	ATM		
B1-RPAS	Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace	AIM	ATM	MET	SWIM

Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar

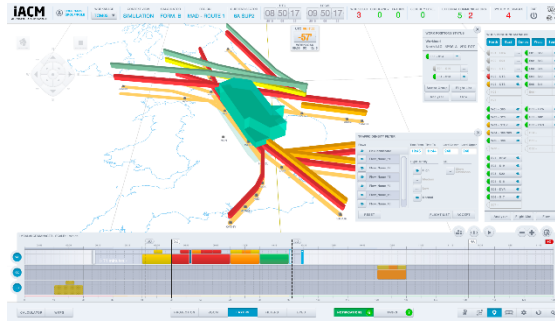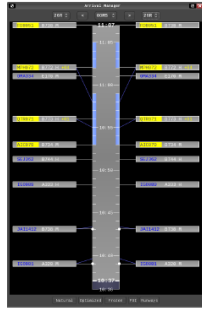**ASECNA OPERATING THE FIRST PAN AFRICAN AMHS LINK USING INDRA'S TECHNOLOGY**

ASECNA countries and operational AMHS link between Togo and Benin
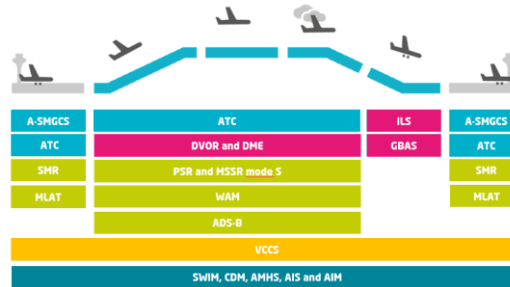
Indra CNS ATM roadmap in line with ASBU

AMAN DMAN, 2017-19
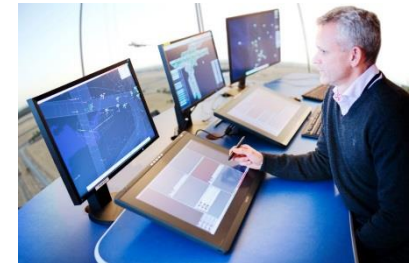**GANP priority**

iACM ATFM, 2017-19
GANP priority
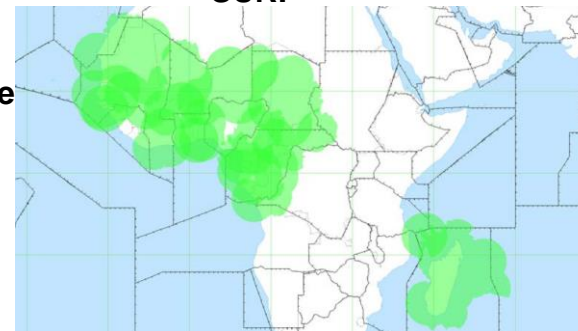
reddot design award
best of the best 2016

A-SMGCS	ATC	ILS	A-SMGCS
ATC	DVOR and DME	GBAS	ATC
SMR	PSR and MSSR mode S		SMR
MLAT	WAM		MLAT
	ADS-B		
	VCCS		
	SWIM, CDM, AMHS, AIS and AIM		

GBAS,
thread APTA

ASMGCS, thread
SURF

ADS-B   WAM   MLAT, thre
ASUR, OPFL

Agence pour la Sécurité de la Navigation
Aérienne en Afrique et à Madagascar

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ASBU and regional programs: SESAR

Single European Sky

The costs of **fragmentation** of European airspace have been estimated at **€4 bn pa**.

To save costs and meet growing capacity demand, **ATM systems** must become **interoperable** and **methods of operation** across Europe must become **aligned**.

In addition, a **unified European airspace structure** would allow for more efficient flights across the European sky.

The European Union **Single European Sky** Programme aims to enable this.

	US	EU
Airspace (millions of km2)	10.4	11.5
Flights (IFR, in millions)	15.9	9.5
Service Providers (en route)	1	38
Area Control Centres	20	63
Air traffic controllers	14.6	16.7
Flights per controller	1089	569
Share of **departure delays** > 15 min. due to **en route constraints**	0.1%	5.7%

Source: EUROCONTROL & FAA Study March 2012, Figures 2010

Single European Sky high level goals

✈ A **27%** increase in Europe's airspace capacity

✈ A **40%** reduction in accident risk per flight hour - corresponding to the safety need associated with the anticipated traffic growth

✈ A **2.8%** reduction per flight in environmental impact;

✈ A **6%** reduction in cost per flight.

Source: SESAR European Master Plan 2012

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SESAR: Single European Sky ATM Research

SESAR is the European R&D programme which enables the realisation of the Single European Sky.

SESAR will drive improvements to the procedures and technologies being used by all stakeholders in order to **increase capacity** and **safety**, and **reduce environmental impact** and **flight costs**.

Benefits

- **Increase** airspace **capacity** using **trajectory-based operations**.

- **Increase safety** with enhanced conflict, detection and resolution tools.

- A **reduction** in aircraft **emissions** and **fuel costs** by optimising aircraft trajectories.

- **Optimisation** of staff resources and an increase in productivity.

- Improved **interoperability** between systems and **reduced operational costs**.

Indra within SESAR1

SESAR Definition Phase (2005-2008)	SESAR Development Phase (2008 – 2016+)	SESAR Deployment Phase (2013/14 - 2020+)

Indra has been a **key member** of SESAR since the definition phase as an integral European Ground Industry Manufacturer.

Indra participates in a third of all SESAR projects, playing a **leading role** in 28.

Indra contributed **€140M investment** to the Development Phase in SESAR 1

Indra contributed actively to the definition of the **European ATM Master Plan**, which defines SESAR's targets and objectives.

ATM **concepts** and **architectural** frameworks developed within SESAR are **incorporated** into Indra iTEC and other products.

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Indra within SESAR 2020

| SESAR 1 (2008-2016) | SESAR 2020 Wave 1 (2017 - 2019) | SESAR 2020 Wave 2 (2019-2021) |

Indra is willing to continue as a **key member** in SESAR 2020 Programme as an integral European Ground Industry Manufacturer.

Indra has bid to participate in 26 of the 28 SESAR 2020 Industrial Research and Very Large-scale Demonstrations projects, playing a **leading role** in 2 of them.

Indra is aiming to contribute over **€60M** to the SESAR 2020 Programme, being 60% of this budget allocated to the ATC domain

Key ANPSs being partners of Indra for S2020 Solutions validations in the ATC domain are DFS, ECTRL-MUAC, ENAIRE, NATS, ON, PANSA

Indra's main contribution to the SESAR Solutions

In the areas of **Advanced air traffic services**, **Optimised ATM network services** and **Enabling aviation infrastructure**

- Interoperability Ground-Ground
- 4D trajectory Management System
- Complexity Management Tools
- Queue Management Tools
- Airport Planning
- CWP/HMI
- Tower/Remote Tower
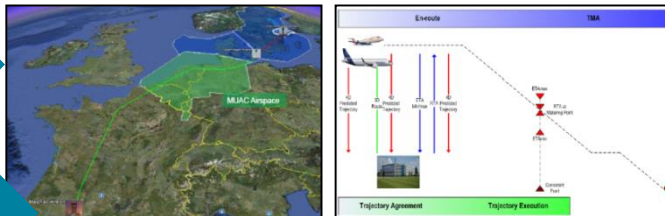
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Indra's main contribution to the SESAR Solutions –iTEC based

Automated assistance to controller for seamless coordination, transfer and dialogue through improved trajectory data sharing

Arrival Management (AMAN) and Point Merge

System Wide Information Management (SWIM)

Medium term conflict detection (MTCD) and conformance monitor tools

Advanced Short ATFCM Measures (STAM)

Extended Arrival Management (AMAN) horizon

Arrival management into multiple airports

Optimised route network using advanced RNP

Variable profile military reserved areas and enhanced (further automated) civil-military collaboration

Automated support for traffic complexity detection and resolution

SESAR Solutions are mapped to ICAO ASBU
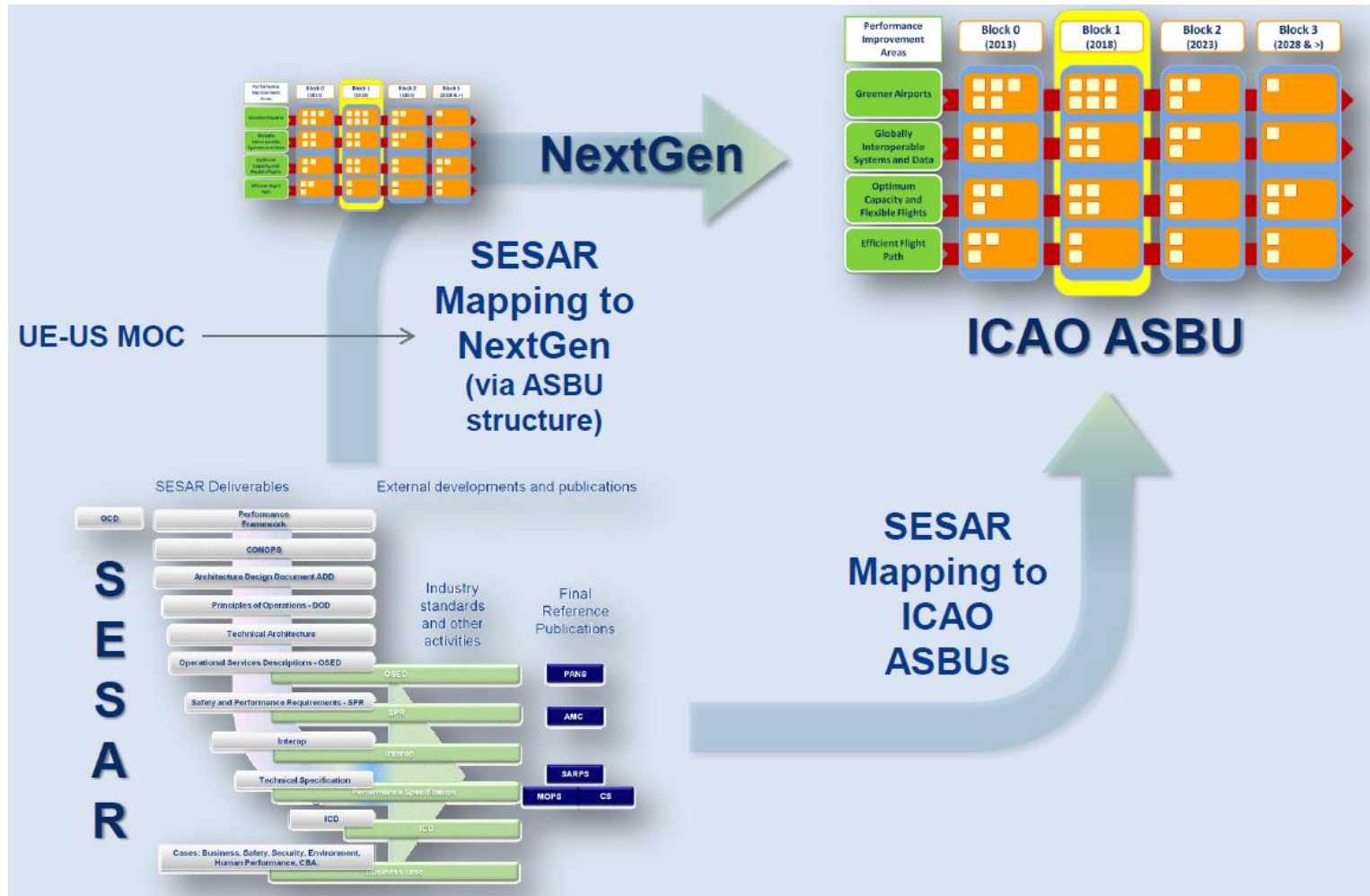
SESAR Solutions are mapped to ICAO ASBU:
ICAO Module ←→ SESAR Operational change
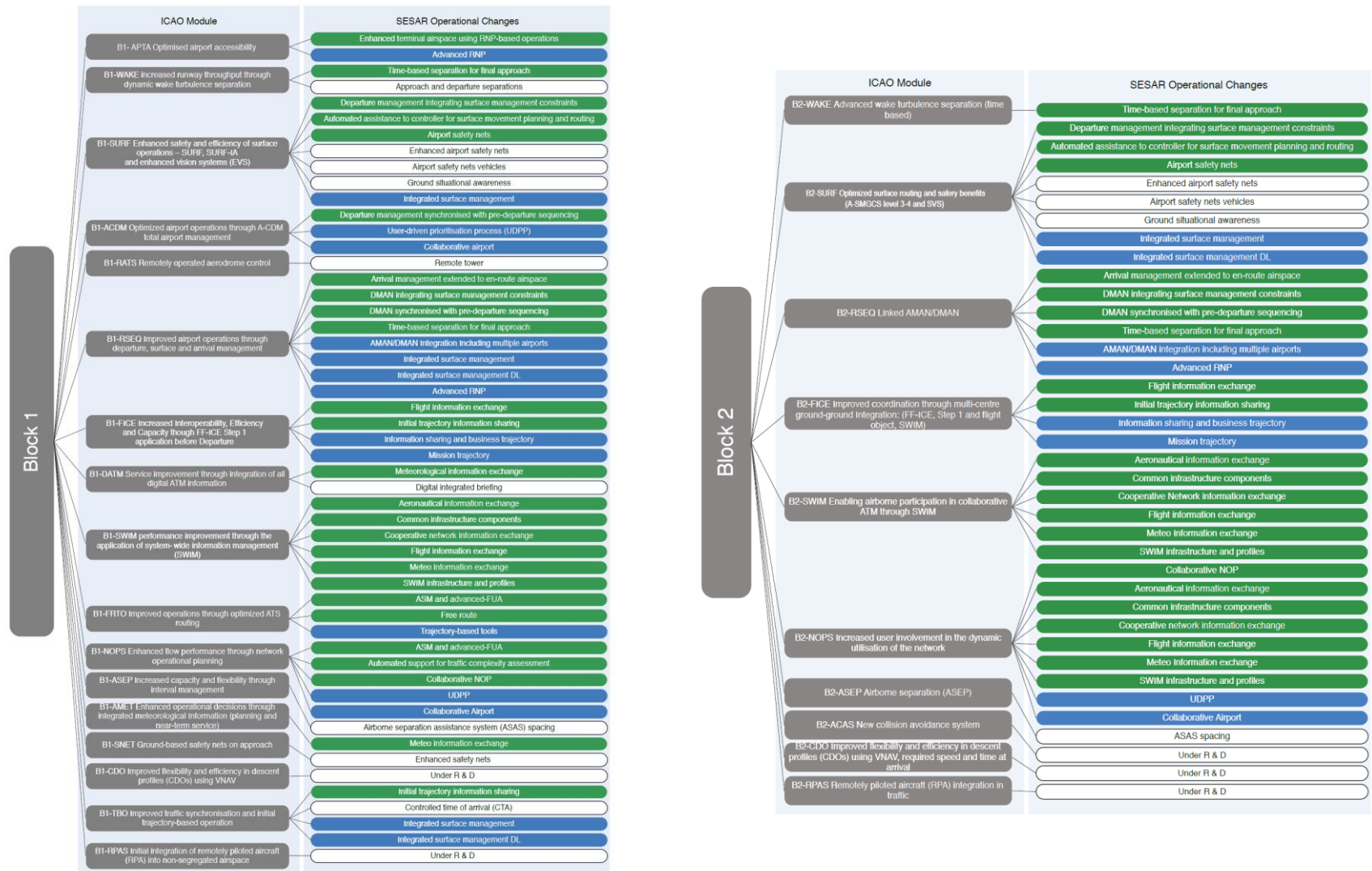
Indra supports ICAO Aviation System Block Upgrades (ASBU) global interoperability through SESAR Programme

Global Cooperation & Interoperability

Standards built on SESAR and NextGen developments will support harmonised Implementation and Regulation

Global consensus to ensure world-wide interoperability.

Industry Standards

ICAO

SESAR

NextGen

EC/FAA Coordination

Programme level coordination enhanced by interoperability and wider industry buy-in.

Development of a common avionics roadmap is a priority for SESAR

ASBU and regional programs: iTEC

iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC: Interoperability Through European Collaboration

International Collaboration

iTEC is an ATM system collaboratively developed by ENAIRE, NATS and DFS as founding members, with LVNL as part of DFS System Group and Indra as technological partner and supplier.

iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC: Interoperability Through European Collaboration

An expanding collaboration

Reduction in operational expenditure and implementation risks

Improvements in safety, training and transition

Interoperability

Current partners: Spain, Germany, Netherlands, UK

Potential partners: Norway, Poland, Lithuania
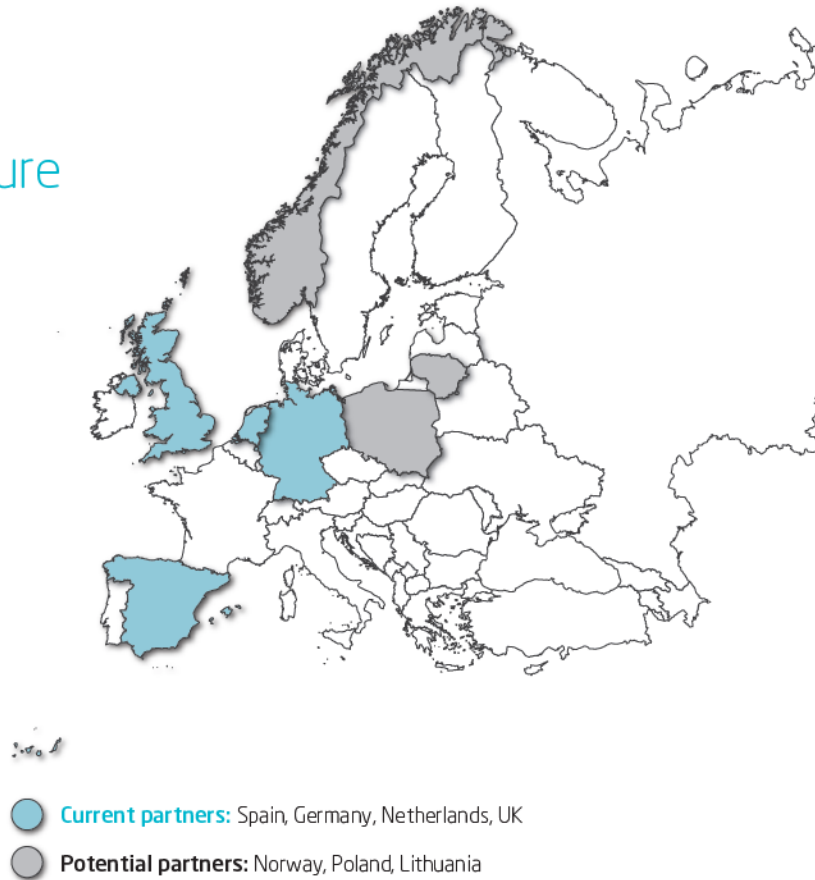
iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC Suite

Supporting future ATM operations

iTEC Suite is an advanced **4D trajectory-based** ATM system that enables conflict detection, flight path monitoring and stripless operations, fully aligned with SESAR principles...

...and ICAO Aviation System Blocks Upgrades (ASBUs) definition and evolution strategy.

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iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC Suite

Guaranteeing iTEC Suite evolution

→ Having a roadmap aligned with the SESAR functionality roadmap and Pilot Common Project (PCP) ATM functionalities (AFs).

→ Driven by the requirements of four very demanding ANSP, whilst sharing the development costs of such evolution.

→ Meets the conditions to call for INEA funds for the deployment of the iTEC Suite.

iTEC Roadmap

AF3 → 2021
AF4 → 2022
AF1 AF2 → 2023
AF5 AF6 → 2024

2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025

iTEC

iTEC version 1

iTEC version 2.1

iTEC version 2.5

iTEC version 3
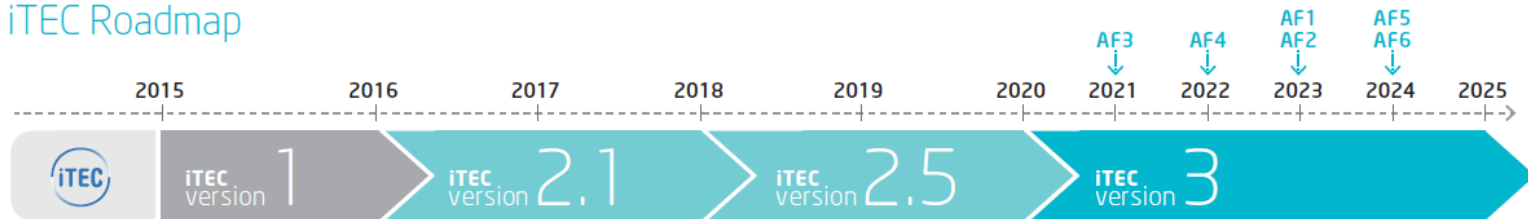
FUNCTIONALITIES

iTEC V1:
4D Trajectory Based Operations

- AF1. Extended AMAN
- AF2. A-CDM
- AF2. A-SMGCS
- AF2. Airport Safety Nets
- AF3. Dynamic Sect. and Advanced FUA
- AF3. FRA and DCT
- AF3. MTCD and CMON
- AF3. Civil/Military coordination
- AF5. FMTP, AMHS, METAR/GRIB2
- AF6. AGDL (FANS1A & ATN)

iTEC V2.1 & V2.5:
Full support to Upper and Lower Airspace.
Provision of advanced separation management tools for Planning and Tactical Control

- AF1. Enhanced TMA using RNP
- AF2. Integrated AMAN/DMAN
- AF2. TBS
- AF3. Tactical Trajectory and Risk Modules
- AF3. LARA ltf
- AF3. Dynamic FRA
- AF3. Contingency sectors
- AF4. Complexity Manager
- AF5. Flight service FIXM
- AF6. ADS-C tracks

iTEC V3:
Full support to IOP, SWIM and i4D

- AF3. NOP ltf
- AF4. Collaborative NOP
- AF4. ADS-C EPP trajectory
- AF5. SWIM full (FIXM, AIXM, WXXM)
- AF6. i4D
- AF6. IOP (ATC-ATC and ATC-NM)

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iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC Suite

Centers

3.000.000 km² of airspace covered

4 million flights p.a. controlled by the end of 2015

To be deployed in 12 centers located throughout Europe before 2020

Prestwick
Bremen
Amsterdam
Swanwick
Langen
Karlsruhe
Munich
Barcelona
Madrid
Mallorca
Seville
Canary Islands

iTEC Suite: the most advanced, safe and reliable ATM system available today

iTEC Suite

Centers - Operational facts (since December 2010)

ACHIEVED BENEFITS

466 direct routes
(46% available 24 hours a day)

Average deviation from shortest route of **1.7%**, significantly lower than the 4.65% EU requirement

More than **1.5 million flights** managed **each year**

More than **5200 flights** managed **during peaks days**

11% increase in **capacity** during its first year of operation

EXPECTED BENEFITS

Capacity growth of **5%** to **7%** annually

YEARLY SAVING

1.5 million nautical miles

9000 tonnes of **fuel**

30000 tonnes of CO_2

* Data posted on DFS press releases from January, 2012 and December, 2014.

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2017-2019 GANP priority: ATFM and iACM

ATFM TOOLS ARE THE FUTURE

Our Priorities

ICAO will focus its efforts over the next three years on the development and implementation of performance-based navigation (PBN), continuous descent operations (CDO), continuous climb operations (CCO) and air traffic flow management (ATFM), including runway sequencing capabilities (AMAN/DMAN).

Source: GANP FifhEdition 2016

ASBUs

Performance Improvement Area 3: Optimum capacity and flexible flights – *through global collaborative ATM*

Thread: Network operations (NOPS)

ATFM tools increase...

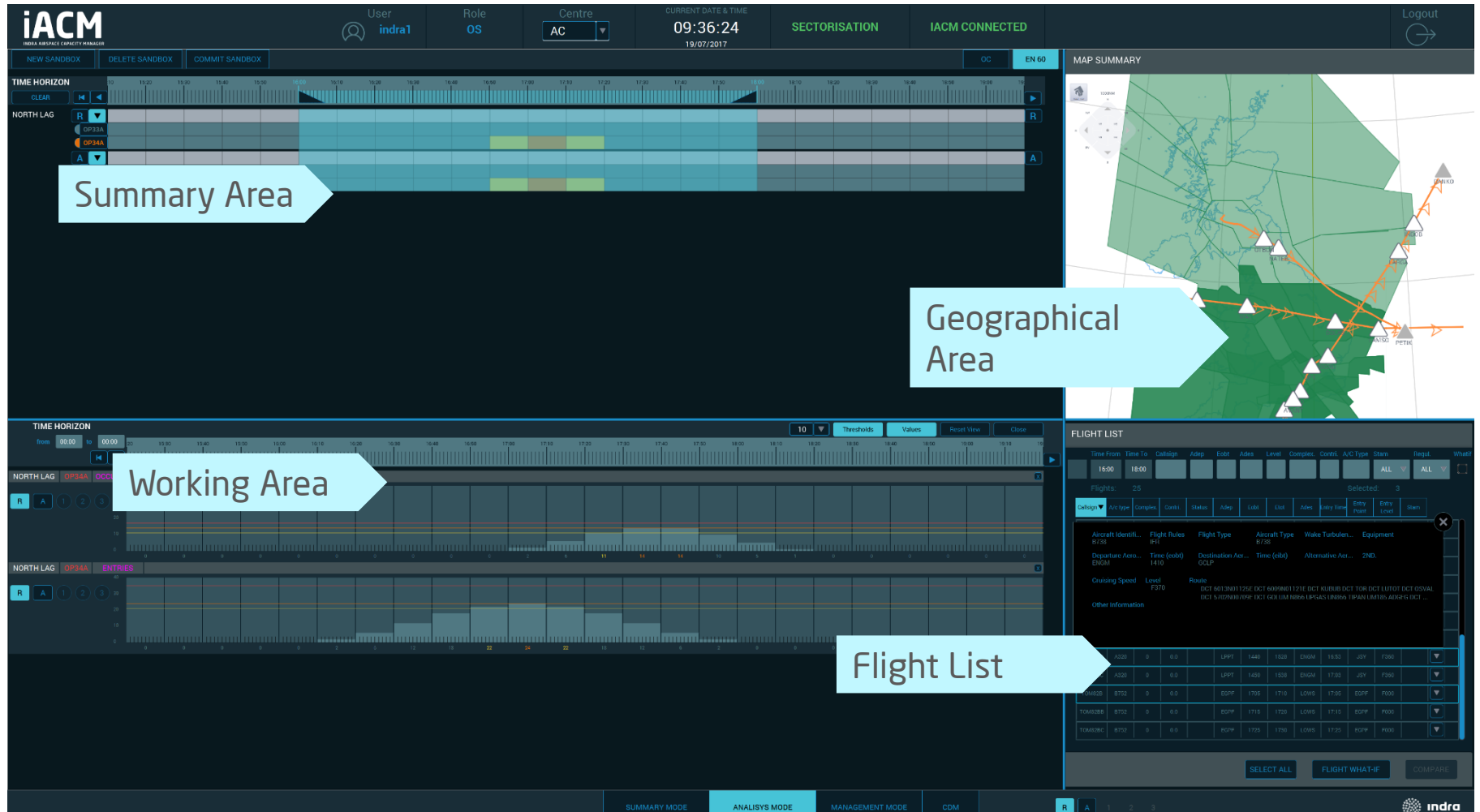| Safety	Efficiency and Delays Reduction	Cost-Efectiveness	Environmental Sustainability

INDRA'S AIRSPACE CAPACITY MANAGER (iACM)

Indra's Airspace Capacity Manager helps ANSPs to strategically adapt demand and capacity enabling ANSPs to optimize operational and environmental performances

INDRA'S AIRSPACE CAPACITY MANAGER (iACM)

INDRA'S AIRSPACE CAPACITY MANAGER (iACM)

The information comes from different sources:
- Historical Data
- Operational FDP
- SUA Schedule

Roles

Regional   ACC   Sector

Controllers workload depending on:
- Traffic
- Planned sectorization
- Complexity of traffic
- Conflicts between flights

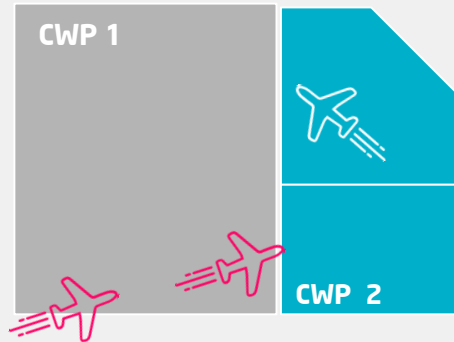## Key Performance Indicators (KPIs)
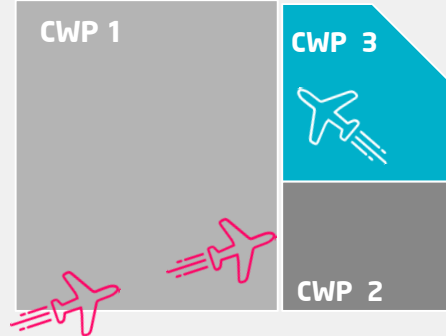
Workload   Occupancy   Entry   Business   Environment

INDRA'S AIRSPACE CAPACITY MANAGER (iACM)
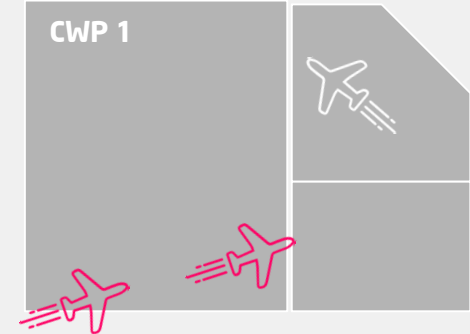
Tactical Phase - Sandboxes

Reality   Copy 1   Copy 2

- Copies of reality that can be manipulated

- Try actions on Demand and Capacity and inspect results

- Same metrics and KPIs as in real context

- Graphics will simultaneously display real and what-if situation

- Several sandboxes in parallel

INDRA'S AIRSPACE CAPACITY MANAGER (iACM)

2017   2018   2019

iACM supports horizons of years

Long/Mid term ACC operations are managed by an Operations Plan:

CWP 1   CWP 2
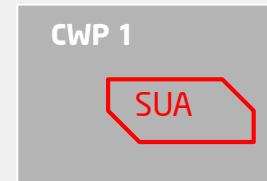00:00-06:00

CWP 1   CWP 3   CWP 2
06:00-13:00

CWP 1   SUA

•Sequence of sectors configurations

•Major Events

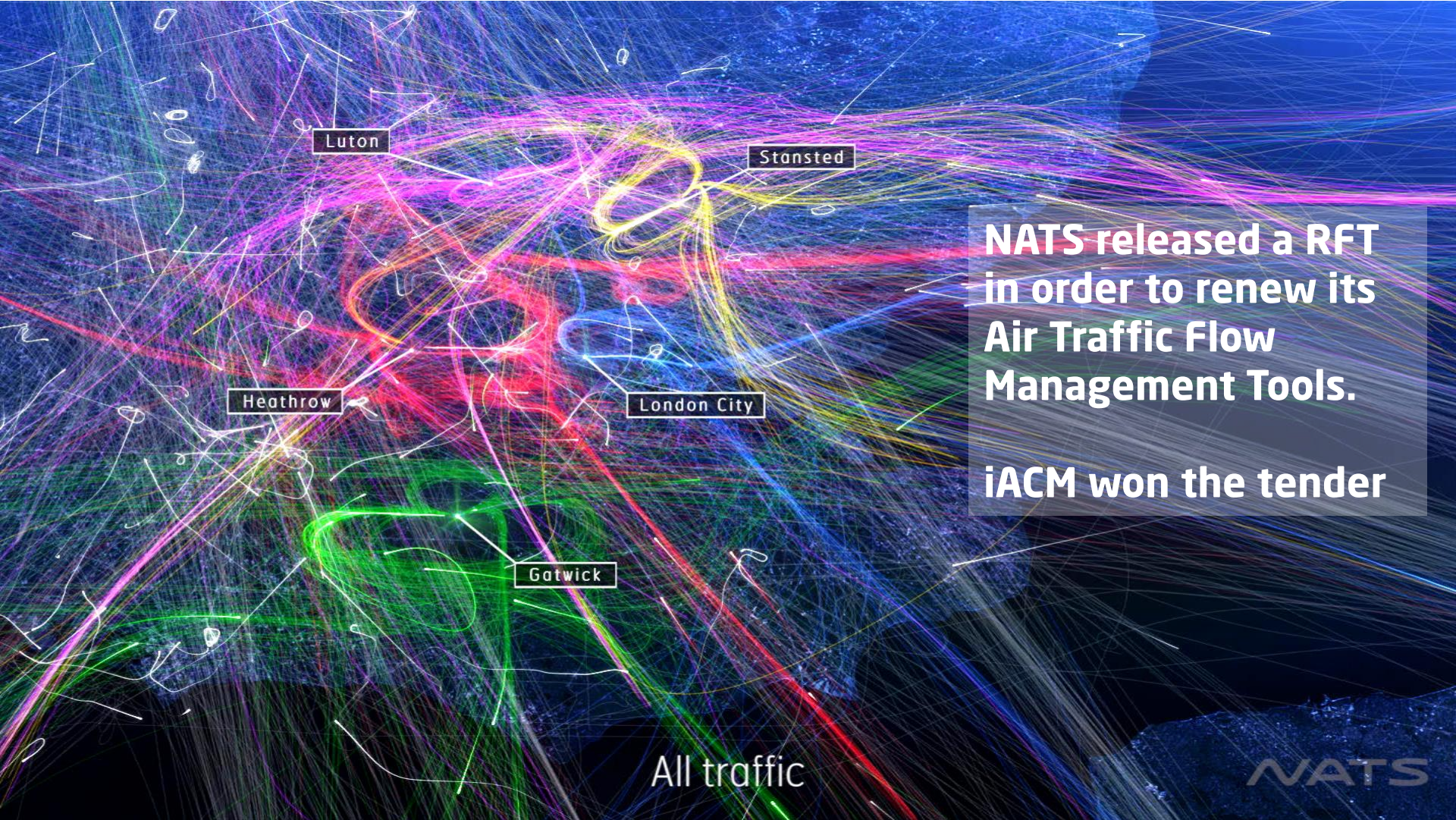•SUA Schedule (long term)

•Capacity

•Environment Updates

• Potential Problems

Plan update and maintenance is executed by users collaboratively
  ■ Users collaborate and decide around it
  ■ Accessible by external actors/tools

THE NATS CASE: INTRODUCTION

NATS released a RFT in order to renew its Air Traffic Flow Management Tools.

iACM won the tender
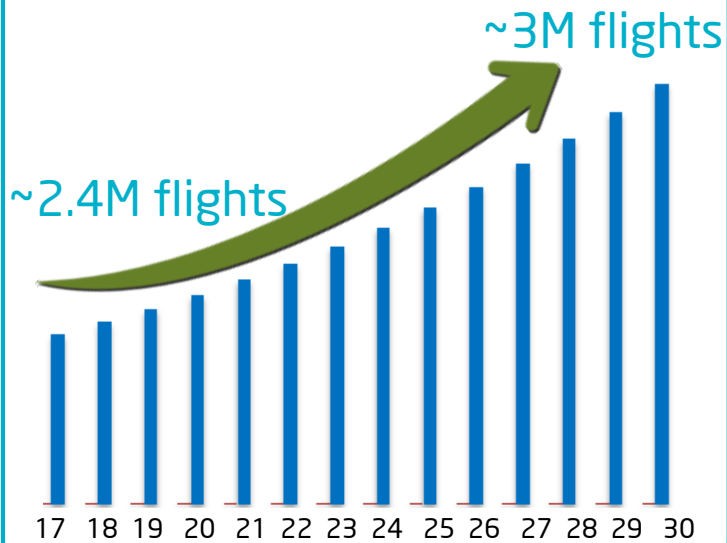
THE NATS CASE: CONTEXT

11%

Of Europe's airspace

25%

Of Europe's traffic

8000 flights /day on average

~3M flights

~2.4M flights

17 18 19 20 21 22 23 24 25 26 27 28 29 30

One of the most complex airspaces in Europe

Shanwick Oceanic Control Area

Scottish FIR

London FIR

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THE NATS CASE: MAIN CHALLENGES

London TMA handles more than 6 airports

Suitable for worldwide deployment

Effective workload calculator tool to reduce minutes of ATC attributable delays

Exchange the information with other NATS systems and stakeholders

Provide service for multiple FIRs, ACCs, APPs and TMAs

Different Planning Phases considered

Strategic Phase → Pre-Tactical Phase → Tactical Phase → Post-Operational Phase

SUCCESS KEY POINTS

Objective: reduce ATM-related CO_2 **emissions by 10%** by 2020. Currently 5% improvement over the baseline

iACM as a key element for NATS operations

Avoiding **10 sec** increase in average **delay**

£14m pa direct delay costs

⇩1% fuel emissions → **£33m pa**

Attractive and functional HMI designed by users for users

Product roadmap following and leading industry trends

Safety target: **reduce** the accident risk per flight attributable to NATS by **13%** by 2020

Capacity increase maintaining low delays per flight

Flights-busy 3h average

Swanwick centre capacity (AC+TC)
calibrated to 20s average annual delay/flight threshold

range of hourly capacity derived from investment plan

high

base

busy hour demand
(derived from Jan 10 flight forecasts)

low

CP2   CP3   CP4

2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Summer of year

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THANK YOU!!