

indra

Central Air Traffic Flow Management System

C-ATFMS



Casablanca 18 MAR 2019

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Introduction

Indra Sistemas Company

Why a Centralized System?

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Indra ATM Experience

Indra is a leading Company in the International market in ATM automation Systems



+4000

facilities in more than 160 countries

+100

years of experience in ATM solutions

+85%

passengers in the world travel using Indra's technology, at some point of the flight

Indra Key ATM Costomers



Indra ATM Experience

Indra is a leading Company in the International market in ATM automation Systems

- Being trusted to manage the busiest and most complex airspace - Europe Core Area such as SACTA) for AENA, Maastricht UAC (MAS-UAC ACC) for EUROCONTROL, Prestwick ACC (Scotland) in the United Kingdom for NATS, Very Advanced Flight Data Processing System (VAFORIT) developed for German DFS,
- Being selected by the most advanced European ANSPs to develop the future ATM systems following the Single Sky Concept, through the iTEC Program (Interoperability Through European Collaboration),
- Having extensive experience and technological know-how necessary to successfully carry out any ATM program, with both a proven International management approach and a history of responsible program execution.
- ACAO Countries - Key Customers:
 - Ongoing : UAE, KSA, Algeria
 - Handed Over : Oman, Kuwait, Tunisia, Morocco, Libya

Indra ATM Worldwide



Afghanistan
Albania
Algeria
Angola
Anguilla
Antarctica
Argentina
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Belgium
Belize
Benin
Bhutan
Bolivia
Bosnia Herzegovina
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi

Cambodia
Cameroun
Canada
Cape Verde
Cayman Islands
Central African Rep.
Chad
Chile
China
Colombia
Comoros
Congo
Cook Islands
Costa Rica
Croatia
Cyprus
Czech Republic
Denmark
Dominican Republic
East Timor
Ecuador
Egypt
El Salvador
Equatorial Guinea
Ethiopia

Faroe Islands
Fiji
Finland
France
Gabon
Georgia
Germany
Ghana
Greece
Greenland
Guatemala
Guinea Bissau
Guyana
Honduras
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Ivory Coast

Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kosovo
Kuwait
Kyrgyzstan
Latvia
Lebanon
Lesotho
Liberia
Libya
Lithuania
Macedonia
Madagascar
Malawi
Malaysia
Maldives
Mali
Martinique
Mauritania
Mauritius
Mexico
Mongolia

Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nauru
Nepal
Netherlands
New Caledonia
New Zealand
Nicaragua
Niger
Nigeria
Niue
Norway
Oman
Pakistan
Palestine
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal

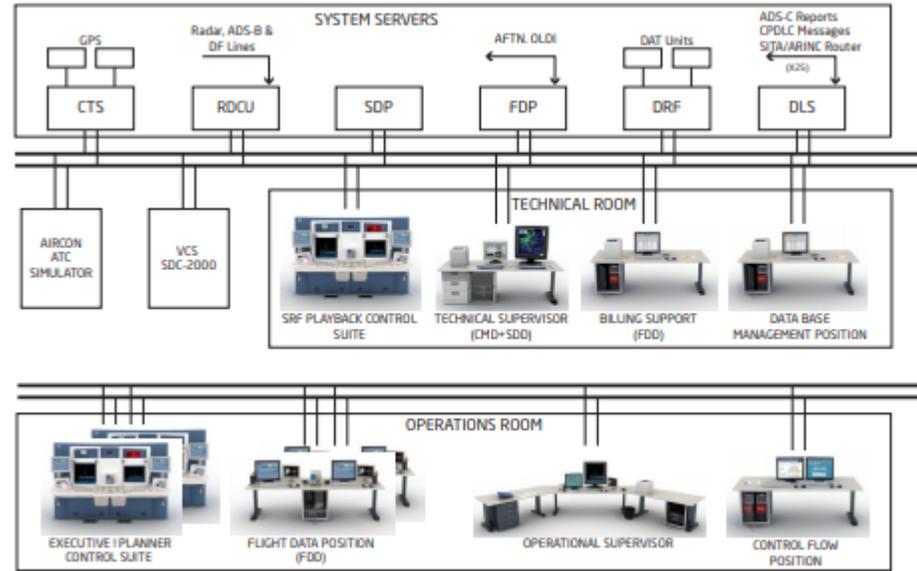
Qatar
Romania
Russia
Rwanda
Saudi Arabia
Senegal
Serbia
Seychelles
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
South Korea
Spain
Sri Lanka
St. Kitts
Sudan
Swaziland
Sweden
Switzerland
Syria
St. Vincent and Grenadines
Tahiti
Tajikistan

Thailand
Togo
Tonga
Tunisia
Turkey
Tuvalu
Uganda
Ukraine
United Arab Emirates
United Kingdom
Uruguay
USA
Vanuatu
Venezuela
Vietnam
Western Samoa
Zambia
Zimbabwe

Indra CNS/ATM Portfolio

ATM:

- iTECH
- Aircon2100
- SIM

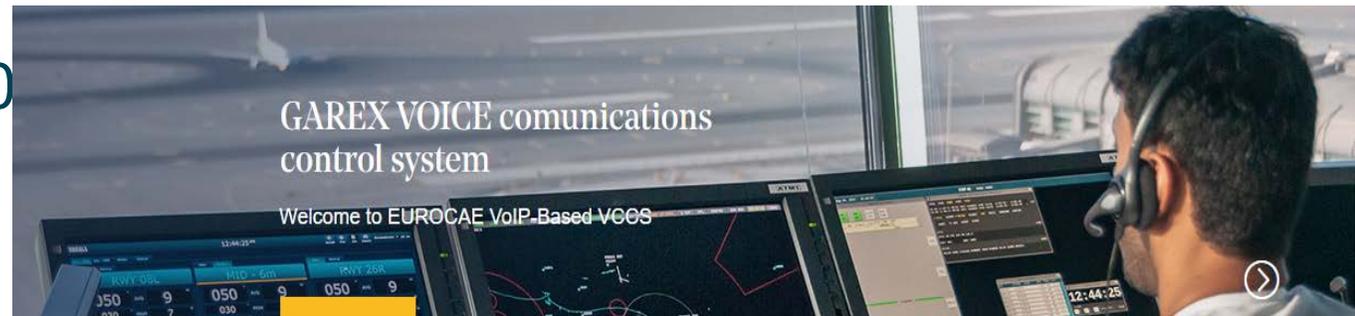


Automation System Overview



COM:

- VCS GAREX 230/300
- VREC
- AFTN/AMHS Avitech



Indra CNS/ATM Portfolio

Navigation

- Indra Navia ILS , DVOR/ DME



Surveillance:

- PSR, Mode S, SMR, ADS-B, MLAT, A-SMGCS, CCTV (remote Tower),



ATM Projects - MID Region Examples



Kuwait ACC



Muscat ACC

Indra Strengths

- Our aim is to provide our Customers with comprehensive, full and turnkey solutions,
- Indra product range covers the whole range of Air Traffic Management Systems, including Surveillance, Automation, Communications, Simulators and Nav aids,
- Indra experience in collaborating with third party Suppliers for integrated Solutions,
- Indra familiarity with working in the Middle East region,
- Indra commitment to provide all necessary resources to ensure the successful design, production, integration, installation, commissioning and continued support of the ATMS project throughout its life cycle during Defect Notification Period and beyond,
- Indra ATM interfacing capability with other auxiliary systems : ATFM, SIM, VREC, VCS, VHF, OIDS, GMCS, MET, AMHS,
- Indra experience in transitions management of ATM systems into operation with no disruption to air transport service or compromise to the safety,
- Indra commitment to provide Customers with the most up-to-date, cost-effective ATM system recognized all around the World.

ATC in High Density Areas

- Controllers need to process more flights:
 - Controlling tasks become more difficult.
 - Workload increases.
 - Incidents are more likely to happen.
 - Limited traffic awareness.
 - Non-efficient measures for avoiding congestion includes deviating flights and holding patterns.

ATC in High Density Areas (Cont'd):

- Inflexible airspace structures reduce ATC capacity:
 - Permanent Segregated Areas.
 - Fixed ATS routes.
 - Cross border areas.
- Independent infrastructure evolution misses improvement opportunities.

C-ATFMS Main Objectives

- Optimizing traffic flows according to air traffic control capacity while enabling airlines to operate safe and efficient flights.
- Provision of central flight plan data.
- Best utilization of available capacity.
- Assurance of protection against overloads and Smoothing of traffic flows.
- Minimization of penalties due to congestion.
- Improve cost effectiveness.
- Adaptation of procedures and systems to the operational evolution.
- Provide reports and statistics on flight operations and delay situation for managerial and operational purposes.

Benefits of a Centralized System

- **Reduce ATS personnel** due to centralized processing of FPL and RPL.
- Provides a **coherent picture** of air traffic situation, flight planning, environment and forecasted capacity and demand.
- All centres have exactly the same information, **timely updated** improving inter-centre coordination.
- **Removes errors** due to validation by different ATM systems in each ATSU's.
- Optimal **global solutions** are found instead of local solutions which could complicate traffic in other areas.
- New **flexible structures** managed based on actual traffic demand.
- **Increased ATC capacity.**

Central Air Traffic Flow Management Unit

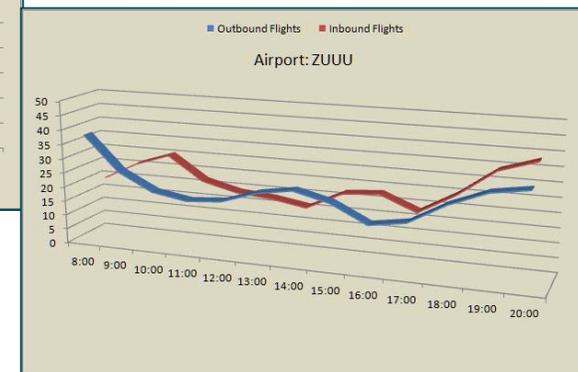
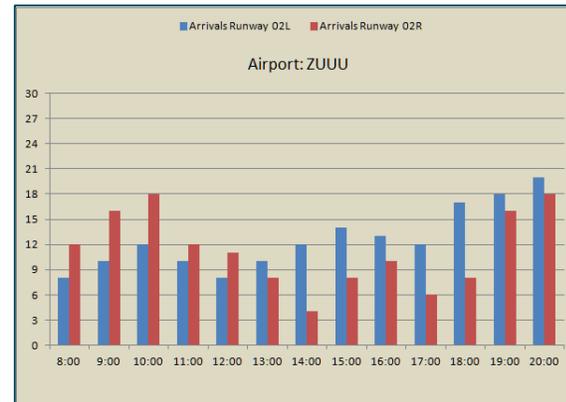
- Systems, procedures and personnel whose main mission is to enhance safety through co-ordinated management of the air traffic in participant States.
- It provides two main functionalities:
 - Flight Plan Management.
 - Flow Management.

Flight Plan Management Basics

- C-ATFMS reduces the number of sources of flight plan data to a **single point**.
- It processes flight plans and associated messages.
 - Correct submitted **messages are automatically processed**.
 - Erroneous ones passed for manual treatment by the C-ATFMS staff, with the benefit of reducing staff for these tasks in ATC centres.
- After correct processing of a flight plan message **4D profile** is built.
- Messages are transmitted at appropriate times according to 4D profile.
- ATSU make available, through C-ATFMS, any necessary **changes** in FPL.

Traffic Demand

- C-ATFMS maintains all flight plans and RPLs within all the participant ATSU's / States.
- C-ATFMS computes demand figures for several days in advance using 4D trajectories for all flights.
- Airspace resources of different kinds are monitored:
 - Navigation Aids.
 - Published Way Points.
 - Aerodromes.
 - Set of Aerodromes.
 - Airspace Volumes.
- Demand is displayed in user friendly HMI.



Data WareHouse (DWH) Function

- The DWH function stores data and logs from IFPS subsystems.
- Stored data and logs are distributed in the IFPS subsystems.
- Data and logs are used for:
 - The assessment of the performance of the IFPS operations.
 - Feed-back on tactical activities.
 - Preparation of the pre-tactical activities.
 - Support to strategic planning and activities.
 - Investigations of reported cases with anomalies or complaints.
 - Quality monitoring of IFPS services.

Web Portal

- Providing access to external airspace users to IFPS functions such as:
 - **Validation** of flight plans and direct submission to operational IFPS
 - **Retrieval** of existing flight plans
 - Requests for **valid routes** between origin and destination
 - Flight plan **statistics**
 - **Aeronautical information**
 - **System users help.**

Indra IFPS System Procured for Saudi Arabia

- Two IFPS Units in Jeddah and Riyadh:
 - Load balancing
 - Redundancy
 - Contingency
- Adapted to Saudi Arabia regulation (e.g. Diplomatic Clearances)
- IFPS Zone expandable for covering whole **Middle East** area.
- Linking with adjacent Regional IFPS

SANS
خدمات الملاحة الجوية السعودية
Saudi Air Navigation Services

FPL Data

Date of Flight * 29/01/2019

Aircraft Identification * ATJ SSSSS

Flight Rules * VFR

Type of Flight * N

Number * 2

Type of Aircraft * SAD

Wake Turbulence Cat. * Medium

Equipment * J5 N

Departure Aerodrome * AGGR

Time * 00 : 00

Route * AGGS BGSS

Destination Aerodrome * BGSF

Total EET * 00 : 00

ALTN Aerodrome

2nd ALTN Aerodrome

Other information * DOF/190129

Supplementary Information

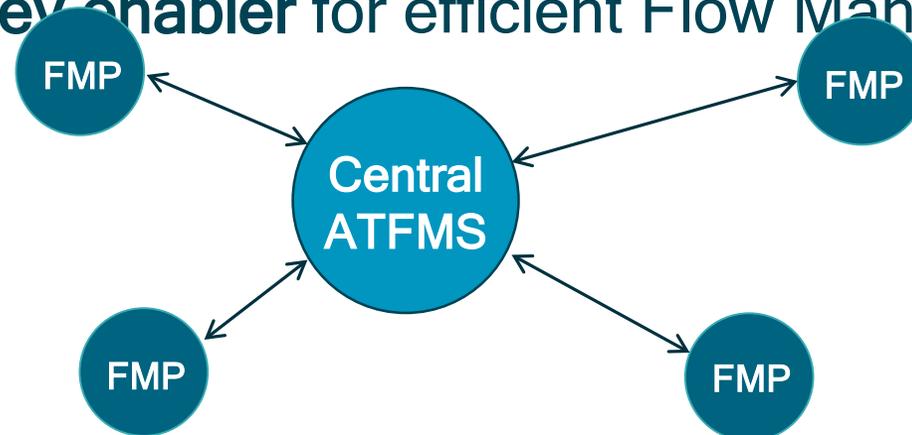
Validate

Capacity Management

- **Capacity schedules** are defined in C-ATFMS adaptation database for monitored airspace resources.
- Capacity can be **modified on-line** from Flow Management Units (FMUs).
 - Bad weather conditions.
 - Navigation aids breakdown.
 - Industrial actions.
 - Etc.
- Updated capacity figures are **immediately considered** by C-ATFMS for balancing demand.

C-ATFMS Design Principle

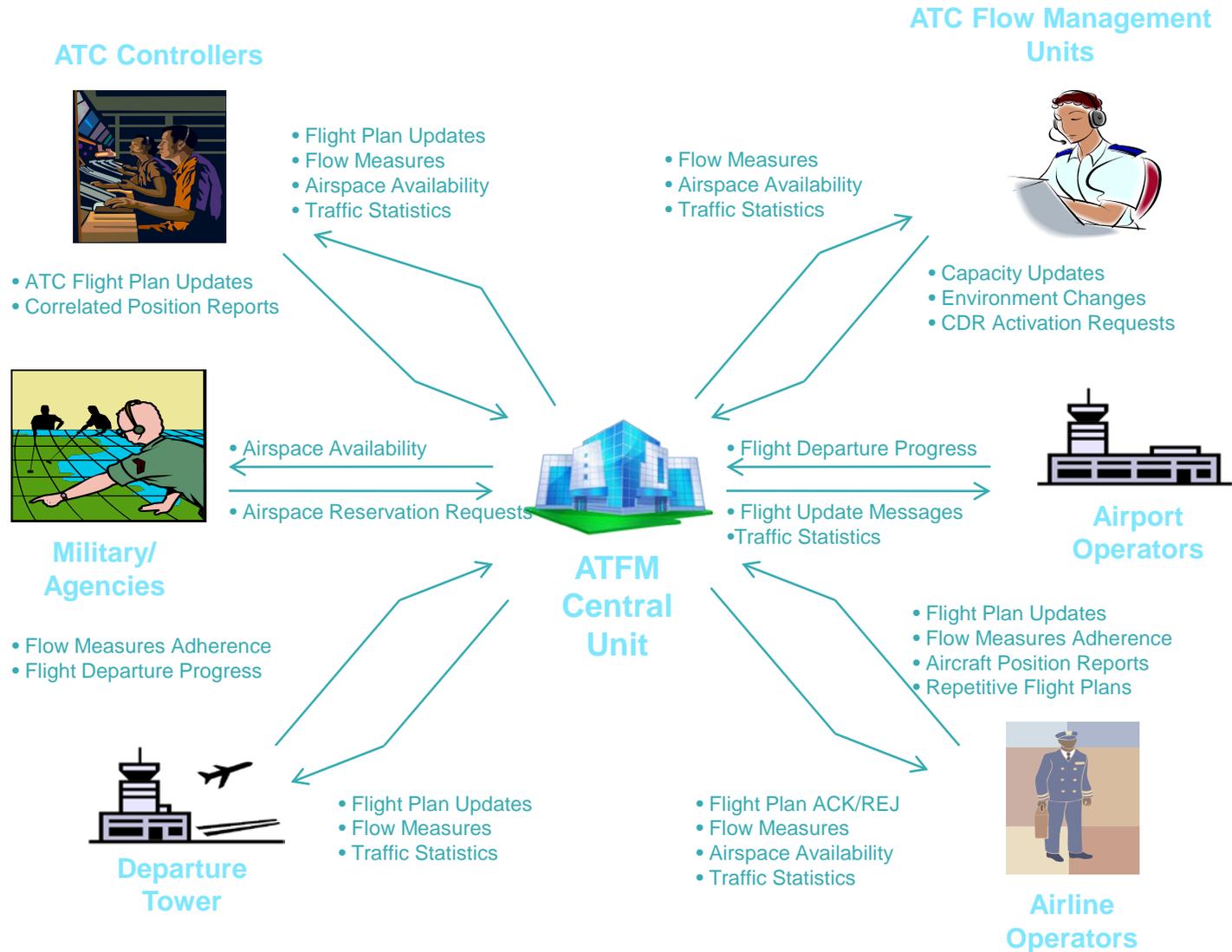
- The C-ATFMS is based on the **ICAO Centralised Traffic Management Organisation (CTMO)** concept which foresaw a central flow management unit supported by Flow Management Positions (**FMPs**) in each Area Control Centre (ACC).
- FMPs deal with flow and capacity issues within the area of responsibility of the ACC, including aerodromes inside it.
- **IFPS** is the main key enabler for efficient Flow Management



Collaborative Decision Making (CDM)

- It allows decisions to be taken by those players best positioned to make them on the basis of the most comprehensive, up-to-date and accurate information:
 - ATC, AO, MIL, etc.
- CDM is a **Key Enabler** for ATFCM allowing:
 - Sharing of all relevant information between the players involved in making decisions.
 - Supports a permanent dialogue between the various players throughout all phases of flight.
- CDM needs to be an **inclusive** and **transparent** process which builds **trust** between the players involved

C-ATFMS Operational Structure



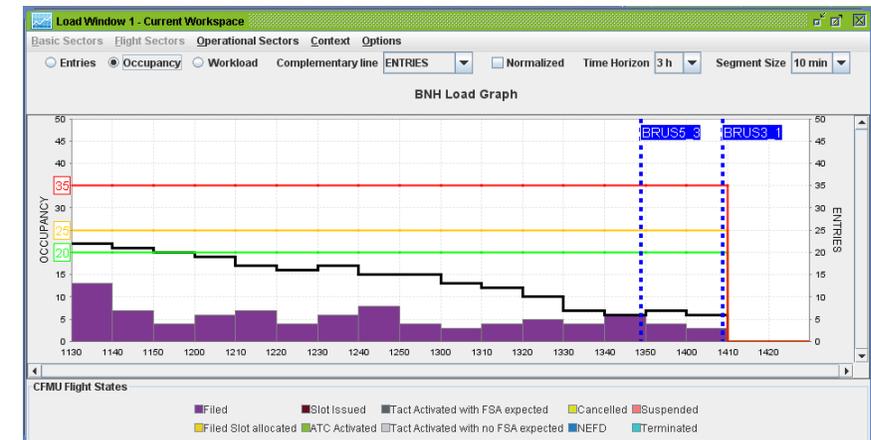
ATFCM Phases

- **Strategic**: 7 days or more prior to the day of operation and includes research, planning and coordination activities.
 - **Outputs**: capacity plan for the following year, the Route Allocation Plans and sets of other plans that can be activated as necessary during the next phases.
- **Pre-Tactical**: during 6 days prior to the day of operation and consists of planning and coordination activities.
 - **Outputs**: Flow Measures Plan and Airspace Availability for the day of operations.
- **Tactical**: Applied the day of operations. Updates the pre-tactical plans and applies slot allocation and other ad-hoc flow measures.
 - **Outputs**: Updates of plans and tactical flow messages.
- **Post-Operations**: Analysis of recorded data and feedback for strategic and pre-tactical phases.

Strategic and Pre-Tactical Phases

- Anticipates air traffic demand based on previous experiences and major events identified.
- Demands from airspace users (e.g. large scale military exercises).
- C-ATFMS supports strategic phase by simulating scenarios and providing statistics and stored data analysis.
- C-ATFMS supports pre-tactical phase with flow predictions and airspace management utilities.

NO	DESIGNATOR	LOWER	UPPER	START TIME	END TIME	TYPE	RESPONSIBLE UNIT	REMARKS
001	JORCUS1	GND	F200	2012-06-01 09:00	2012-06-01 15:00	R	UCS1	CLOSURE DUE TO MIL
002	JORCUS1	GND	F250	2012-06-01 13:00	2012-06-01 15:00	R	UCS3	NIL
003	URGTTD	F200	F300	2012-06-01 08:00	2012-06-01 18:00	R	UCS1	



Tactical Phase

- C-ATFMS continuously monitors the air traffic situation and detects imbalances in traffic demand and capacity.
- Imbalances detected covers medium-term predictions.
- Tactical flow measures applied to individual or set of flights:
 - Assignment and revision of departure slots.
 - Flight suspension and de-suspension.
 - Flight rerouting.
- C-ATFMS **automatically issues tactical flow measures** and provides support to operators to manage and negotiate them with stakeholders implied.

Tactical Phase (Cont'd)

Departure Slots

- C-ATFMS sends the corresponding delay via **Slot Allocation Message (SAM)**.
- C-ATFMS continuously monitors the situation. If a slot is freed, a **Slot Revision Message (SRM)** is sent.
- C-ATFMS sends **Slot Cancellation (SLC)** if flight is not operating or not longer regulated.
- Others messages are used by Airline Operators for:
 - Stating the readiness of flight.
 - Reporting missed slots.
 - Communicating delays.
 - Requesting new slots.

Tactical Phase (Cont'd)

Flight Re-Routings and Suspension

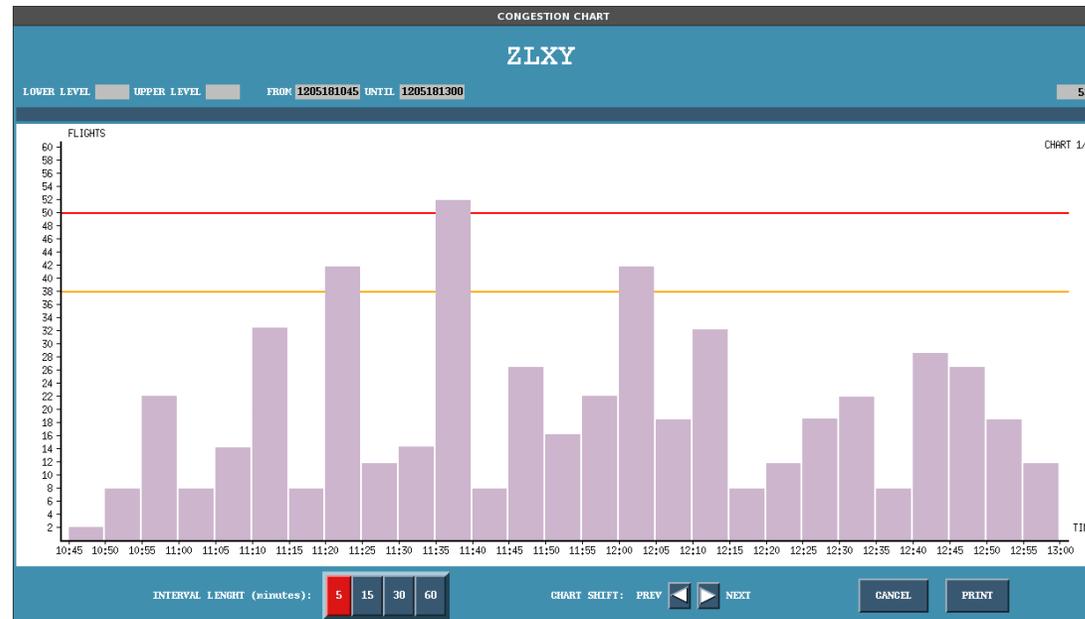
- Re-routings
 - C-ATFMS detects and proposes alternative routes among a set of alternative routes defined in strategic and pre-tactical phases.
 - An alternative route is proposed if less departure delay is obtained with it.
 - Airline Operators can decide then if benefit from alternative route or not.
- Flight Suspension
 - Applicable in some circumstances. E.g:
 - low visibility at ADES.
 - Aerodrome closure.

Post-Operations Phase

- Aims to improve the flow management process.
 - Recording.
 - Local and remote data access.
 - Analysis tools for exploiting data.
- Data recording is made in a large database and includes:
 - Operational data: Flights details, Flight evolution, Applied flow measures (manual and automatic) , etc.
 - Technical data: Subsystem logs, System warnings and errors, Others.

Post-Operations Phase (Cont'd)

- C-ATFMS provides statistics as graphics (e.g. bar diagram, pie chart, etc.) and flight lists.
- C-ATFMS generates manual and automatic reports (e.g. monthly reports).
- C-ATFMS provides all means for better understanding the flow management process so that it can be amended in the future.



Conclusions

- IFPS centralizes flight planning, management and distribution:
 - **Coherent** air picture
 - Reduces mistakes and **Improves efficiency**
 - **Improves inter-centre coordination** (both civil and military)
 - Repetitive flight plan management
 - **Central repository** of flight data
 - **Main key-enabler** for efficient Flow Management.
 - Allows to easily implement **other central services**:

Central route charges office
codes

Central allocation of SSR

Central investigation of incidents

Process claim

Conclusions (Cont'd)

- C-ATFMS centralizes the flow management process:
 - Provides **fair allocation of airspace resources** for civil and military users.
 - **Globally improves** the ATM operations network.
 - Process developed in three phases (strategic, pre-tactical and tactical) plus one analysis phase.
 - Automation systems detects demand/capacity imbalances and provides automatic actions for **reducing such imbalances**.
 - **Enhance the safety** of the ATM system by ensuring the delivery of safe traffic densities and **minimizing traffic surges**.
 - Automation systems provide support to CDM and manual flow management actions.
 - Provides reports and statistics that allow **detecting opportunities** for process and system improvements. Also monitors the adherence to established rules and applicability of penalties.

Thank You

indra

At the core