Indra Integrated Tower System

Solution & Practice

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Challenge in Tower

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Challenge in Tower

- Traditional air traffic control automation system is mainly designed for the use in ACC and TMA control centre, and it normally provides various tools to assist controller to be aware of air situation and guarantee separation between flights.
- But this is not enough in tower, as tower controllers normally need more tools to know ground traffic situation, to coordinate with airport, to control airfield ground lighting system, to access to AWOS, and etcetera.
- And finally different systems for different purposes are all installed in the limited space of a control tower.

A Typical Tower Consists of


Shuangliu Airport, Chengdu

- ATC automation system
- A-SMGCS system
- Electronic Flight Strip system
- Airport CDM system
- AIS system
- AWOS/Met System
- AGL System
- ILS/Navid CMS System
- Voice Control System
- D-ATIS System
- ...

And Finally It Looks Like

- Each controller need to manage multiple screens, keyboards, and mice.
- Useful information are displayed in different screens.
- Different actions need to be performed in different systems.
- Each system is an isolated island, very limited information is shared across systems.

Integrated Tower Solution

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Indra Automation Systems Family

How does Indra help air traffic controllers to apply separation, prevent collisions, manage flow and direct aircrafts?

ACC/TMA Automation Systems

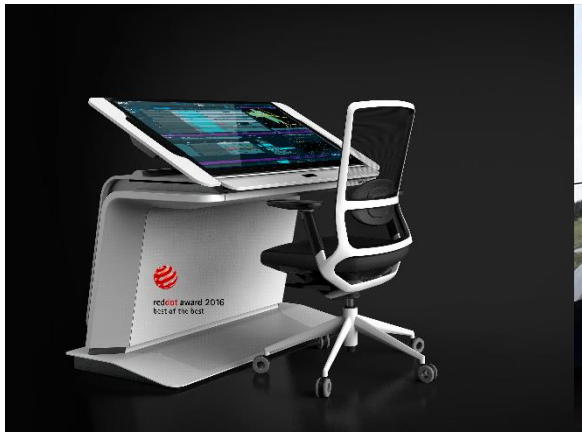
En-route and approach capability

Integrated Tower Automation Systems

A-SMGCS - Airport Movement & Control Guidance and Remote Towers solution

Simulation Systems

2D & 3D Simulators



Integrated Tower Automation Systems

Core functions for tower control are seamlessly integrated into one system

- Flight plan management and air traffic display (ATM)
- Ground traffic display (A-SMGCS)
- Electronic flight strip for ATC and apron tower (EFS)
- Safety Net and RIMCAS
- Taxi route planning and guidance
- Access to AIS/MET/NAVID

And Finally We Get

High-End Features of Indra iTWR

- SDP (Surveillance Data Processor)

  Provides surveillance information from both air and ground sensors.

- FDP (Flight Data Processor)

  Manage flight plans information.

- iCWP (Integrated Controller Working Position)

  Provides the controller with a complete traffic situation display (Air & Ground) with optimum information.

- EFS (Electronic Flight Strip):

  Provides a modern, configurable and paper strip-less HMI.

- Safety Nets (SNET) Function

  RIMCAS (Runway Incursion Monitoring and Conflict Alert System). Alerting system that monitors runway incursions to avoid incidents.

  CMAC (Conformance Monitoring Alerts for Controllers) & CATC (Conflicting ATC Clearances) alerts.

- DMAN (Departure Manager):

  Provides departure and pre-departure sequences.

- A-CDM (Airport Collaborative Decision Making Tools)

  Increase predictability by integrating processes and providing Departure and Pre-departure Sequence

- Routing & Guidance

  Provides ground route for both departure and arrival aircrafts.

  Provides AGL control and Follow the Greens guidance to avoid ground conflicts.

- CMD (Control and Monitoring Display) & DBM (Adaptation Database Management)

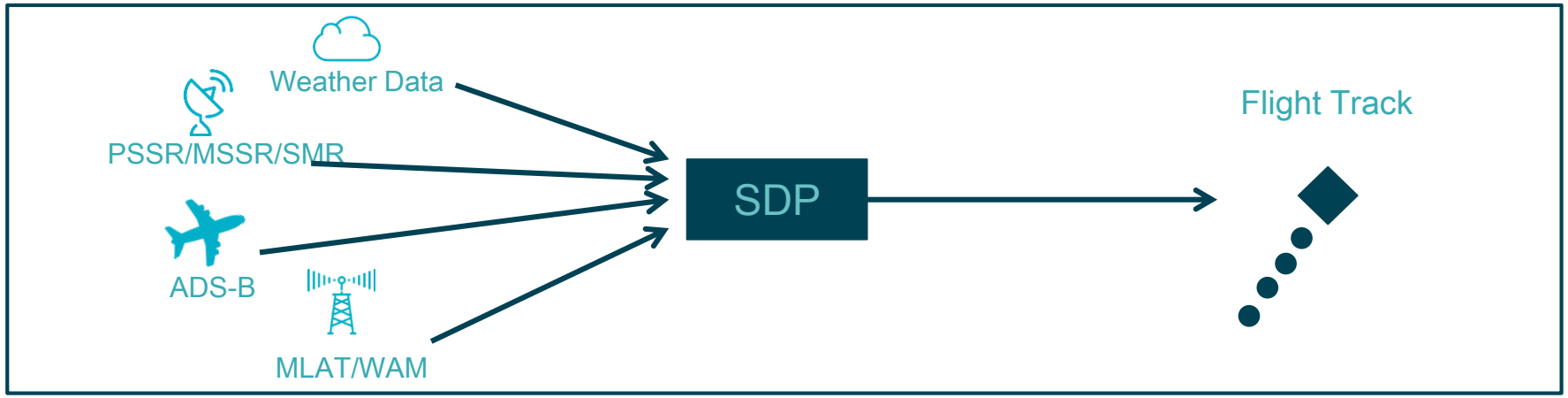
  Provides the status of the systems monitored.

  System configuration, map editing facilities and system monitoring facilities.

- DRF (Data Recording and Playback Facility)

  Provides storage and retrieval of all relevant information at the controller working positions, including high resolution SMR video, target data, relevant operator actions and events (alarms) at each CWP

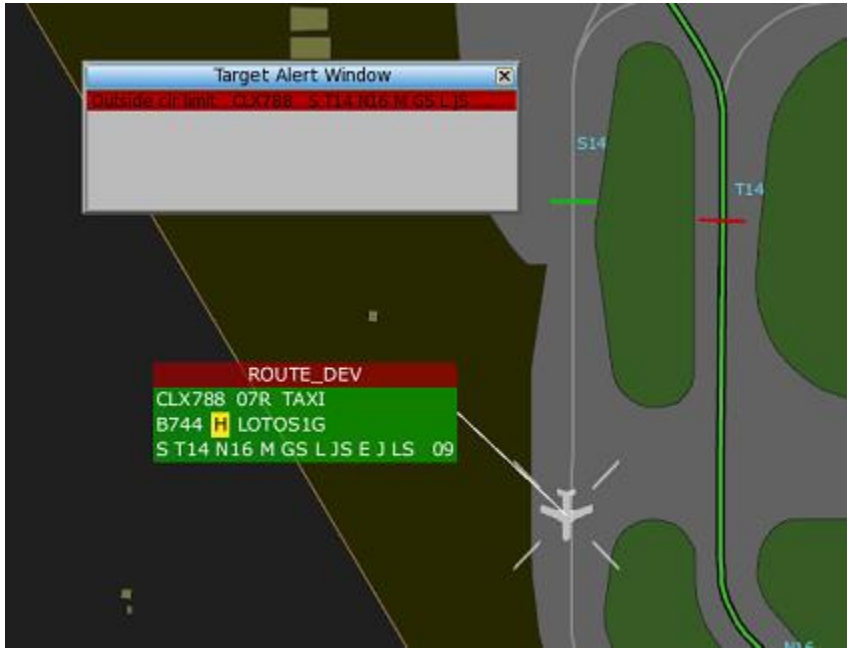
High-End Features - SDP



- Collects data from different types of surveillance sensors and airport information systems
- Integrated air tracking and ground tracking in one server
- Unique and continuous system track update for departure and landing flights
- Distribute the processed data to the controller working positions
- Provides decoding and integrity checking of the received data for each source of data

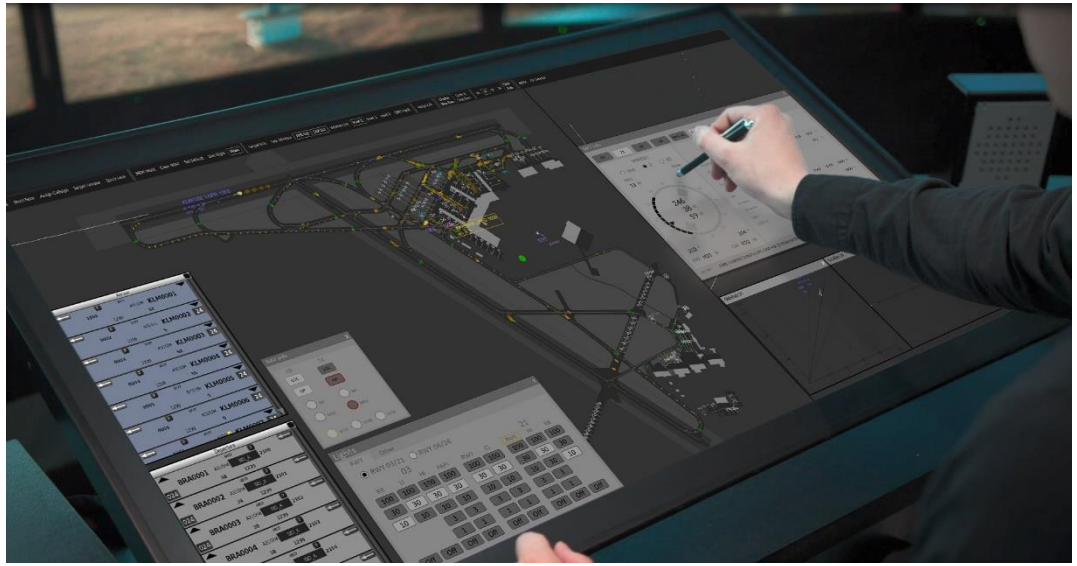
High-End Features - FDP

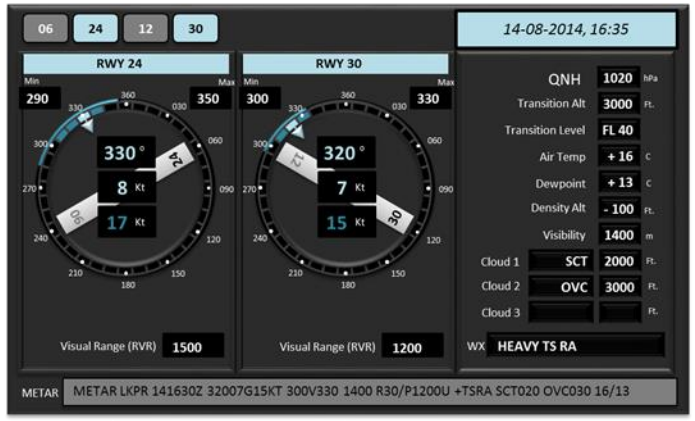
- iTWR FDP is designed to work in two modes, integrated mode and autonomous mode.
- When working integrated mode, iTWR FDP is fully integrated with TMA/ACC FDP system, so that the flight plan in iTWR system are exactly the same with TMA/ACC.
- When working in autonomous mode, iTWR FDP can work independently, and process all external data sources (e.g. AFTN) by itself. Coordination and handover between TMA and TWR can be done by using open protocol.
- Flight data used only in tower are processed locally in iTWR FDP.
- Integrated EFS function, so that EFS data is always coherent, and EFS modification can be send back to TMA/ACC system.

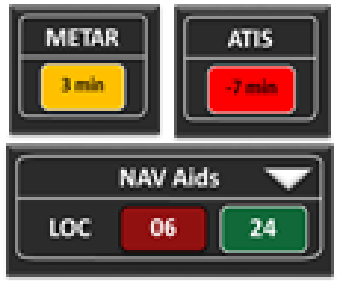


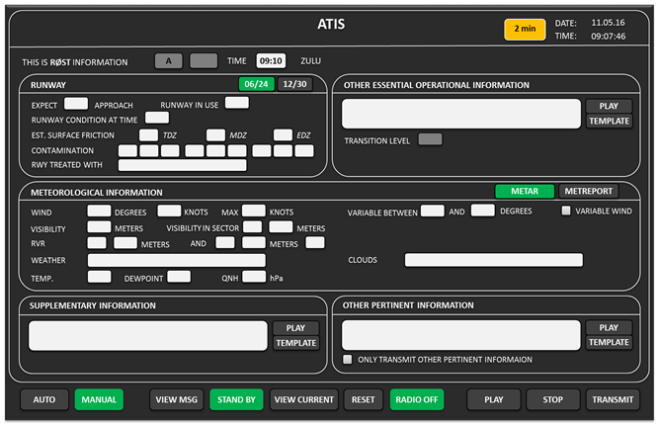
High-End Features - iCWP

- Highly integrated controller working position HMI.
- Different information can be displayed and accessed in one screen.
  - Air situation
  - Ground situation
  - EFS
  - AGL status & control
  - MET/NAVID/AIS information display
- One keyboard and one mouse only.
- EFS is optimized for touch screen.









High-End Features - Safety Net

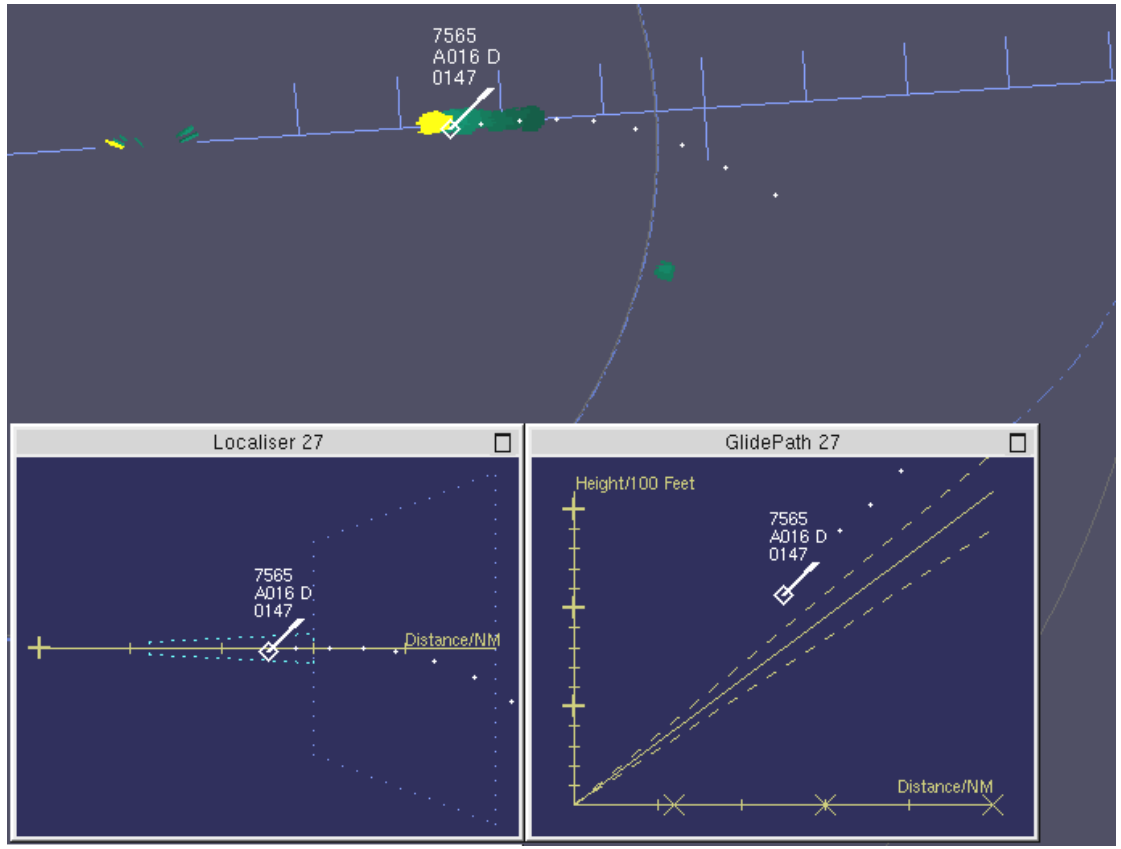
RIMCAS is a software module designed to monitor movements on an aerodrome surface, using data from a surveillance system, in order to detect and identify possible conflict situations within the surveillance area.

- Approaching/landing aircraft
- Departing aircraft
- Opposite/Wrong thresholds
- Restricted areas
- Stop bars
- Runway status (open/closed)
- Runway crossing
- Taxiway separation
- Clearance violation (with EFS)

High-End Features - Safety Net

AFDAS - Approach Funnel Deviation Alerting System Features:

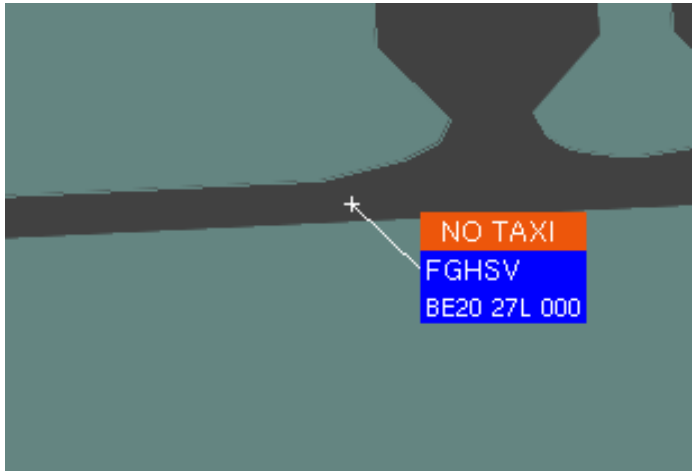
- Glide Path & Localiser Monitoring
- Up to 8 RWYs
- Go-Around alert
- Audible Alarm
- Visual Alarm



High-End Features - Safety Net

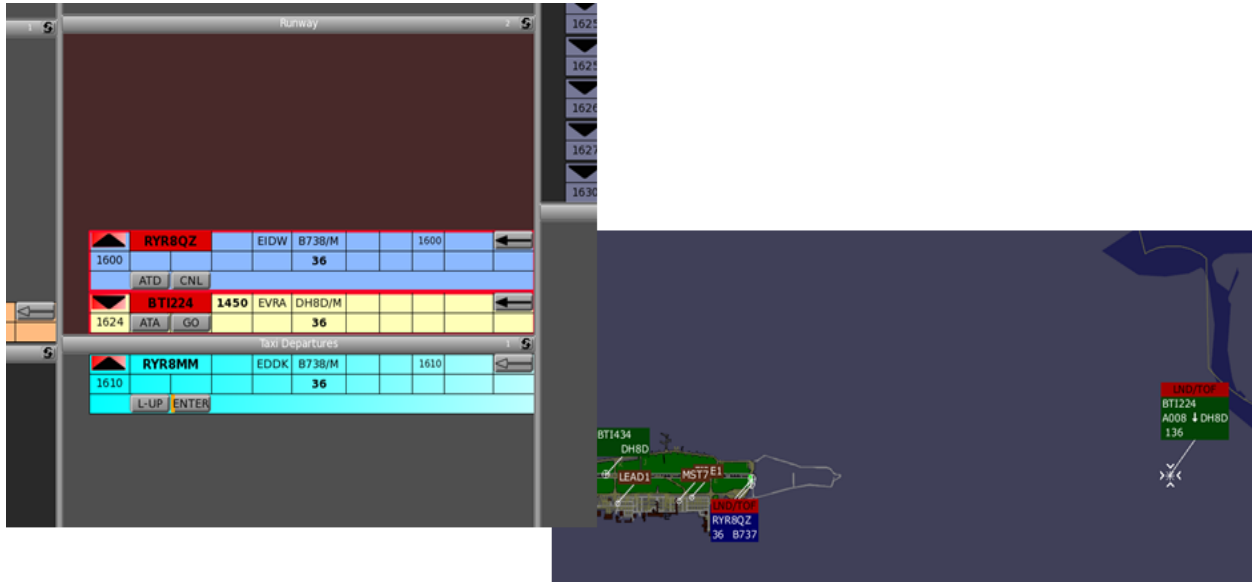
CMAC - Conformance Monitoring Alerts for Controllers

Service designed to monitor movements and ATC controller clearances at the aerodrome surface and the neighboring airspace in order to detect non-conformance by pilots and vehicle drivers to ATC instructions or aerodrome procedures



CATC - Conflicting ATC Clearances

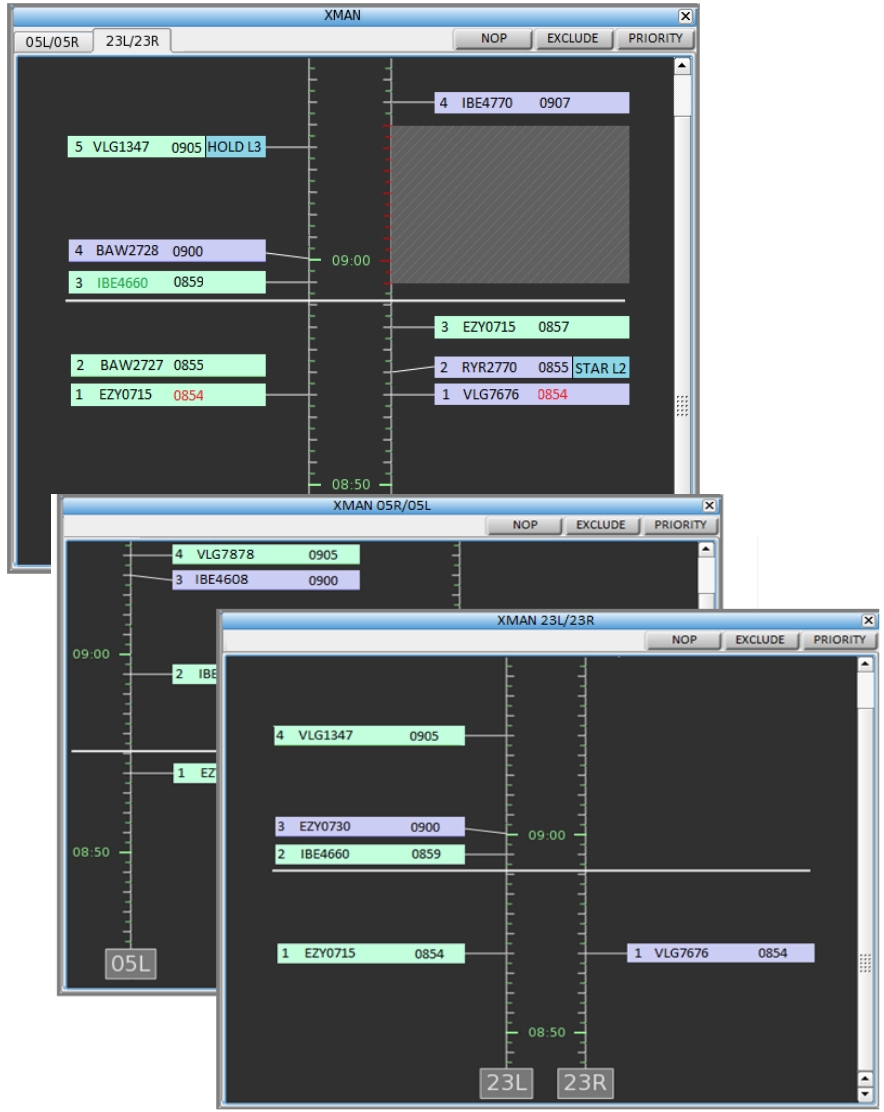
Conflicting ATC Clearances is a service designed to monitor clearances and instructions given by ATCOs.



High-End Features - DMAN

DMAN provides pre-departure sequence to the clearance controller

- Assistance and reduction of the controller workload.
- TMA and aerodrome coordination
- Supports the integration with AMAN sequence in a Master/Slave mode or just for display purposes.
- Airport efficiency improvement.
- Can be easily adapted to local characteristics and procedures (dependent runways or waypoints, mixed mode runways…) and supports on-line modifications of configuration data as well. Reduction of environment impact and aerodrome pollution
- Easy integration with other components.



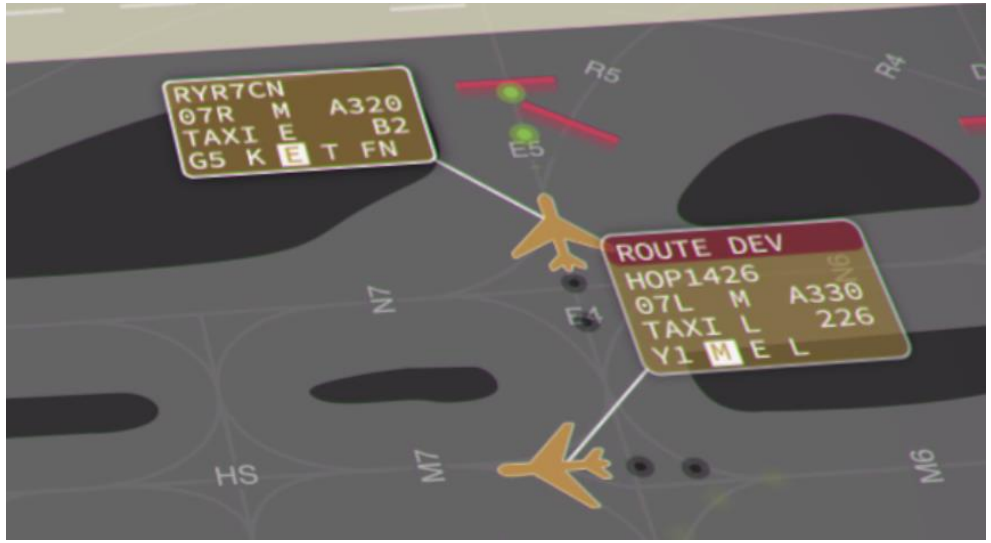
High-End Features – Routing & Guidance

Routing & Guidance

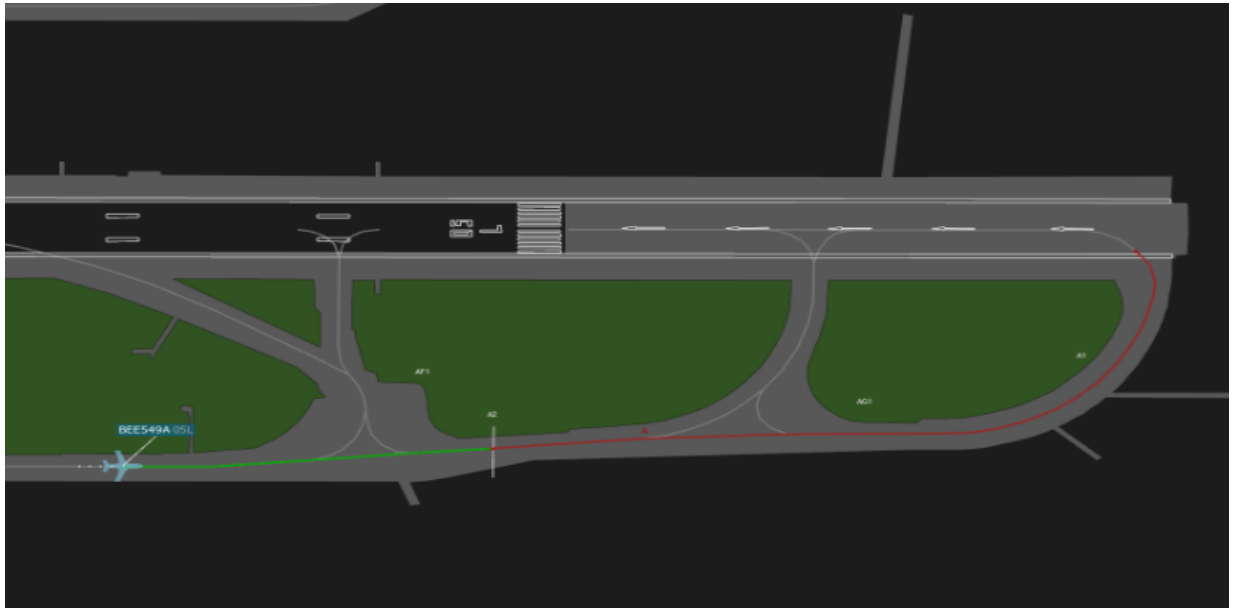
- based on airport modelling, easily adaptable to any airport layout
- route assigned can be easily changed
- route assigned is automatically updated when any inputs change
- Consideration of mobile position for the route recalculation

Optimised for:

- Minimum distance
- Minimum time.
- Minimization of turns and stops.
- Minimization of taxiway conflicts between coincident surface routes.

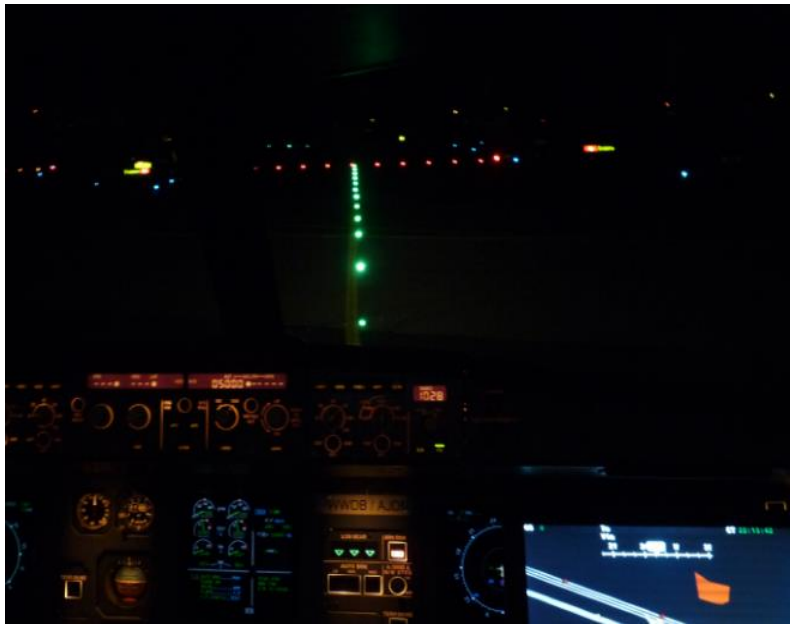


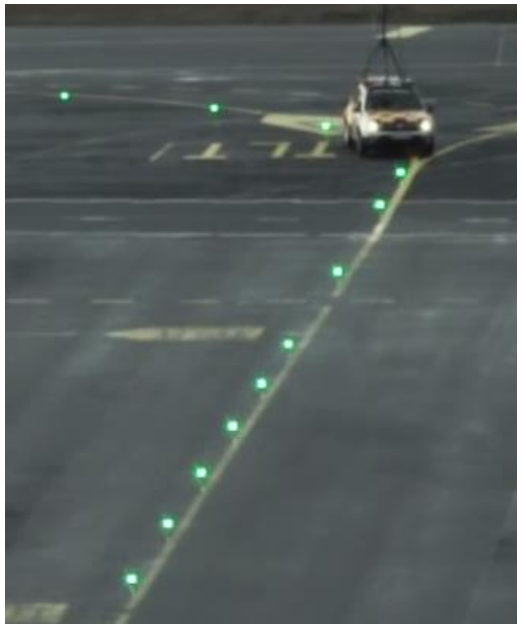
High-End Features – Routing & Guidance



High-End Features – Routing & Guidance

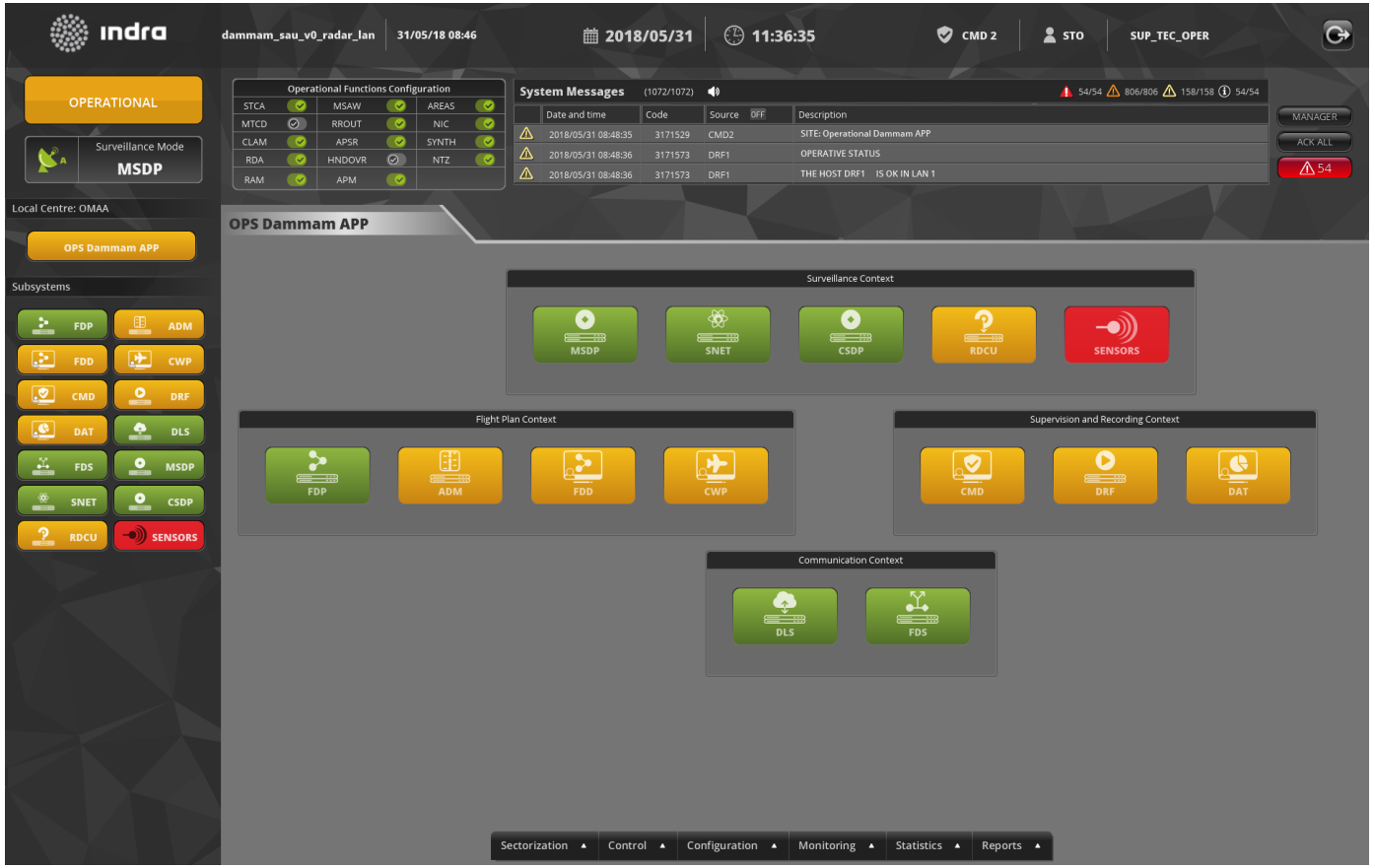
- Controlling the AGL system (Stop bar and Taxiways).
- Provide guidance direct to the aircraft and vehicle by controlling the lights (FtG)





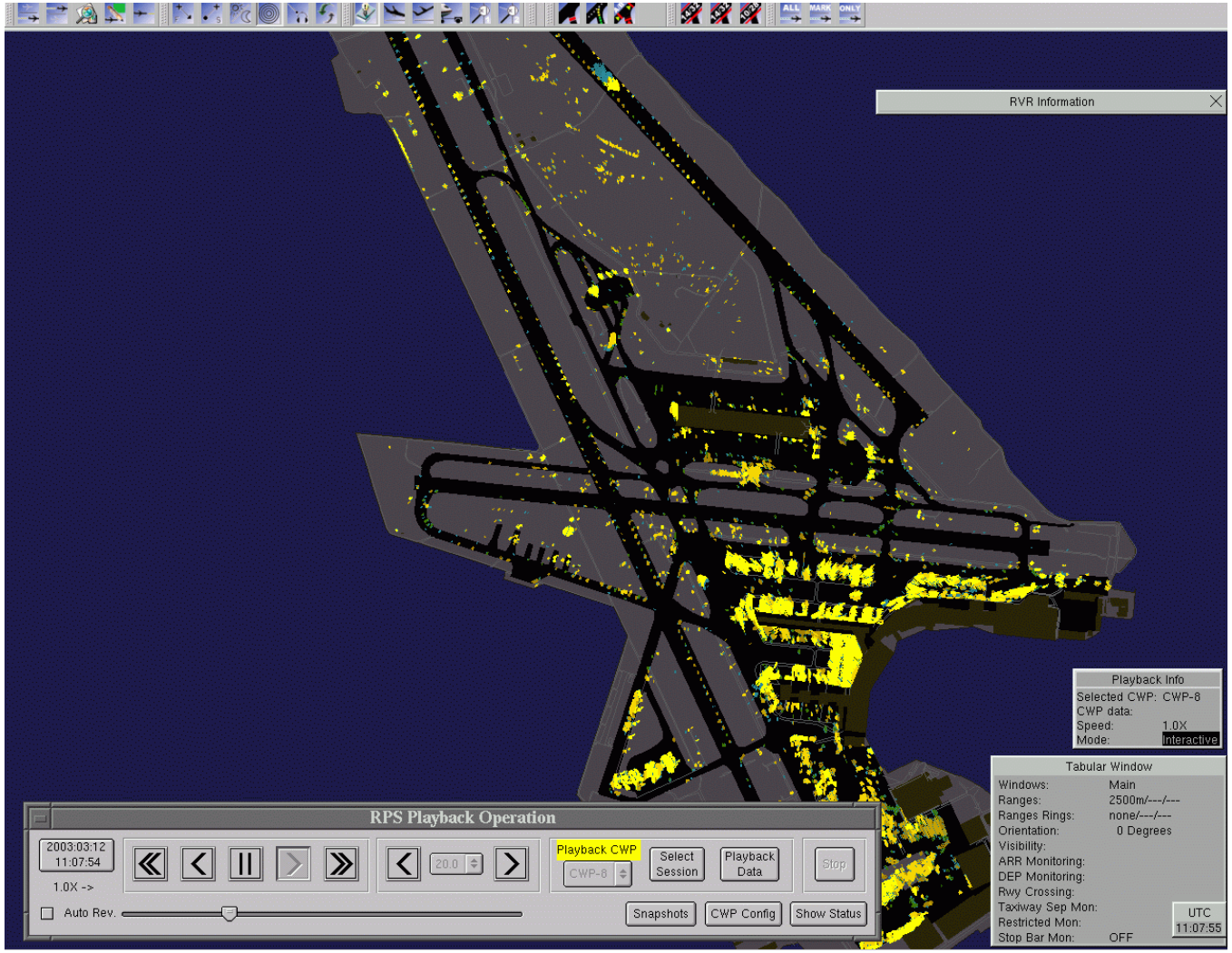
High-End Features – CMD

- Common CMD between TMA and iTWR
- Handling of Customizable user-friendly HMI.



High-End Features – DRF

- All operation data, including sensor input, operator actions, communication line, screen video are all recorded in real time, and stored in centralized DRF server.
- During playback, a picture is displayed in the air/ground situation window, plotting the plots / tracks received for the specified flights, drawing the actual trajectory for these flights.



Practice in New Chengdu Airport

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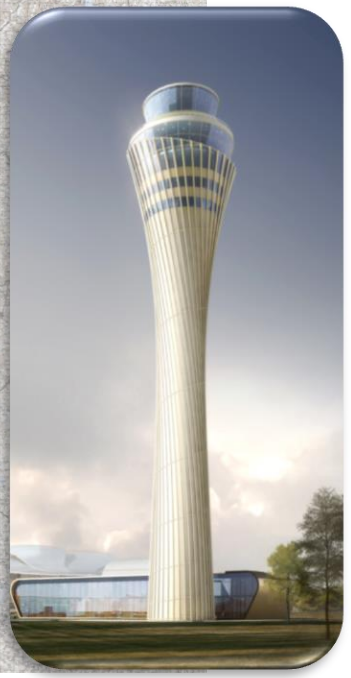
Background

- Nowadays
  - One Shuangliu international airport (ZUUU) with 2 runways, 1 ATC tower and 1 apron tower.
  - Traditional tower with different and isolated systems (Automation, A-SMGCS, T-EFS, A-CDM, DCL, AGL, AWOS, …)
  - Limited information is shared between systems.

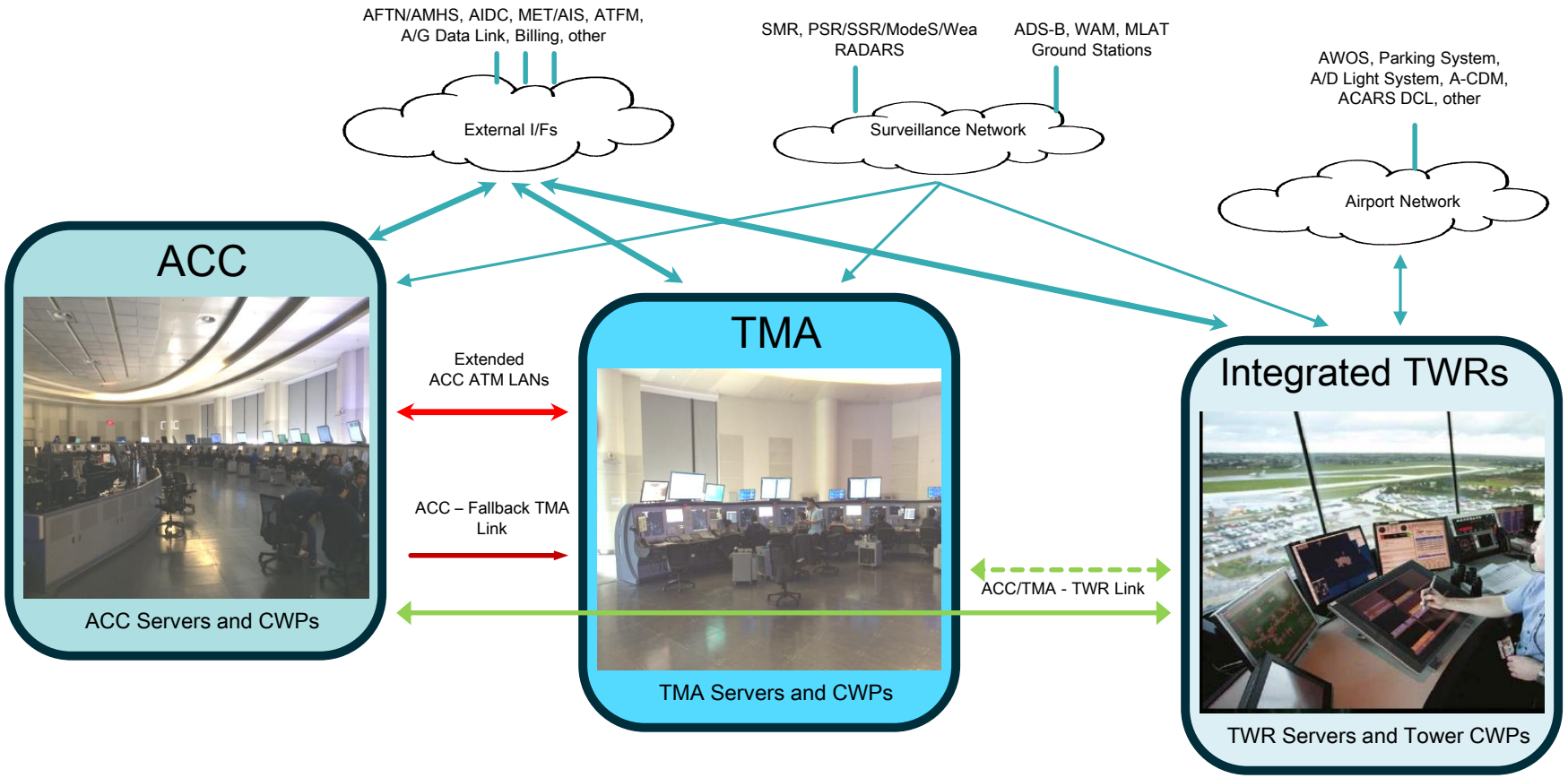
- Future
  - A new Tianfu International airport will be constructed with 3 runways, 2 ATC towers and 2 apron towers.
  - Current Shuangliu international airport (ZUUU) will be continue in service.
  - New integrated TWR systems will be build to provide tower control service to Shuangliu and Tianfu airports.

Background



Chengdu City
成都市
双流机场
Shuangliu Airport
20KM
ACC Centre
区管中心
天府新区
50KM
龙
泉
山
脉
28KM
13.5KM
15KM
15KM
Jianyang City
简阳市
Tianfu Airport
终端区
TMA Centre
25KM
资阳市
Ziyang City

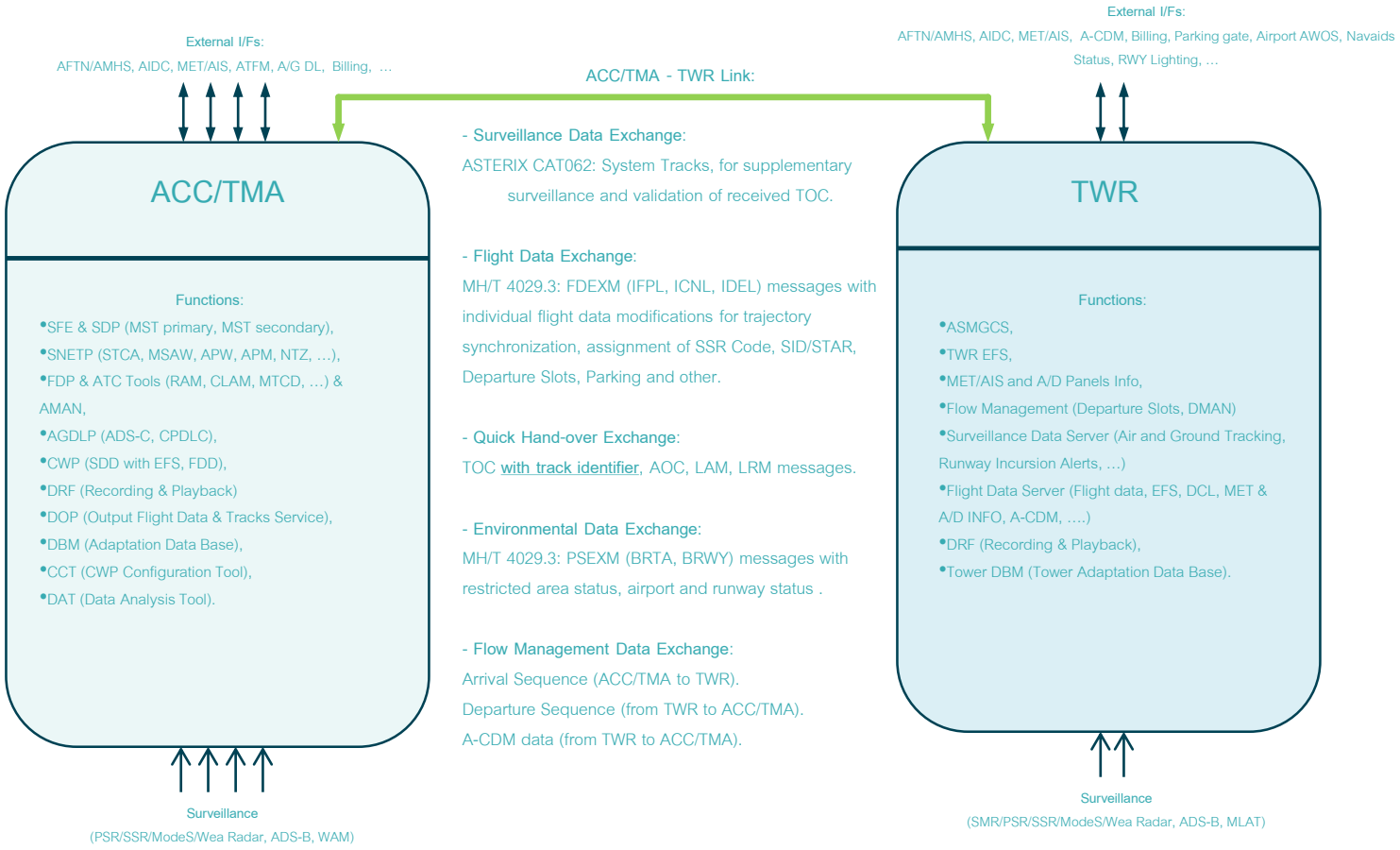
System Architecture



iTWR and TMA/ACC

- Challenge in this project is not only supplying two iTWR system for each airport, but also integrated TWR system and TMA/ACC systems, and make them work like one system.
- To archive this target, we defined a compressive interface between iTWR system and TMA/ACC system, and exchange all necessary flight and track data between two systems.
- Finally we get a general purpose ICD for iTWR and TMA/ACC system data exchange.
- As we try to reuse standard protocol as much as possible, the interface can be used between systems from different manufacturers.
- And the interface can be used to connect other internal airport to TMA system, so that this airport can also take benefit of sharing global flight plan from TMA.

iTWR and TMA/ACC




indra
At the core