

Implementation of A-SMGCS including Routing, Planning and Safety at airports

Airport environment

- Data and trend report a traffic growth in the next years
- Airports need to support this trend assuring always high level of safety and passenger services
- Technology can support in improving throughput and safety, as well as reducing ATCO workload
- Tower digitalization is the key enabler

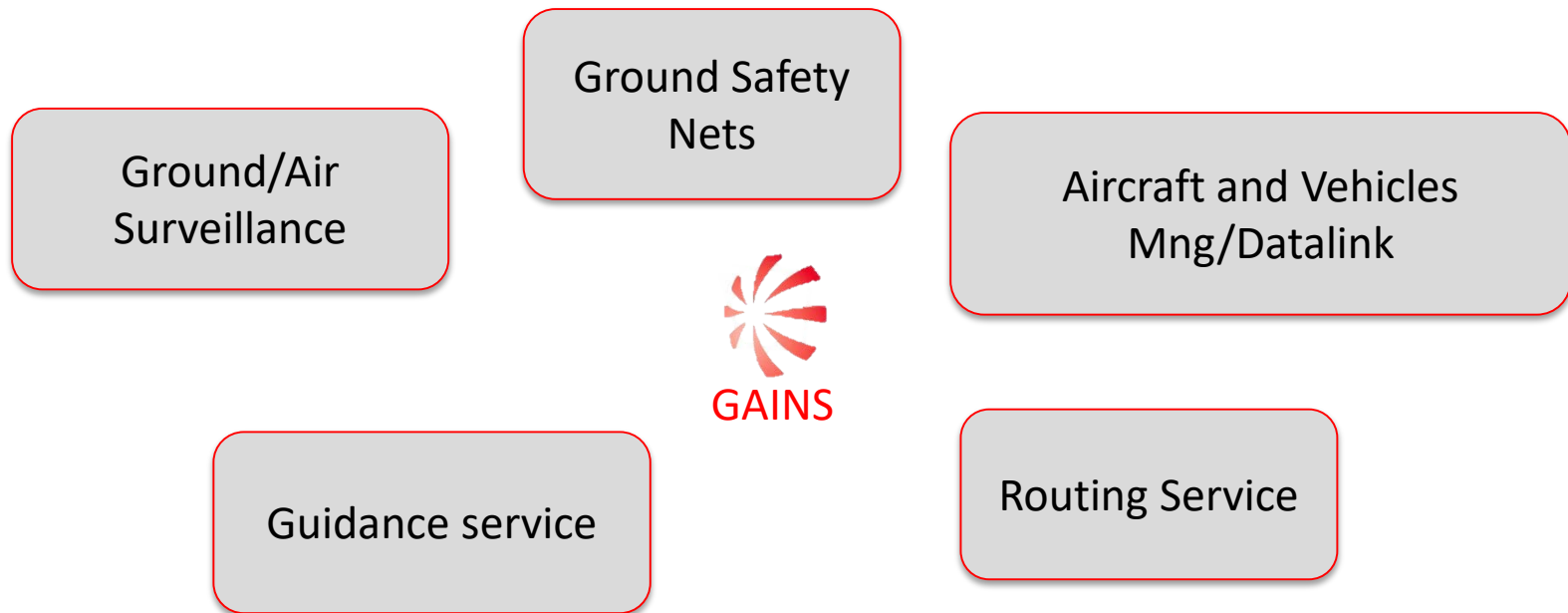


Airport vision



GAINS: Leonardo A-SMGCS solution

- GAINS key elements:
 - High usability
 - Less, quick and intuitive clicks/information
 - «Focus on information»
 - Many data don't mean many available information
 - Monitor rationalization for supporting strip-less solution
- GAINS was developed according with SESAR concepts having been involved in several validation activities at Milano Malpensa Airport and Sofia Airport



GAINS Working Position

e-Strip



- Overlapping information (≈85%)
- ATCO up and down

Stripless



- ATCO focus on radar situation awareness
- Main orders directly on label
- Main information on label
- Further information hidden but quickly available
- One screen
- integration further applications

Sofia Airport

GAINS Working Position

Track label cetric

Callsign

Next Order

SSR Code

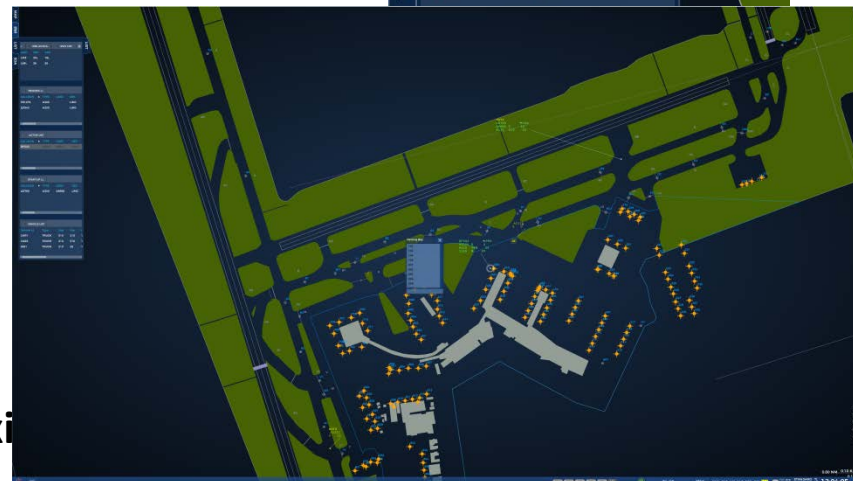
Ground Route

Aircraft type

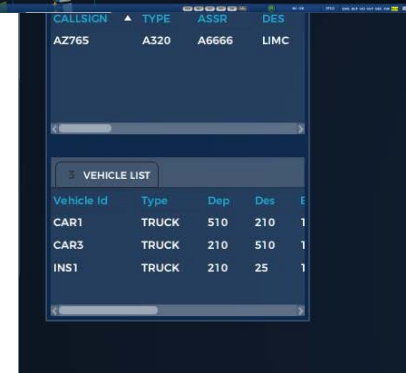
EP

TSAT/TTOT

Alarm/warning

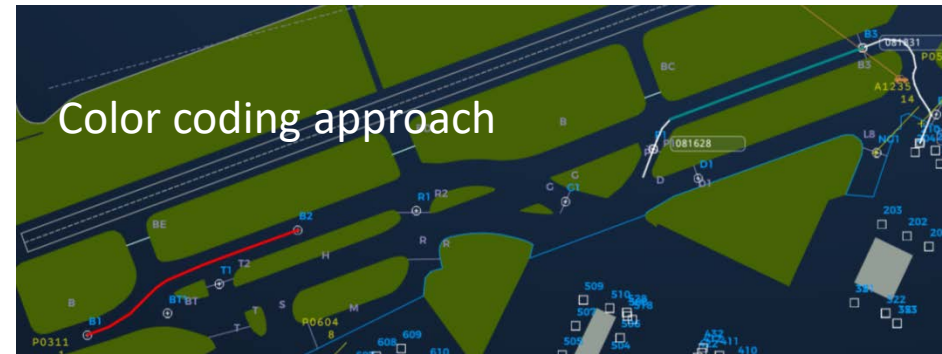
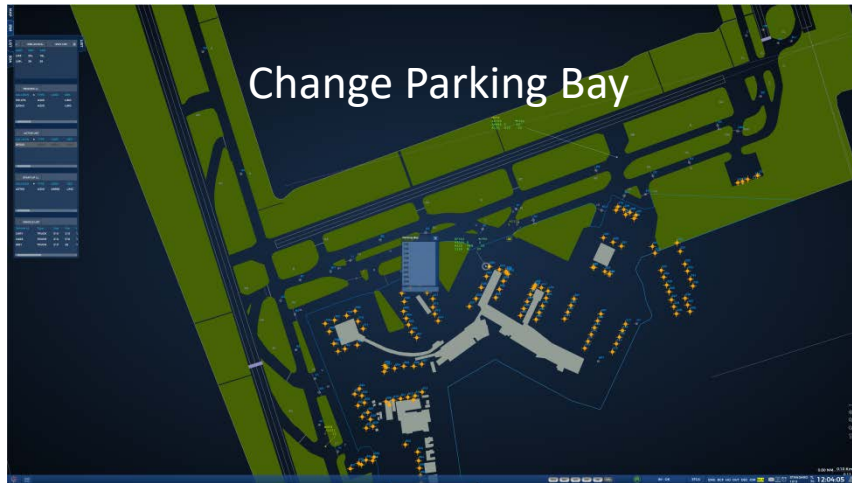


Taxi



GAINS Working Position

All order can be graphically performed

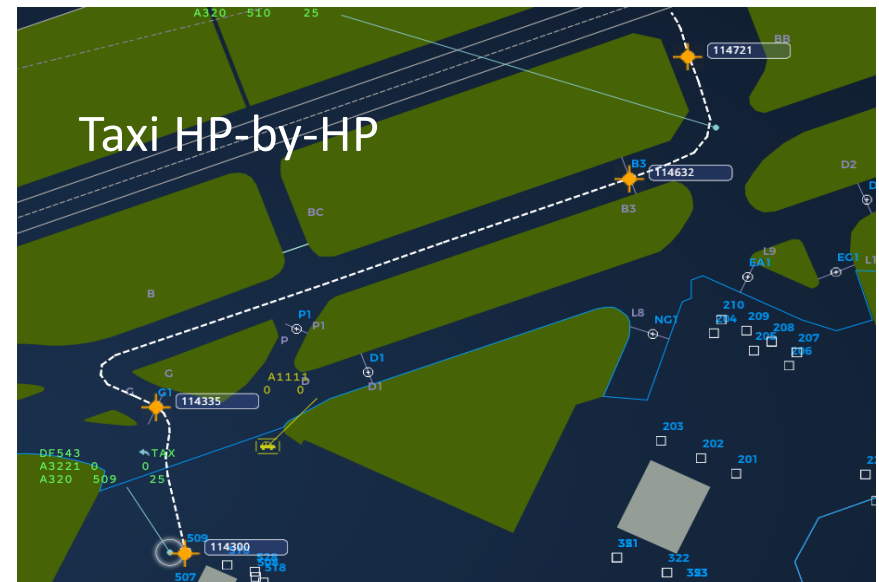
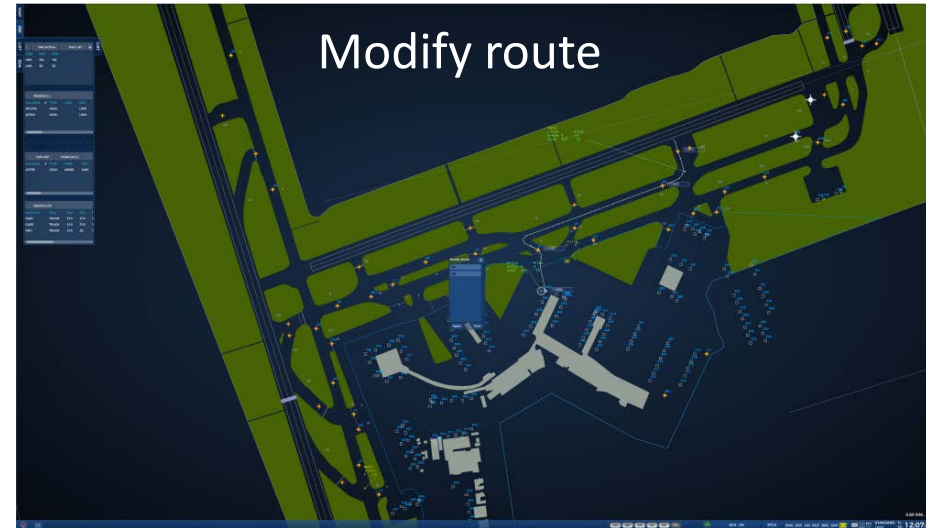


Open/close Segments



GAINS: Vehicle Management

- Vehicle management:
 - Proceed To
 - HOLD
 - Enter/Vacate Runway
 - TOW
 - Follow Me





GAINS SAFETY ALERT NET

- GAINS converts the three level of safety alert:
 - **Runway Monitoring Conflict Alert (RMCA)**
 - **Conflict ATC Clearance (CATC)**
 - **Conformance Monitoring Alert for controller (CMAC)**
- Safety alerts are available for all mobiles
- Different thresholds can be set for **L-VP and VP** procedure
- **Safety Alert** detects anomalous situations on ground, based on different kinds of inputs:
 - Surveillance data
 - Planning information (e.g. the taxi route computed by the Route Planning tool)
 - Inputs and orders received from the CWP (e.g. clearances)
- Alerting conditions depend from a number of parameters and thresholds set on mobiles behaviour, such as:
 - distances
 - speeds
 - times
- **Goals**
 - Increased level of safety felt by ATCO
 - Decreased pressure/workload felt by ATCO
- More than **200 types of alerts** can be configured
- Sound can be added for each alert

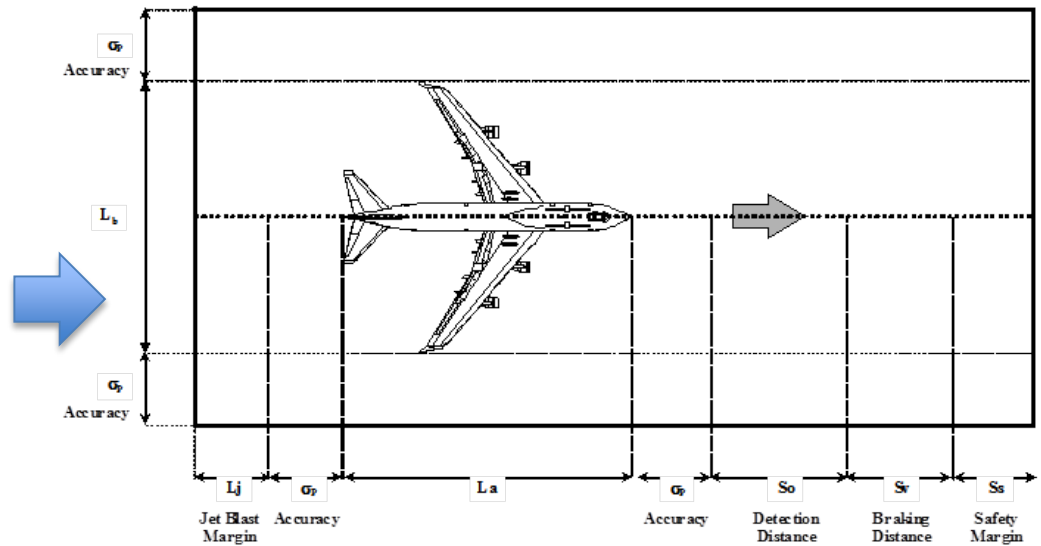
GAINS SAFETY ALERT NET

- **SCA** considers the airport as geometrically partitioned into several areas:
 - Runways
 - Taxiways
 - Movement areas
 - Approach cones
 - Line-up areas
 - Obstacle free zones
 - Crossings
- On each area SCA can be **selectively** configured in order to perform monitoring for conflicts via on-line application

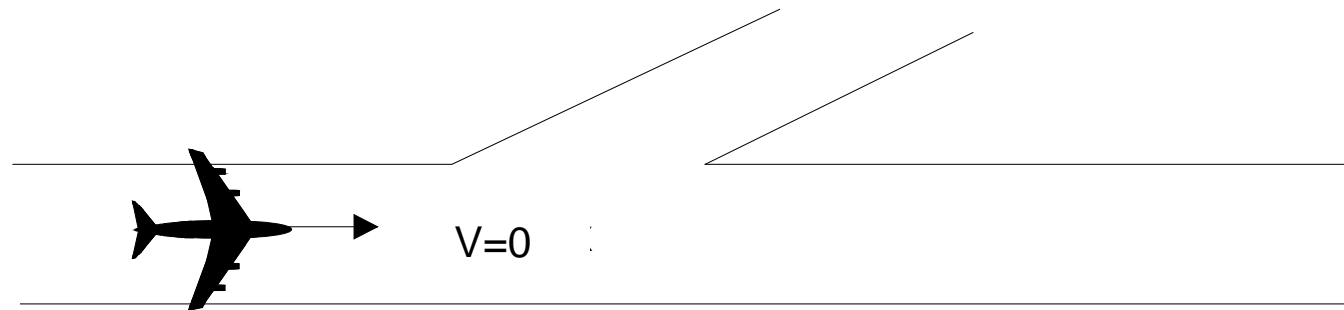


GAINS SAFETY ALERT NET

- The **SCA** computation engine is based on a mixed “time-based” and “distance-based” algorithm founded on the so-called “**safety bubble**”
- **Safety Bubble** depends from the **geometry** and the **cynematics** of the target itself



GAINS SAFETY ALERT NET: Examples



Max time stationary after takeoff clearance = 60 sec

Max time stationary (at the holding point) after lineup clearance = 60 sec

Max time stationary after taxi clearance = 60 sec

Max time stationary after pushback clearance = 120 sec

Stationary speed threshold = 2 kts (anyway, less than pushback and towing speed!!)

GAINS: Routing Service

- Routing service is handled for all mobiles (flights and vehicles)
 - Aircraft route: Parking Bay \leftrightarrow Runway
 - Vehicle route: from any airport know-point (HP, entry/exit-point, and PB)
- Routing function is based on the realization of a full graph of the airport based on:
 - Holding points;
 - Parking Bay;
 - Taxiways;
 - Entry/Exit Point
- Optimization is performed through the graph and the ground route is created as union of segments and Holding Point
 - ETO (Estimation Time Over) is provided on each HP along the ground route



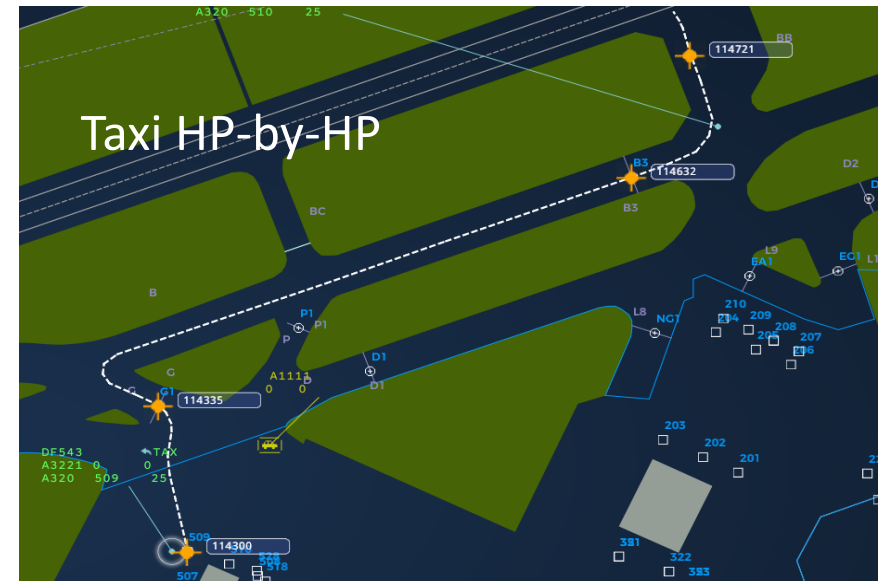
GAINS: Routing Service

- GAINS routing function can be set to have different target:
 - Minimize time
 - Minimize distance
 - Free-conflicts over HP
- Automatic **re-routing** functionality is implemented when mobiles divert from the planned route
 - Calculate a new route to reach the destination from its actual position




GAINS: Routing Service

- Route status:
 - Planned (dashed)
 - Cleared (continuous)
 - Reported
- Taxi Clearance can be provided step-by-step via Holding points
- Manual modify route can be graphically performed to change the proposed one



GAINS: Routing Service

- GAINS monitors the mobiles position and apply a **report function** each time they are close to a known points (e.g. Holding Point, Parking Bay, Entry/exit Point)
 - Report function does:
 - ETO updates along the route;
 - the remaining taxi-time calculation;
 - remove part of the cleared ground route already taxed.
- Ground route is **automatically re-calculated** each time that the segments closure action is performed
 - Re-opening or status change is detected and re-calculation is performed only for mobiles previously impacted from the new segment status;
- At Vehicle **"Vacate Runway"** order, GAINS automatically:
 - provides the close exit point from the current position;
 - Automatically calculate the ground route from the above exit point up to destination point;
- Each deviation from the nominal ground route is cautiously detected, and a new "best" ground route is generated to reduce the ATCO workload, as well as warning is raised to ATCO awareness

The background is a light gray gradient. It features several thin white lines: a single line descending from the top left towards the center, and two parallel lines ascending from the bottom left towards the top right, meeting the first line at a point near the center.

Thank you for your attention.