

*Si AMAN is an integrated component of the Si ATMSys product, but it can also be provided as stand-alone arrival management system as a complement to, or be integrated with other systems. It supports Air Traffic Control operations for En-route (ACC), Approach (APP) and Tower (TWR) control functions. It was first launched in 2011 and will be upgraded with new functionalities as defined and requested by the ATM community.*

### Objectives

Main objectives of the implementation of the AMAN product are:

1. To reduce overall controller workload which will be achieved because
  - There will be less multiple trajectory related information committed to controller memory
  - AMAN will provide recommendation of optimized approach traffic control tactics
2. To minimize delay in high traffic situations by
  - Reducing holding and low-level vectoring
  - Increasing runway throughput
3. To support continuous descent approach and thereby
  - Contribute to noise reduction
  - Allow user to fly preferred trajectories for reduction of fuel burn and emissions
4. To improve safety, flight efficiency and predictability

### Overview Functionality

The following functionality is included in the Si AMAN:

- Determine location of aircraft and trajectory to TMA entry point and runway
- Determine and present a landing sequence to the controllers
- Provide speed, altitude and route advisory to enable sequence making

### Tasks and operators

AMAN is an automated application that supports the planning and implementation of an optimized arrival sequence by en-route and approach air traffic controllers. Furthermore, AMAN provides a plan for runway use set by tower controllers, which can be used as input to mixed mode runway planning and take off sequences, or as demand input for gate and stand planning by the airport.

AMAN determines the demand of the runway(s) and determines the optimized sequence for each runway based on the airspace configuration, actual location and flight plan of each aircraft. Once the sequence plan is known, advisories to achieve the sequence are presented to the controllers to execute the sequence plan.

### ATC Functions

*Speed Advisory:* Based on the planned sequence and actual traffic situation detailed speed advisories per aircraft are presented to the controller

*Route Advisory:* Based on the planned sequence and actual traffic situation detailed route, altitude and vectoring advisories per aircraft are presented to the controller

*Controller HMI:* The HMI is window driven and adapts to the recommendations of EUROCONTROL concerning paperless HMI with extensive use of flight list and label interactions.

*Probe function:* The application offers to enter various constraints or scenarios without activating them, in order for the controller to anticipate consequences.

### Data Management

Based on surveillance and flight plan data, a detailed picture of the position and route of all inbound aircraft can be determined. Surveillance data is collected from local and adjacent radar stations, whilst flight plan is collected and updated with information from local and adjacent ACC sectors.

## Basic Elements

Basic elements of the AMAN concept are:

1. AMAN receives and processes FPLs with system trajectories for flights to the concerned aerodrome.
2. AMAN receives and processes system tracks from the multi sensor tracker.
3. AMAN uses system trajectories and track data to calculate the flights' nominal arrival times to build an estimated arrival sequence.
4. AMAN applies various optimization criteria and maintains the optimized sequence. The optimized sequence contains for each flight a target arrival time and an arrival slot, which constitute the overall arrival strategy.
5. For the implementation of the arrival strategy some flights need to lose or to gain time, to be displaced.
6. AMAN applies various tactics to displaced flights to build suitable trajectories, reflecting the determined strategy - these are termed the AMAN trajectories.
7. The AMAN trajectories may be accepted, or first modified and then accepted, by the planner.
8. At acceptance the AMAN trajectory replaces the system trajectory and it thereby becomes subject to all existing automatic and manual ATC functions.
9. For accepted trajectories within the AMAN advisory horizon AMAN produces and presents controller(s) with advisories. These are controller clearances or instructions to be executed in sequence, at specific times, while the flight proceeds along the trajectory.
10. AMAN uses track data to monitor the flights' progress along the trajectories in order to correctly time the advisories and to check the flight's possibility to meet their arrival slots.

## Main Operational Features

- The functionality supports ACC, APP and TWR operations
- Traffic situation can be shown as "planned sequence" in a time oriented window
- Flight plan data is presented and operator interaction is performed in lists and labels.
- The design of these HMI objects is to present only the required data, however, additional data is easy to retrieve, with a click of the mouse
- Lists and labels are specially designed to support control of the air traffic in a paperless environment.
- Each flight plan is dynamically updated based upon controller input of clearances/instructions given verbally or as part of CPDLC. Input facilities are available in any of the flight's HMI objects.
- Internal co-ordination is performed silently through system functions, including that co-ordination between controllers in TWR and APP.
- Coordination with adjacent units is performed by means of OLDI/AIDC where such connections are available.
- The dynamic handling of the operational configuration allows a highly flexible use of the airspace. Reconfiguration of sector jurisdiction is handled in a decentralised manner. The system supports on-line reclassification of sectors.

## Technical Features

### *Commercial hardware and software*

- COTS workstations with monitor(s), keyboard and mouse
- Fault-tolerant servers
- Redundant LAN
- Unix / Linux operating system
- X Window / Motif

### *General Design aspects*

- Client/server concept
- Open system architecture
- Distributed processing
- Fault-tolerant software



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