ATM Automation System

Role and Scope

LUO Yi,
Regional Officer, CNS
ICAO APAC Regional Office

Nanjing, China
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This presentation covers

- ATMS and ATM automation
- ICAO Provisions
- Transition to future

Background

- R&D on automation system
  - Since late 1960's
  - Surveillance data processing
  - Conflict detection and resolution advice
  - Human-in-the-loop (HITL)
  - Diversity, Event driven operations
  - Safety, efficiency and capacity

Equipment or Project

- A joint effort of users and equipment supplier incorporating local practices, constraints and optimizations
  - Not a procurement of a piece of COTS equipment
  - Challenging project practice focusing on engineering software to support critical mission through interactive process between stakeholders under strict restrictions.

Scope of Automation System

- Information centralization and information exchange
- Safety tool, Planning tool, Efficiency tool
  - Under interactive conditions
- Contingency fallback system
  - one of the biggest problems with automation system is that it can fail/mal-function

Expanding and blurred boundary

- AMAN, DMAN, A-SMGCS, SWIM, A-CDM, ATFM
- Airport safety nets,
- Flexible airspace management and free route airspace,
- Traffic complexity assessment,
- Initial trajectory information sharing.
- ……

input

- Radar
- ADS-B (ground/space based)/ADS-C
- MLAT
- Flight plan
- Weather
- Cooperative surveillance tool
- AIDC
- Datalink
- Aeronautical Info
- ……

- Surveillance Data Processing,
- Flight Data Processing,
- Electronic data displays,
- Electronic flight strips,
- Mode S down-linked airborne parameters,
- Safety nets such as STCA, MTCD
- Pre-Departure Clearance
- Arrival and Departure Manager,
- Time Based Separation support tools,
- Aeronautical Message Handling ~~Systems~~,
- Aeronautical Information Management,
- …

output

- Enhanced Situational awareness
- Improved capability for: safety, efficiency, capacity and environmental protection

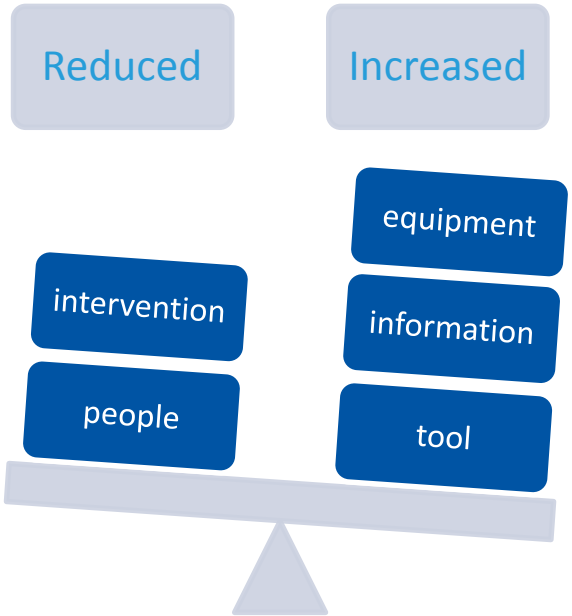
(By taking over many routine tasks, automation increases controller capacity and productivity)

Automation system

Automation Today

- The use of automation is limited to the provision of information / advice /alert to the controller, it does not make decisions. The controller remains decision maker in control.

Automation is a key component



Automation will continue to increase its role in the future of ATC.

Automation Tomorrow

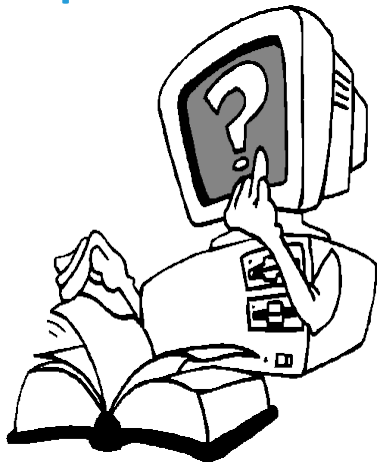
- Take most tasks and controller interventions as exception.
- Full automation will combine automated planning (and plan updates) in a look-ahead time horizon of up to several hours.
- The benefits are assumed to be significant improvement in overall operational safety, efficiency and capacity.

ICAO provisions

- Annex 2,4,10,11,15,19,…
- PANS ATM/OPS
  - Doc 4444,8168
- GANP Suite
  - Doc 9750,
  - Doc 9854, 9882, 9883
- Doc 7030, 9673, 9985,…
- APAC Seamless ATM Plan

Standard?

Specification?



ATM

- Air traffic management (ATM)*
  - The dynamic, integrated management of air traffic and airspace — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties.

*Doc 9854 Global Air Traffic Management Operational Concept

ATMS

- Air traffic management system
  - A system that provides ATM through the collaborative **integration of humans, information, technology, facilities and services**, supported by air and ground- and/or space-based **communications, navigation and surveillance.** (CNS/ATM)

Doc 9854

Operational Concept

- It describes how the air traffic management system will operate and identifies the services that will be required.
- A CONOPS portrays an ideal state in the future (2025), to be reached progressively through a number of discrete change steps from the current situation.

Architecture

- Architecture includes the (overall) infrastructure and a technical system description that includes specific technologies and personnel functions.
- **Architecture defines what specific technologies are implemented to deliver services, to be developed by planning and implementation regional groups (PIRGs) and States.**
- A CONOPS drives the architecture.
- For the global ATM operational concept, **2025** was selected as the point in which the majority of expectations described could be realized.

Doc 9854

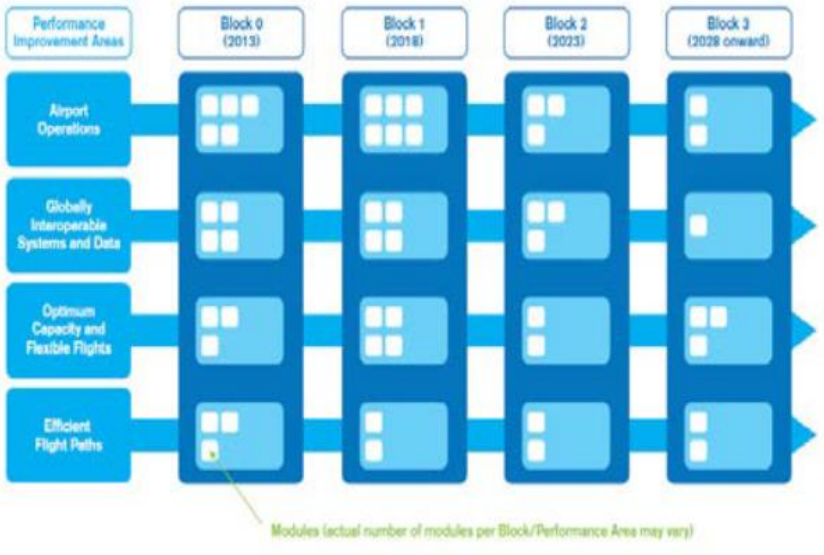
Concept of Use

- An ATM “concept of use” is a more detailed description of how a particular functionality or technology could be used.

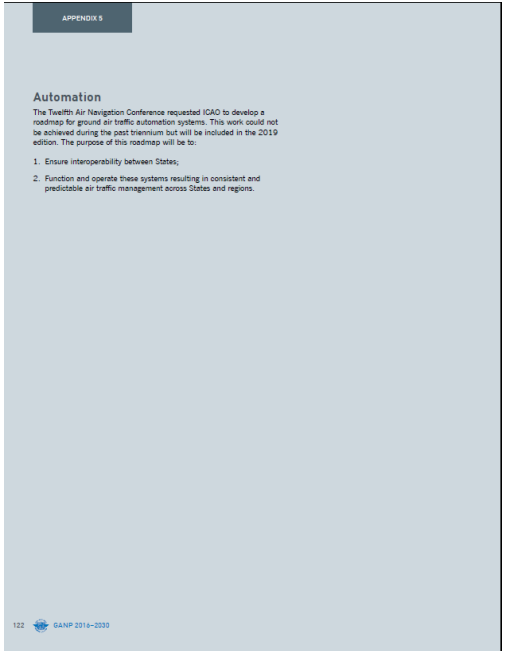
Doc 9854

Where is automation

- GANP
  - ASBU modules
    - Safety net?
    - Surveillance integration
  - Technology Roadmap
- TWR,APP,ACC,FOC, …



Automation in GANP Technology Roadmap



APPENDIX 5

Automation

The Twelfth Air Navigation Conference requested ICAO to develop a roadmap for ground air traffic automation systems. This work could not be achieved during the past triennium but will be included in the 2019 edition. The purpose of this roadmap will be to:

1. Ensure interoperability between States;
2. Function and operate these systems resulting in consistent and predictable air traffic management across States and regions.

122 GANP 2016–2030

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Regional Air Navigation Plan

- ICAO Doc.9673 Asia and Pacific Regions Air Navigation Plan (Regional ANP Vol. I & Vol. II)
- In Vol. I, **regional policy** on surveillance is specified:

Planning of aeronautical surveillance systems should be made based on a **system approach concept**, where collaboration and sharing of data sources should be considered in support of an **efficient use of airspace**.

Regional Air Navigation Plan

- In Vol. II, the **required surveillance infrastructure** is detailed under Table CNS II-APAC-3, Surveillance.
  - Column 4: Integration of Surveillance Information into **ATC Situation Display**
  - Column 5: **Multi-Surveillance Data Processing** Capability
  - Column 7: Level of A-SMGCS Implemented

APAC Seamless ATM Plan V2.0

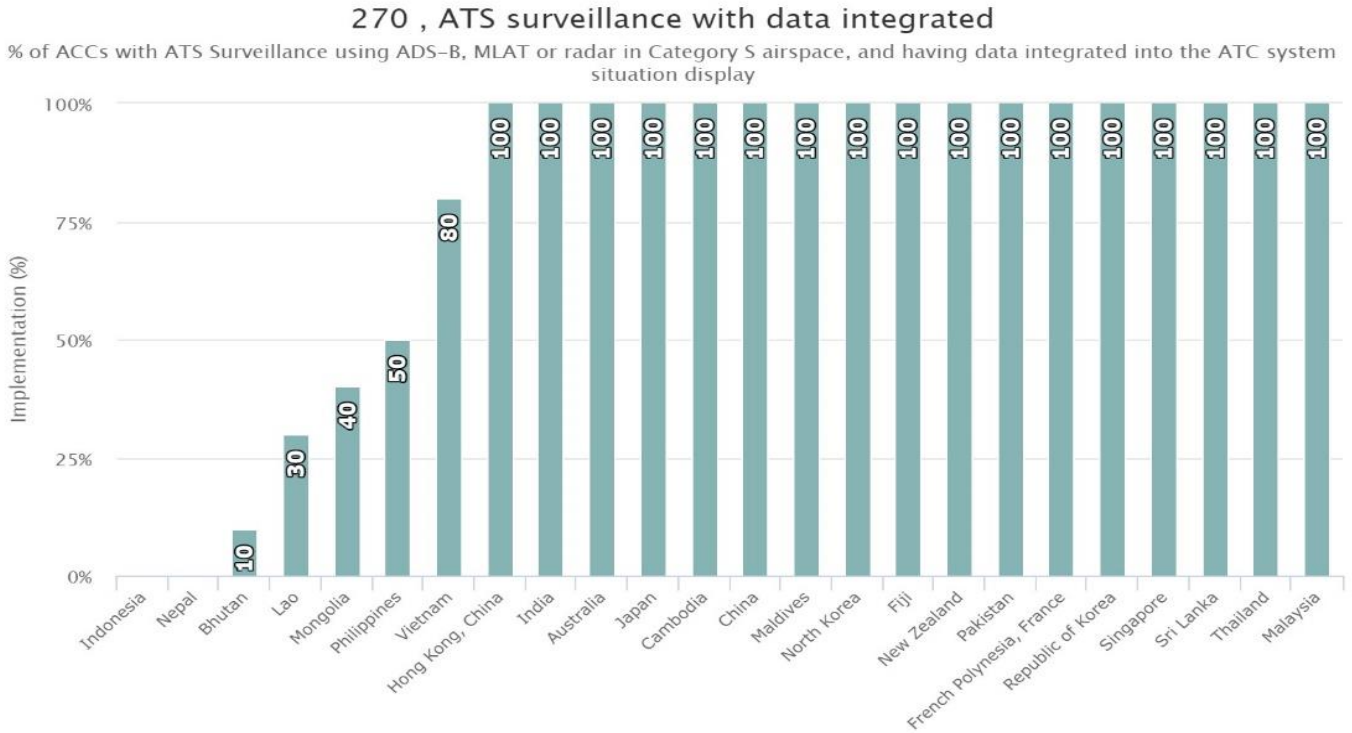
- Many indications about automation
- Regional priorities
- Seamless ATM principles

Supporting Seamless ATM Planning Objectives

ADS-C, CPDLC	B0-TBO
Strategic Civil Military coordination	Regional
Tactical Civil Military coordination	Regional
ATS surveillance with data integrated	B0-ASUR
ATS Inter-facility Data-link Communications (AIDC)	B0-FICE
Civil Military use of Special Use of Airspace (SUA)	B0-FRTO
Approaches, including PBN	B0-APTA
Air Traffic Flow Management/Collaborative Decision-Making (ATFM/CDM)	B0-NOPS
ADS-B airspace	B0-ASUR
Aeronautical Information Management (AIM)	B0-DATM

Automation

Monitoring Implementation



Seamless ATM Principles

- Facilities：
  - ATS Units
    - 15. Collaboration by ANSPs for **evaluation and planning of ATM facilities**.
    - 16. Optimization of ATM facilities through amalgamation and the use of technology, including **automation,** satellite-based systems and remote facilities.

Seamless ATM Principles

- Technology and Information:
  - ATM Systems and Safety Nets
    - 31. Ground-based safety nets (such as APW, STCA) and MSAW.
    - 32. …**Inter-facility** Flight Data Processing System capability. 33. CDM, ATFM, AMAN and DMAN tools. 34. Digital ATIS and VOLMET 35. air traffic **data sharing between military/civil ATM systems**

Seamless ATM Principles

- Technology and Information
  - ATM Modernisation Projects
    - 36. **Inter-regional cooperation** (‘clustering’) for the research, development and implementation of ATM projects.
    - 37. A focus on technologies **for earliest deployment and best cost benefits**

Evolutionary Implementation

2005 → Requirements in GANP suites → 2025 (2030)

- Performance based approach in steps
- Formulate Regional and National ANPs
- Continuous Investment
- Training
- Business continuity (contingency plan)

Transition to future

- Participating and contributing in ICAO meetings/ symposium
- Early improvement in operational safety, efficiency, capacity and environmental protection
- Initiating city-pairs joint trials
- Experience sharing for future
- Today is a beginning

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THANK YOU