Trajectory-Based Operations (TBO)

Workshop on preparations for ANConf/12 – ASBU methodology
(Mexico City, 27 February-2 March 2012)
OVERVIEW

- Context
- Baseline
- Concept
- Applicability
- Capabilities
- Why TBO
- Procedures
- Checklist
- Dependencies
Context

- Traffic Synchronisation
- CM and DCB integrated
- Organized flow of traffic
- Flexible capacity management
- Adjustments in capacity to variations in demand
- Delegation of separation to flight deck reducing ground system workload
- Information rich environment.
Baseline

Information rich environment

People
- Management
- Communications
- Navigation
- Surveillance

Systems
- Aerodrome Operator
- ATM Service provider
- Aircraft operations
- Maintenance Engineering
- Airspace User
- Conflict Management
- Airspace organization and Management
- ATM service delivery management
- Traffic synchronisation
- Demand capacity balancing
- Airspace user operations
- Aerodrome operations
Baseline

• Shared four-dimensional trajectory
• Up-to-date information system wide
• Decision support tools
• Global ATM decision-making
• Procedures and automation capabilities, both ground-based and aircraft-based
• Accurate trajectories to benefit the system.
The Paradigm Shift

**Past**
Procedural
*Estimate the current and planned a/c positions*

**Today**
Radar
*Know the current and estimate planned a/c positions*

**Future**
Trajectory
*Know & share the current and planned a/c positions*
Concept

• 4 dimensional continuum flight path based on points in time from gate-to-gate

• Ability of cockpit automation to fly the aircraft more precisely and predictably reduces routine tasks of controllers.
Applicability

- Air traffic flow planning
- En-route operations
- Terminal operations (arrival/departure)
  - aircraft equipage is assumed in the areas of:
    - ADS-B/CDTI
    - data communication and advanced navigation capabilities.
Capabilities

- Advance Aircraft Capabilities
- Problem Detection and Resolution
- Traffic Flow Management and Time-Based Metering
Capabilities

4D FMS Trajectory Downlink
October 19th, 2005 – Stockholm to Oslo
Scandinavian Airlines B737-600NG
Flight SK495
Why TBO

• Greater capacity

• Better efficiency

• Improved safety

• Reduced fuel burn and CO2 emissions
Why TBO

• Increased flexibility

• Better predictability

• Leverages the best of the ground automation and the performance of the aircraft.
Procedures

• Use of ADS-B/CDTI

• Other cockpit capabilities to support aircraft avoidance

• Is still a research topic and will necessitate procedures development

• Including the roles of ANSPs
Procedures

• Decision support automation

• Automation-to-automation negotiation

• Information on accurate trajectory
Procedures

• Human Factor Considerations

• Training and Qualifications Requirements

• Regulatory/Standardisation needs and Approval Plan (Air & Ground).
Checklist

- Standards Readiness - 2025
- Avionics Availability - 2028
- Ground Systems Availability - 2028
- Procedures available - 2028
- Operations Approval - 2028
Main dependencies

- Data Link En-Route
- Free routing
- FF-ICE
- Traffic Synchronization..
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