



AIR NAVIGATION SERVICES OF SWEDEN

SDM Workshop on Free Route Airspace

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AGENDA



- ✓ Evolution of Free Route Airspace in Sweden
- ✓ Best practices on ATM system evolution,
 - The need to update systems for FRA, including what is missing in legacy systems;
- ✓ Tool support,
 - What will be required to support FRA;
 - Conflicts/Trajectory predictions incl. FF-ICE;
 - Complexity.
- ✓ Interoperability,
 - The need for systems to communicate with each other, i.e information exchange on FRA stopping at ACC or National borders;
- ✓ Advanced Flexible Use of Airspace.

Evolution of Free Route Airspace in Sweden

- ✓ 2000 Eight State Project
- ✓ 2006 PM
- ✓ 2007 FRA Project
- ✓ 9th of April 2009 FRASweden Phase 1 (only overflights north of 61° N)
- ✓ 6th of May 2010 FRAS Phase 2 (only overflights)
- ✓ 16th of December 2010 FRAS Phase 3 (overflights and arr/dep north of 61° N)
- ✓ 5th of May 2011 FRAS Phase 4 (all traffic with a planned trajectory above FL285)
- ✓ 17th of November 2011 DK-SE FAB FRA (all traffic with a planned trajectory above FL285)
- ✓ 11th of March 2013 Declaration of Commitment for Cooperation in Airspace Development between the Governments of Denmark, Estonia, Finland, Latvia, Norway and Sweden
- ✓ 23rd of June 2016 DK-SE FAB FRA – NEFAB EAST FRA
- ✓ 25th of May 2017 NEFRA
- ✓ 25th of April 2019 Open BRDR DK-SE FAB – KUAC H24 & MUAC evenings/weekends
- ✓ 5th of December 2019 Open BRDR DK-SE FAB – MUAC H24
- ✓ Q4 2020 – 2024+ Borealis FRA UK (4 steps)

Best practices on ATM system evolution

The need to update for FRA, including what is missing in legacy systems

LFV – background

- ✓ Even before starting to implement a FRA LFV had a fairly advanced system with functionality supporting FRA.
- ✓ Over time as the FRA concept has evolved system enhancements have, where required, been added to meet the developed FRA concept.



Best practices on ATM system evolution

The need to update for FRA, including what is missing in legacy systems

Key success factors;

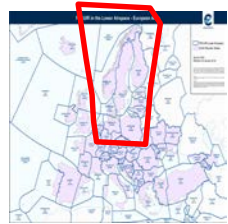
- ✓ Large Flight Plan System Area
- ✓ Collaborative trajectory distribution of flight data internally to sectors, and trajectory exchange to/from adjacent AoRs via OLDI based on actual route and level.
- ✓ Inter-sector interoperability – automation and silent coordination
- ✓ MTCD (Medium Term Conflict Detection) – not only used as planning but also as “TCT” (Tactical Controller Tool)
- ✓ OLDI functionality adaptable to meet individual adjacent centres’ capabilities

Best practices on ATM system evolution

The need to update for FRA, including what is missing in legacy systems

Key success factors in more details;

- ✓ Large Flight Plan System Area – to cover at least own AoR + adjacent AoRs + significant points used for DCT further away to allow automatic processing of AFTN and OLDI messages
- ✓ Silent coordination - SYSCO (System Supported Coordination) – inter-sector
- ✓ OLDI
 - floating COPs (coordination points) for horizontal or vertical entry/exit
 - entry level handling for robust processing and correct posting of flight data based on trajectory and parameters
 - Processing of "Route" in OLDI messages – transmission/reception (Annex B – OLDI spec.)
 - Processing of flight routes on a direct track, off route, across the boundary as the result of a tactical direct route segment filed or in the flight plan.
 - Processing of a direct track to rejoin the original route at a later point.
 - Adapt your system to send in OLDI what your neighbours require
 - Possibilities to adapt own system to only use required data



Tools support

What will be required to support FRA; Conflicts/Trajectory predictions incl. FF-ICE.

- ✓ Operator tools to update trajectory to match tactical clearances
- ✓ Presentation of trajectory as flight leg in ASD (air situation display) together with MCTD information
- ✓ MTCD – based on current clearance and information;
 - Current position
 - Current route
 - CFL (cleared flight level)
 - XFL (exit flight level - contract between downstream sector/AoR)
 - ETO (estimated time over) calculation based on speed coming from radar.
- ✓ Probe
 - Possibility to test clearances
- ✓ Segregated Area Probe
 - Conflict detection with areas
- ✓ Monitoring aids:
 - RAM (Route adherence monitoring)
 - APW (Area proximity warning)
 - AIW (Airspace intrusion warning)



Interoperability – Inter-sector.

The need for systems to communicate with each other, i.e. information exchange on FRA stopping at ACC or National borders

- ✓ Inter-sector ~ the SYSCO concept.
 - Sharing of data
 - Silent negotiations (exit/entry levels, route, DCT)
 - Transfer & Release
 - SKIP
 - MIL coordination support

Interoperability – Inter-AoR.

The need for systems to communicate with each other, i.e. information exchange on FRA stopping at ACC or National borders

High level of automation – automatic message handling – pass rate >98%

✓ OLDI – inter-AoR

- ABI (Advanced boundary information), ACT (Activate message) , REV (Revision message)
- Exchange of Route information in ABI/ACT/REV
 - To support neighbours' needs and capabilities definition of types of route and/or formats **to protect own route** where required and to **serve adjacent AoR with the requested type of route.**
 - Full route sending
 - Partial route sending – send route from a point on the route a parameter before exit COP; do not distribute, e.g. SIDs, to downstream AoR
 - Partial processing of received route (to only use part of the received route, e.g. to a DCT point to protect STAR allocation)
- FPL creation based on OLDI message in case of missing FPL.
- Transfer messages (COF (Change of Frequency) & release information/TIM (Transfer initiation message)/MAS(Manual Assumption of communication message)/ROF (Request on Frequency message))
- OLDI message LOF (Log-on Forward message) & NAN (Next Authority Notification message) for CPDLC (Controller-Pilot Data Link Communication)

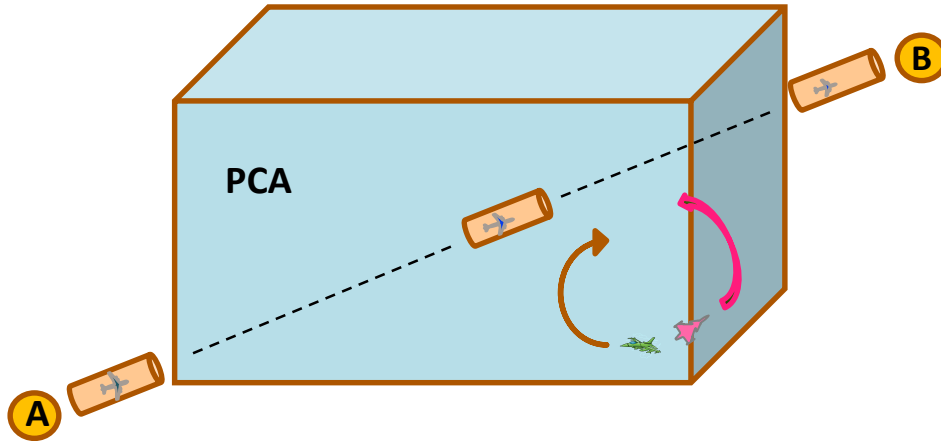
Interoperability - NM

Airborne Trajectory updates;

- ✓ AFP (ATC Flight plan Proposal)
 - Automatic transmission based on FPL creation
 - Manual sending based on significant route updates, diversion, etc.
- ✓ ACH (ATC Flight plan Change)
 - Automatic processing of ACH messages
 - Manual ACH processing or automatic flushing of messages after first OLDI message reception

Advanced Flexible Use of Airspace

- ✓ One integrated ANS provider for both Civil and Military aviation (since 1978)
 - LFV is the ANS provider for both civ and mil aviation. Peacetime, crises up to war.
 - SwAF puts requirements and has agreements with LFV
 - The SwAF has no own Mil ATC-personnel
- ✓ Airspace Structure
 - PCAs & TRAs
 - Move from CDR1/2 to Single CDR Category (implemented 25th of April 2019)
- ✓ Coordination procedures ATCO – Fighter Control
 - Fighter Control allowed provide separation between their OAT from penetrating coordinated GAT (OAT) in Class C airspace
 - Priority rules (Agreed route extension is 10 NM with a maximum of 20 NM in total)



Coordination from A to B

Military priority,
except when civil on ATS route

Separation to a "moving"
Airspace volume; border by
Fighter Controller

(Tactical) Coordination ATS-Mil.

Communication with civil a/c
via ATS (never Fighter controller)

