Airborne Integrated Systems for Safety Improvement,
Flight Hazard Protection and All Weather Operations

FLYSAFE FORUM N° 01 Situation Awareness, Conflict Detection & Resolution

27 – 06 – 2006
EUROCONTROL Brussels

Vision on 2020

- **Air traffic will more than double or even triple in the next 20 years**
- **Ambition of Vision 2020 is that increased traffic will not be accompanied by increased accidents, meaning …**

  … the performance of safety-related systems and procedures must be tripled in the 20 years
- **This improvement must be achieved with :**
  - **All weather operation**
  - **Operation at airports 24 hours per day**
  - **99 % of flight departing within 15 min of schedule**

To resolve a conflict it must be detected

Different points of view (1/2)

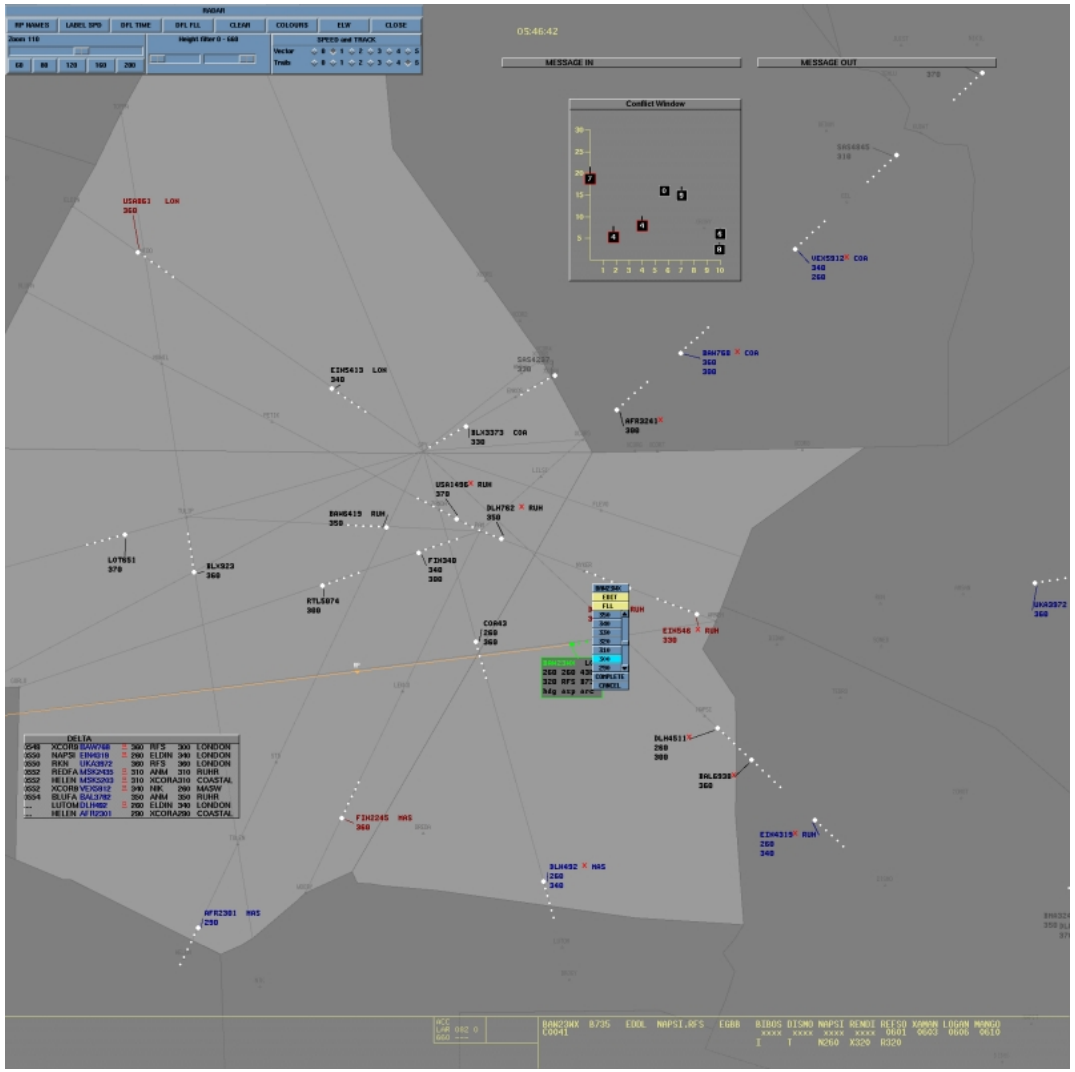
- Identifying potential conflicts requires Situational Awareness
  - ATCO and Flight Crew have different perceptions & tasks
  - FLYSAFE will treat Weather, Traffic and Terrain conflicts integrated

- Information ATCO and Flight Crew different
  - Weather & Traffic picture not shared; “atm” & “on board” sensors
  - Terrain issues not always handled standard by ATC
  - Crews read RADAR MINIMUM ALTITUDES from often complicated chart info; ATCO can display these on screen.
  - Developments in terrain presentation at the flight deck:
    - Till 1995 Nothing at all
    - Now TAWS
    - Future Simulated outside view on parts of EFIS
      - Data base generated
      - Smart sensors as inputs

Different points of view (2/2)

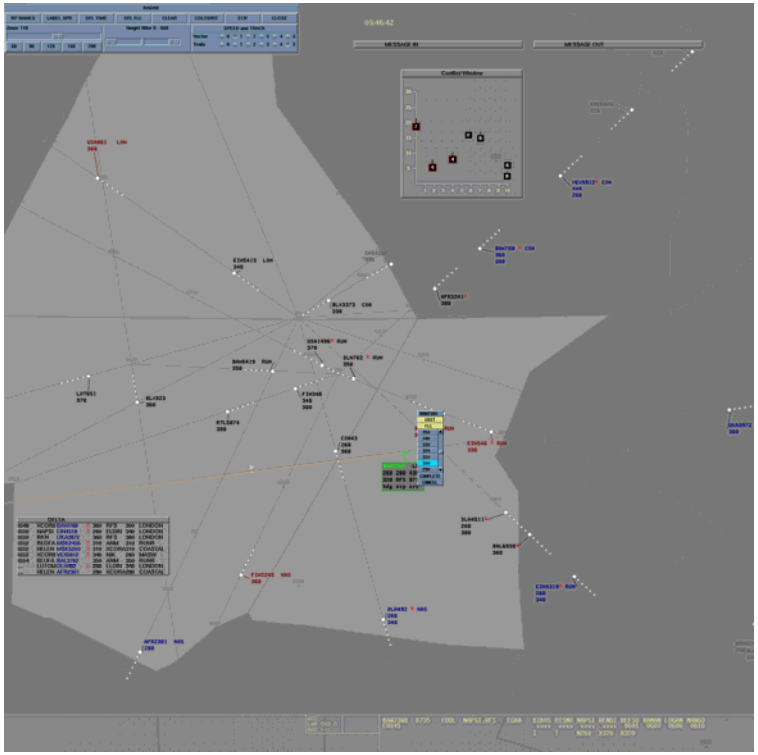
- Weather and atmospheric information now partly shared ATCO/Flight Crew
  - Routine weather and atmospheric data can be hours late
  - ATCO & Flight Crew use different sensors
  - Weather Information Management Systems [WIMS] will provide shared:
    - Information about CB, CAT, Wake Vortex and Icing & Routine data
    - Available for ATCO and Flight Crew (via datalink)
- Traffic Information
  - ATCO & Flight Crew traffic pictures are very different
  - ATCO & Flight Crew tasks are very different
- Terrain & Obstacle Information
  - ATCO works in the “same” environment
  - Flight Crew works in different environments
- Conflict resolution at more than 3 minutes ahead currently only possible for ATCO

Traffic Situation: Controller's picture is complex



Traffic Situation: Flight Crew picture even with add on's relatively simple

Traffic Situation
Controller's versus Flight Crew picture



EUROCONTROL's European Safety Programme

- **European Safety Programme [ESP] runs in 2006-2008.**
- **5 fields have been chosen having the best potential for short term improvements in the ATM contribution to the safety of flight operations.**
  - **Field 1: Implementation and Support of European Safety Legislation / Regulation**
  - **Field 2: Incident Reporting and Data Sharing including amongst other things "Just Culture"**
  - **Field 3: Risk Assessment & Mitigation in Day – to Day Operations**
  - **Field 4: System Safety Defences covers airborne and ground-based safety nets**
    - **Remaining work on RA downlink feasibility (FARADS)**
    - **Survey of best practices In Safety Nets (SPIN)**
  - **Field 5: Safety Management Enhancement**
    - **State – of – the – art Safety Management Systems (SMS) and best practices development.**

ESP / FLYSAFE common ground?

- **EUROCONTROL Field 4: System Safety Defences**
- **Common international standards for working with safety nets in ATC?**
- **<u>Air & Ground Safety Nets act independently</u>**
- **Coordination of safety net actions (ATM/ on board) just initiated, e.g. ACAS RA downlinking, see Eurocontrol FARADS**
  - **Information provision Air to Ground only**
    - **Is this sufficient to ensure safe operations?**
  - **Are other activities needed to achieve the goals?**
    - **What contributions are expected by EUROCONTROL from**
      - **Air Navigation Service Providers (also outside greater Europe)?**
      - **Operators, airframers, avionics manufactures or others?**
      - **Consortia like FLYSAFE?**

Airborne Safety Nets for Weather, Traffic & Terrain

- Operational Procedures
- Safety Nets Flight Crew
  - Weather
    - ATIS and standard weather information (from charts)
    - Predictive & Reactive Windshear Warning and Escape guidance
    - WXR
  - Traffic
    - Standard R/T ('party line' effect)
    - looking out of the window (for runway incursion prevention)
    - ACAS
  - Terrain
    - Terrain and peak altitude depiction on charts
    - TAWS

Potential pitfalls

- **Terminology not shared**
- **Situational awareness not shared**
- **Time Span Aspects**
- **Conflict Detection not shared**
- **Conflict Resolution not coordinated**

Strategic versus Tactical

flight deck viewpoint / fuzzy

	Strategic		Tactical	
Criteria Elements	"Planning-like task"	"Executive-like task"	Tactical Manoeuvre	Safety Net
Key words	Information only	Awareness	Immediate Awareness	Immediate Action
Time	>= 25 min.	25 min - 3 min.	3 min – 30 sec.	< 30 sec.
Alert levels	0, Information	1, Advisory	2, Immediate Attention	3, Immediate Action
"Natural" Ctl.	FMS	FMS or AP	AP or Manual	Manual
Abruptness	=< 0,05 G	=< 0,05 G	=< 0,15 G	Up to 0,5 G
Bank Angle	=<5 deg.	=<10 deg.	=<25 deg.	>25 deg.
Example	Rerouting	Small heading change	Unplanned level off	TAWS mode 1

How can FLYSAFE development assist to enhance System Safety Defences

- FLYSAFE has the intention to develop equipment allowing
  - Sharing up to date information between AOC, ATM and flight crews
  - Improved situational awareness
  - Timely decision making by all parties, including the crew members
  - Early conflict detection and conflict resolution
- What can FLYSAFE do in developing a Next Generation ISS and WIMS?
- Did we miss important aspects?

TCAS example of assumed reactions

- Monitor Vertical speed scenario:
  - For TCAS to properly function, initial vertical speed response is expected
    - Respond within 5 seconds of an RA
    - with G forces similar to clearance to climb or descend "immediately," approximately ±0.25 G change in load factor.

- Increase or reversal RA manoeuvre scenario:
  - For TCAS to properly function, initial vertical speed response is expected
    - Respond immediately within 2-1/2 seconds of issuance of the advisory
    - With G forces of approximately ±0.50 G change in load factor.

- In the case of conflict between ATC clearance and RA, follow RA advisories and advise ATC.

Radar Minimum Altitudes

- **Descriptions called describe the same thing :**
  - IFR Minimum Radar Section Altitudes
  - Minimum Vectoring Altitudes
  - IFR Minimum Vectoring Altitudes (MVA)
  - Minimum Area Altitudes

  ***Reason is that originators (countries) provide these different terms*.**

- **Since 2002 Jeppesen uses “RADAR MINIMUM ALTITUDES” as the chart type identifier.**

- **These charts are not for navigation purposes**

- **Flight crews may monitor radar-vectoring altitudes assigned by radar controllers**