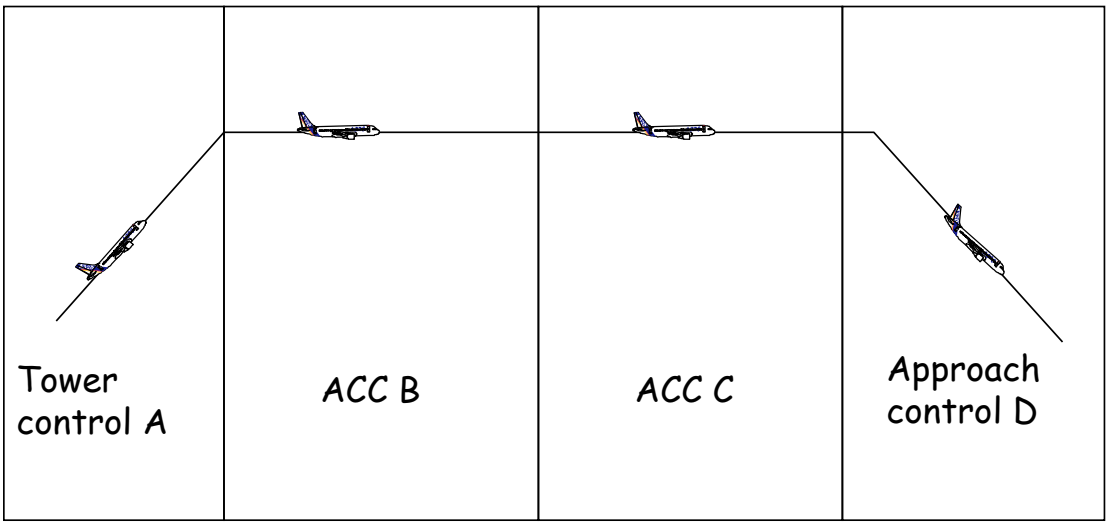
Resilience in Air Traffic Management

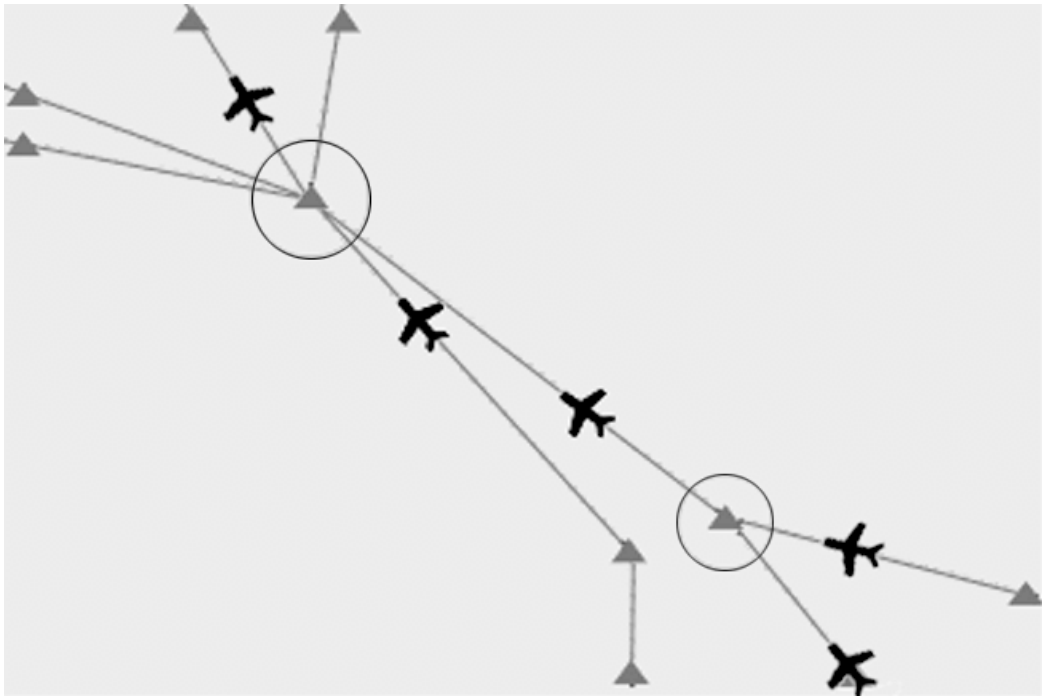
Alberto Pasquini – Deep Blue

A few words about ATM - I

Assistance for the whole duration of the flight



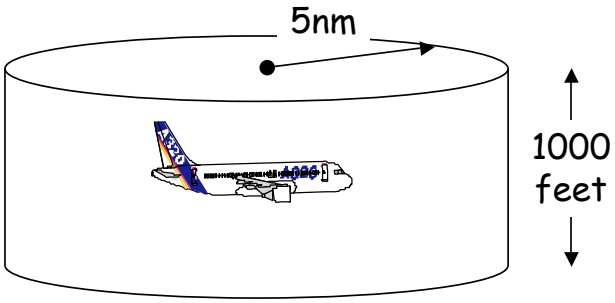
A few words about ATM - II



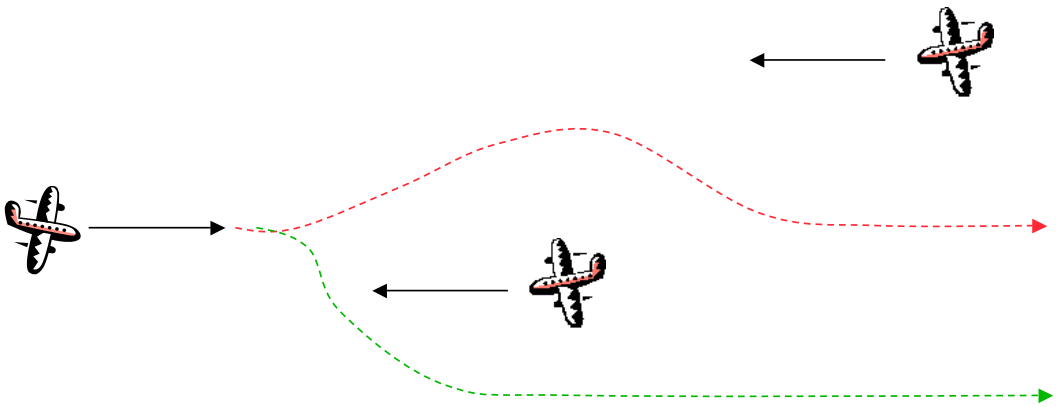
The human role in ATM

Predominant Human Role (and responsibility), supported by well structured rules and procedures, graphic presentation tools, conflict detection tools

Separation between aircraft



Optimisation of the problem



In Summary - I

Air Traffic Management (ATM) is a set of services provided by ground-based Air Traffic Controllers to ensure:

- → separation between aircrafts, preventing them from coming too close to each other horizontally and vertically
- → flow of traffic, providing information to the pilots (routes to waypoints, weather conditions, etc.)

In Summary - II

Services based on human activity with central role of the controller, and stringent requirements concerning:

- → Reliability
- → Safety
- → Security
- → Availability

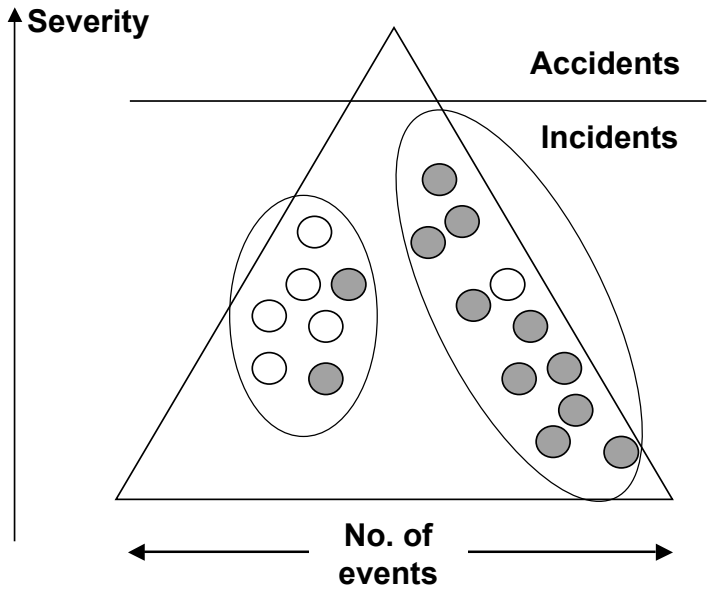
Resilience in ATM

- → Limited interaction with external world (data provided by radars serving a local community of controllers)
- → Human at the centre of the decision process, with limited role of automated system
- → Current safety problems mainly due to human errors, air-ground communication problems and degradation of technical and human services combined with adverse atmospheric conditions
- → Limited security problems (in ATM only)

Safety performances in ATM - ECAC States - Year 2002

Number of FATAL ACCIDENTS	92
Number of TOTAL fatal injuries	162
Number of CREW fatal injuries	94
Number of PASSENGERS fatal injuries	63
Number of THIRD PARTIES fatal injuries	3
Number of FATAL ACCIDENTS where ATM was identified as having DIRECTLY contributed	0
Number of FATAL ACCIDENTS where ATM was identified as having INDIRECTLY contributed	1

Safety Reporting



Safety reporting in ATM - ECAC States - Year 2002

Total Number of Reports	17692
Total Number of Reports Investigated	2828
AIRPROX Report	706
TCAS Report	992
TCAS FALSE RAs	107
Number of FATAL ACCIDENTS where ATM was identified as having DIRECTLY contributed	0
Number of FATAL ACCIDENTS where ATM was identified as having INDIRECTLY contributed	1

However ...

Two accidents with ATM contribution in recent years (1 direct and 1 indirect)

Milano Linate in 2001

Uberlingen in 2002

ATM as evolving system

Maintenance

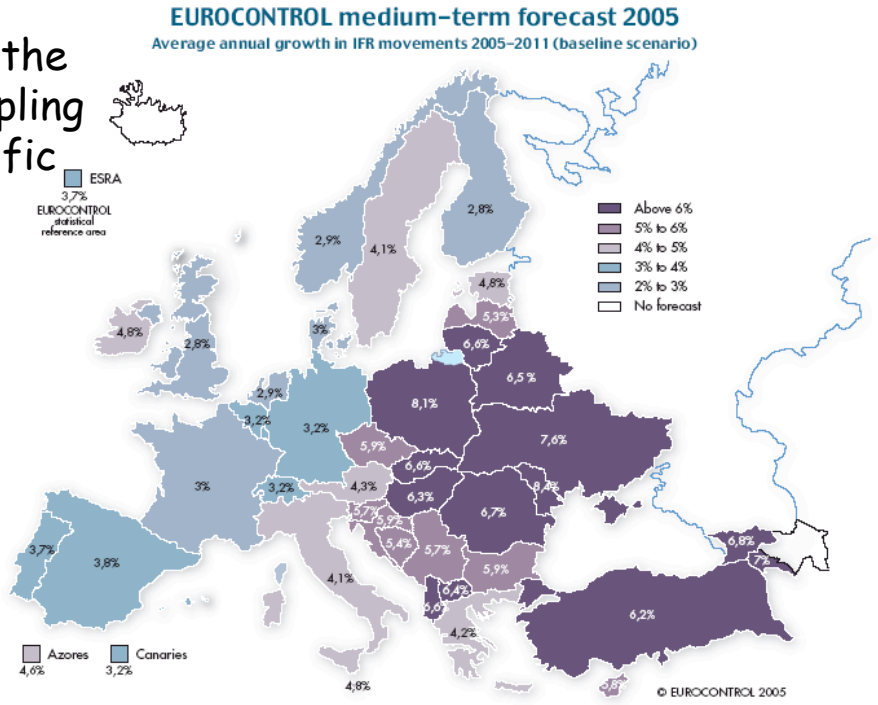
Procedures different from practices

Transitions

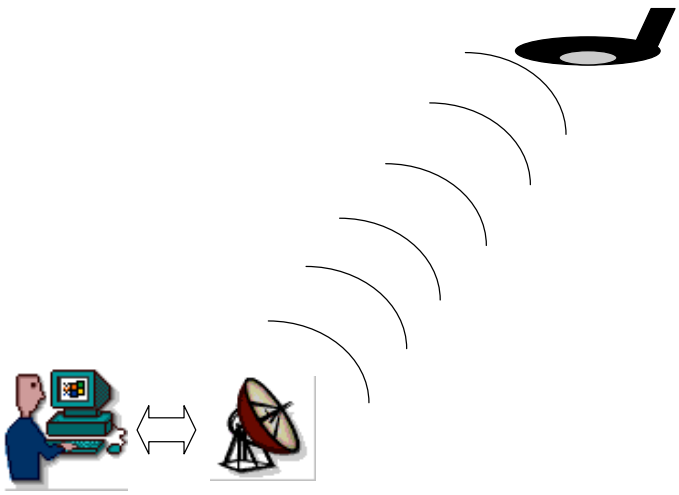
Evolutions of the environment (e.g. aircraft performances, traffic growth)

Challenges of the future – Traffic growth

However, there is the problem of de-coupling accidents and traffic growth



Challenges of the future – The current system



Challenges of the future – The future system

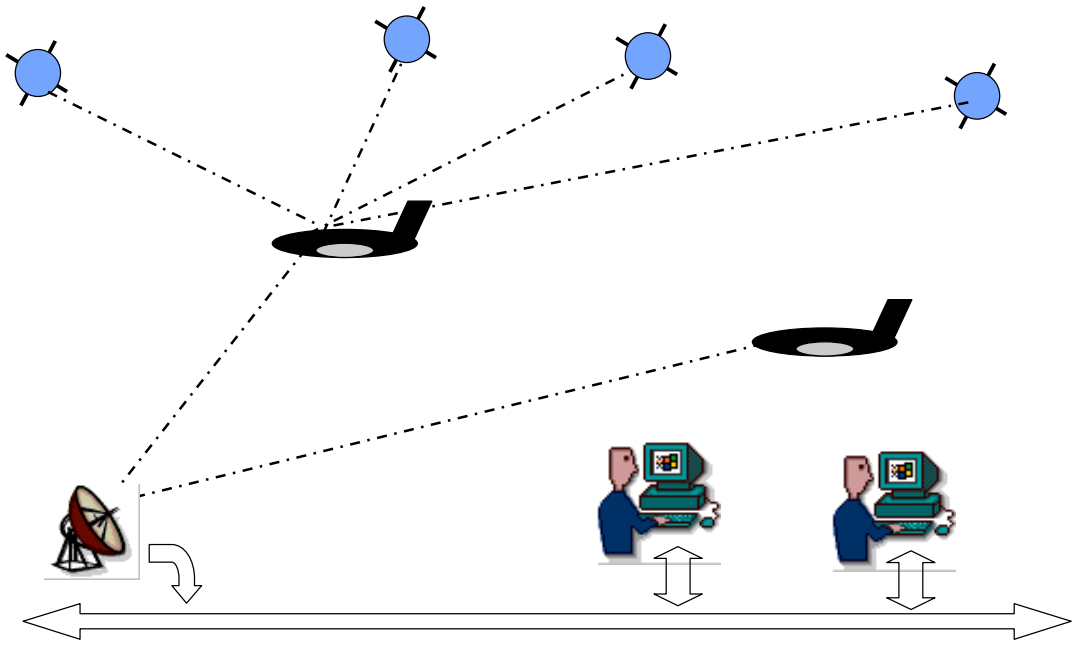
→ Increase in automation to face growing capacity demand

→ Increase in data exchange between aircraft and ground and between ground centres, due to new systems, equipments and ATM strategies

→ Growing concern for both dependability and security aspects

→ Limited awareness of problem and possible solutions between Providers of Air Traffic Services.

Challenges of the future – The future system



Eurocontrol and EU investements on:

- Safety learning in support of design of new systems
- Target setting and apportionment
- Tolerance of degraded mode operations
- Downlink to controller of TCAS information
- Improvements and further evolution of airborne and ground-based safety nets
- Managing complexity in safety assessment
- Measure and advance safety culture

A Case Study

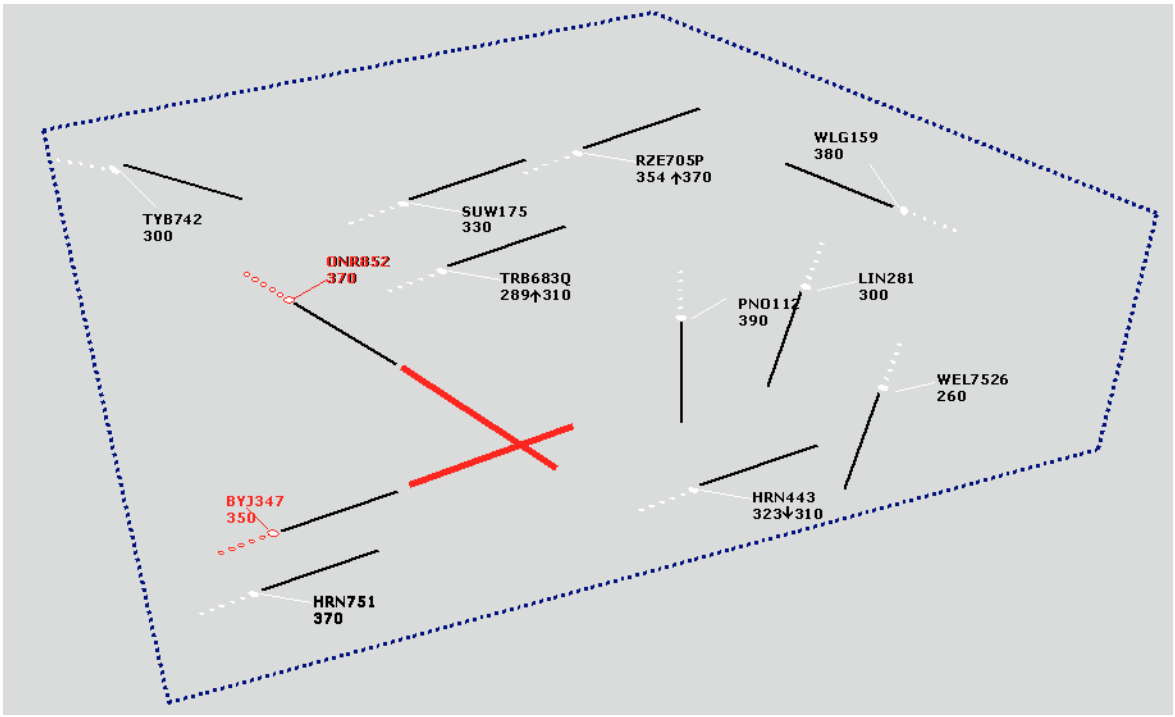
The Short Term Conflict Alert (STCA)

Actions following the Uberlingen accident

As a result from the investigations about the Uberlingen accident a set o initiatives started to improve the features and practice of use of the ground based safety nets and in particular of the STCA

Deep Blue was responsible of a survey about the current adoption and use of the STCA and is participating to the related actions for its improvement

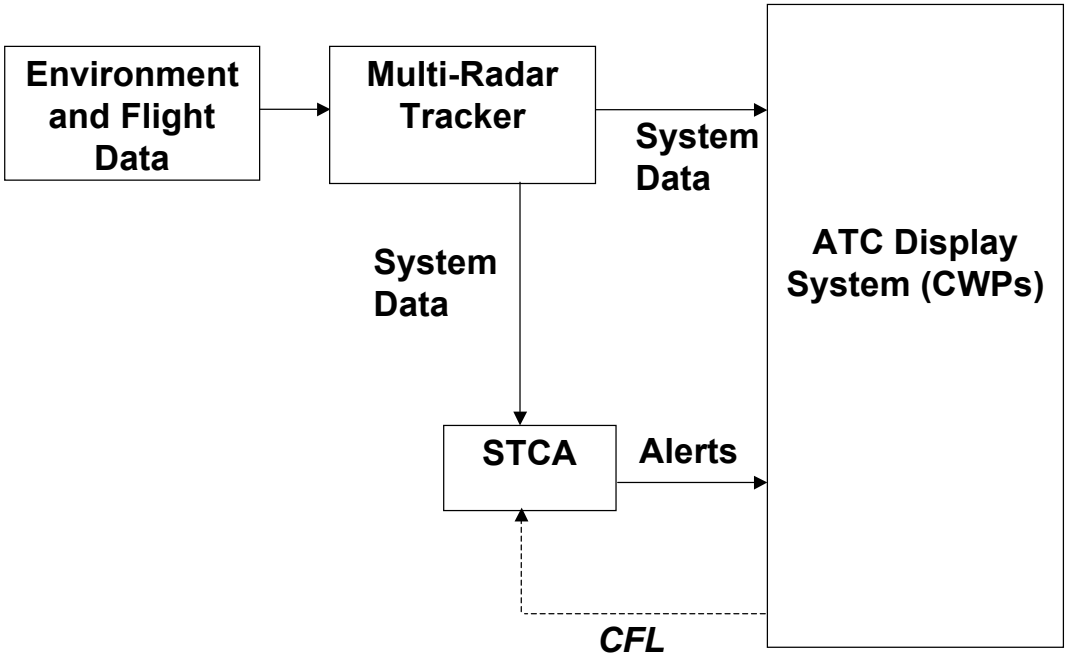
STCA - Functions



STCA - An example

Let's see an example of conflict avoided thanks to the contribution of the STCA

STCA - Architecture



Is the STCA the silver bullet ?

Is the STCA the solution ?

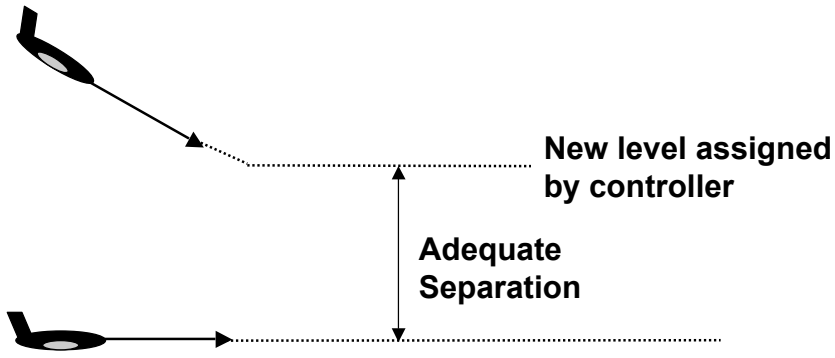
STCA could have prevented the Uberlingen accident ?

Several limiting factors:

- Controller wokload and ability to follow the overall situatiion
- Technical limitations
- Potential interactions with the TCAS
- Implementation and usage problems

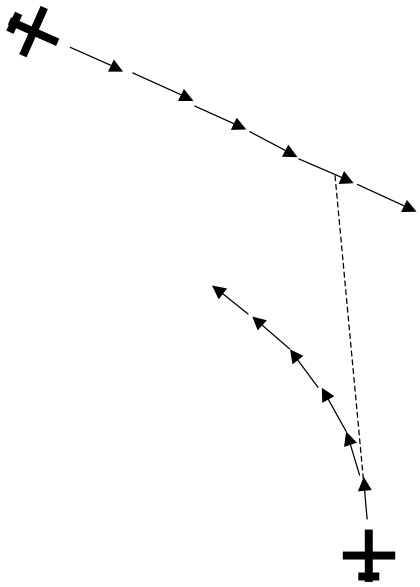
Technical limitations - I

Vertical view



Technical limitations - II

Horizontal view



Survey on adoption, implementation and use of STCA

Survey regarding the adoption, implementation and use of STCA in the ECAC states

Survey concluded in 2004

Information from 35 states out of the 44 ECAC members (at that time)

Refined interviews with a representative subset of the respondents

Task force set up as a response to the indication of the survey

Main Results of the Survey

Good level of adoption but unsatisfactory tuning

No standardisation between the systems at the different locations

No coherent view of the STCA aims, between the different involved authorities

Little information to controllers

Reinforcement of already available information

The different views of STCA

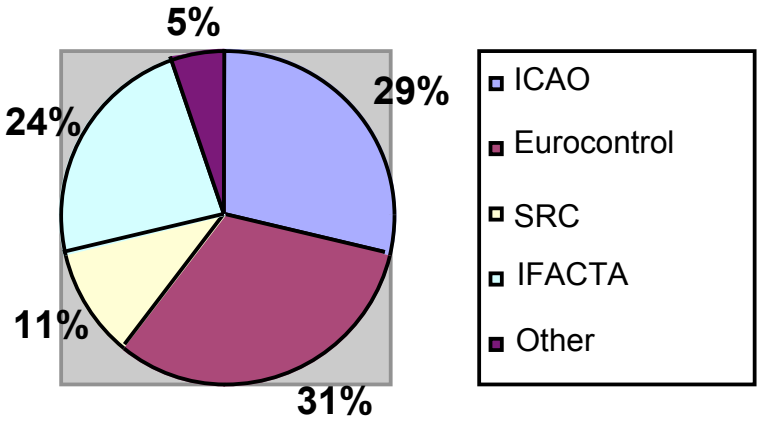
Assist in maintaining separation - ICAO

Alert of potential hazardous situations – Eurocontrol Technical Dept.

Collision avoidance – Safety Regulation Commission (SRC) of Eurocontrol

Alert of imminence of collision – International Air Traffic Controller organisation (IFATCA)

Aim of STCA at the national level



Setting of STCA parameters

	% Respondents	N° Respondents
Defined by Regulator at national level and the same for any control center	0%	0
Defined by ANSP at national level and the same for any control center	**50%**	**8**
Defined independently by each control center	31,2%	5
Left to the default option of the manufacturer	6,2%	1
Other (please specify)	12,5 %	2
Total respondents		**16**

Monitoring of STCA performances

	% Respondents	N° Respondents
Yes, performances are monitored with a specific analysis tool	18,8%	3
Yes, performances are manually monitored	**21,2%**	**5**
Yes, the way in which performances are monitored is defined at a local level	12,5%	2
No, we do not currently have any monitoring process with respect to STCA performances	25%	4
Other (please specify)	12,5 %	2
Total respondents		**16**

Instructions for controllers

	% Respondents	N° Respondents
Yes, we have written Instructions compliant with ICAO DOC 4444	30,8%	4
No, our written Instructions are not compliant with ICAO DOC	7,7%	1
No, we don't have written Instructions related to the STCA function	**61,5%**	**8**
Total respondents		**13**

Actions suggested and areas of activity of the Safety Nets Task Force

Have a clear management policy

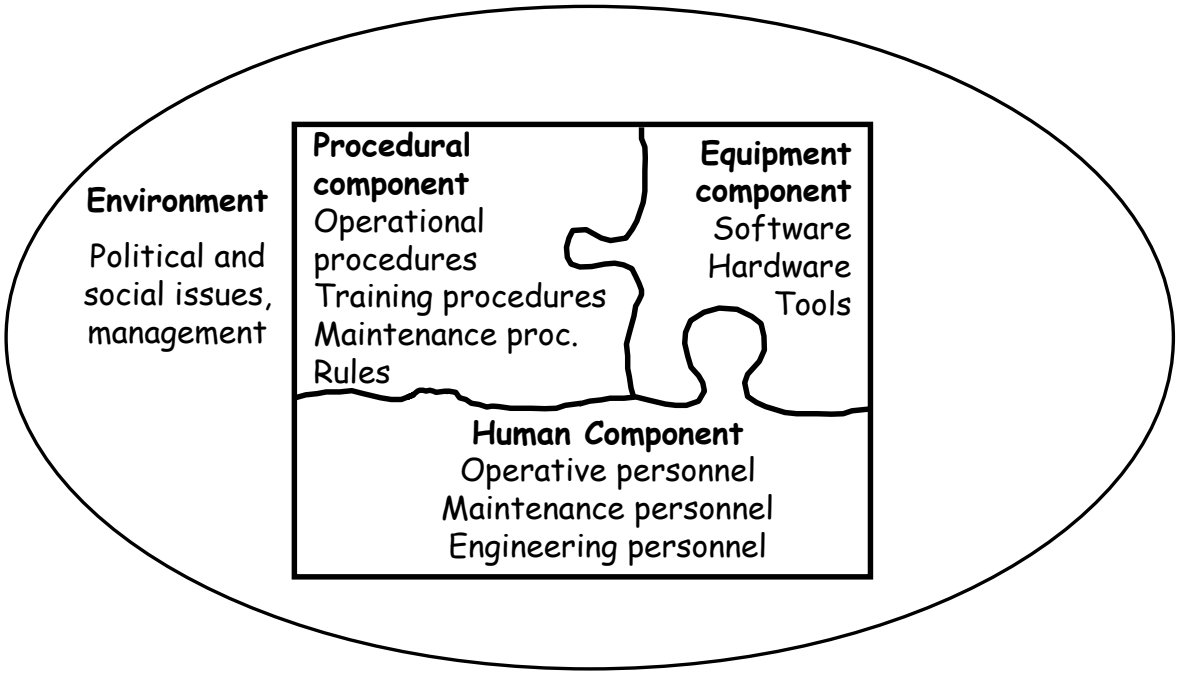
Identify STCA validation criteria and define validation process

Provide local instructions and information for controllers

Study how to improve the STCA algorithm (cleared flight level)

Study possible interactions between STCA and TCAS

STCA as a socio technical system



Questions