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direction générale de l'Aviation civile

direction des services de la Navigation aérienne

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Evaluation of ATC Working practice from a Safety and Human Factor perspective

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Plan

- Quick Introduction
- The IJAMAN (lIssage de traJectoires avec extrAction et identification de MANœuvres) toolkit
- The BISCOT (human Based rIsk and deciSion taking Complexity integrated tOolkiT) toolkit
- Application of IJAMAN and BISCOT to ATC evaluation
- Case Study : the ERASMUS project

Quick Introduction

Human factors in a safety perspective

Hidden causes:

- **Physical equipment**
- **Procedures**
- **Human**

Means for mitigating hidden causes

Physical Equipment

Rules& Procedures

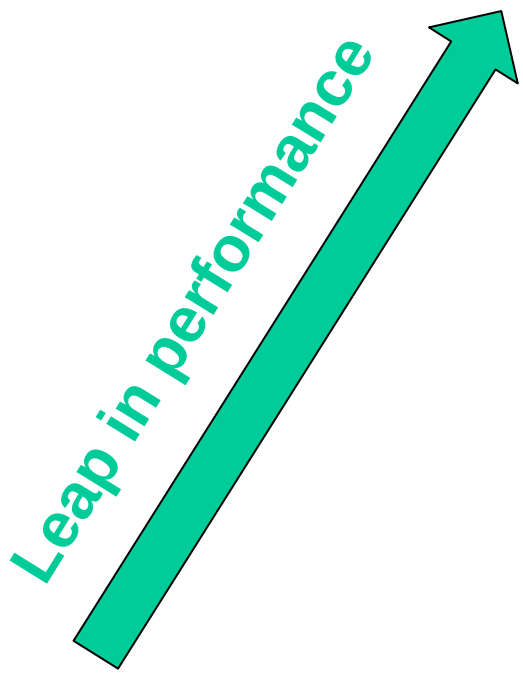
Human

Industrial Requirements

Airspace Planning
- **Separation minima**
- **Letters of agreement**

- **Sectorization**
- **Human factors**

Evolution from past to current



Rules & Procedures

Human

Physical Equipment

Major changes in SESAR ConOps

Rules& Procedures + **Human**

Aircraft Trajectory

Physical Equipment **Will allow for a safe implementation**

provided **Industrial Requirements** **are defined accordingly**

Safety implications in SESAR

No more acccidents
than in the past

Human
Procedures
Physical Equipment

How can we validate the human&procedures components of the safety argument ?

The IJAMAN and BISCOT toolkits

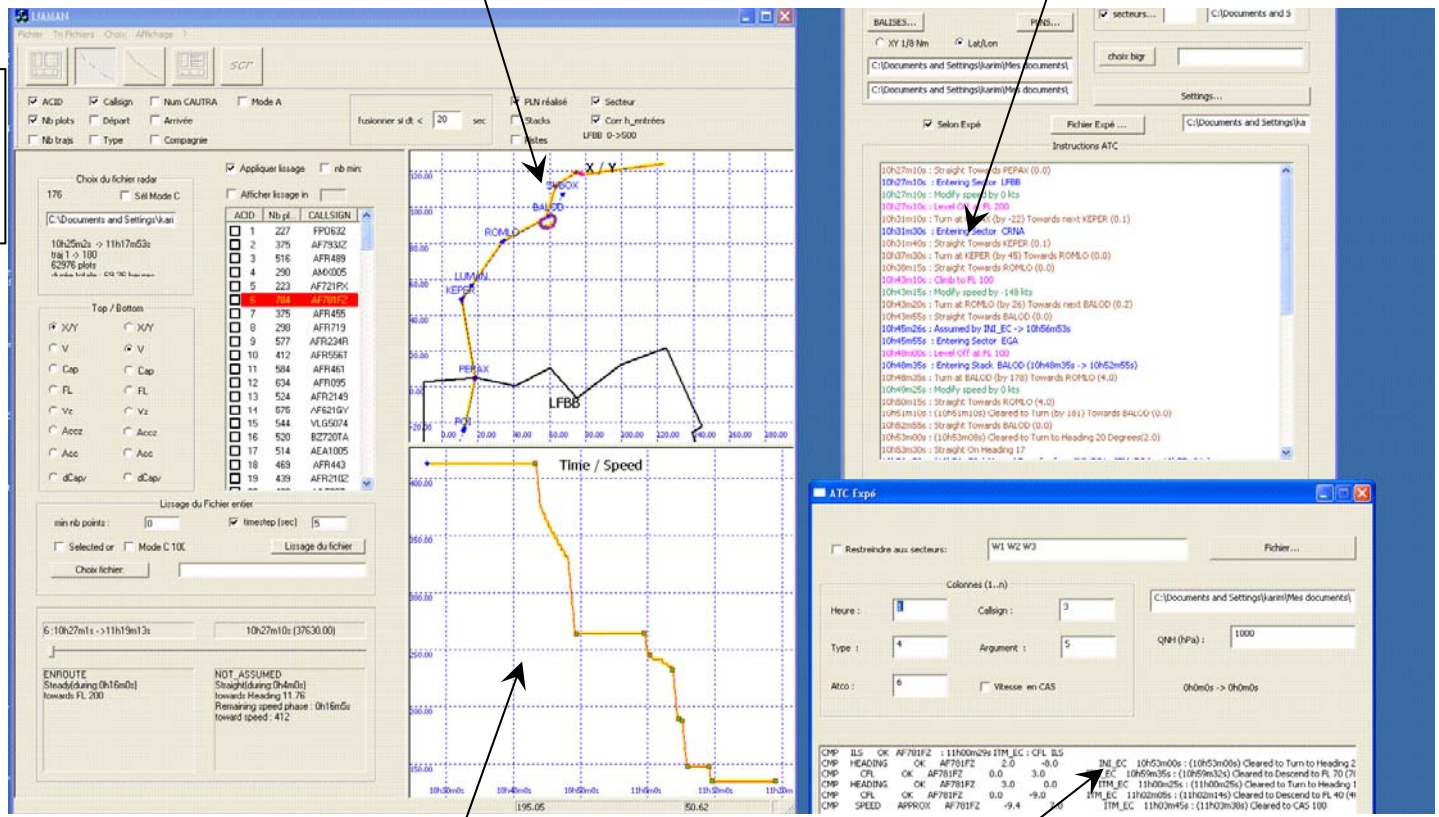
The IJAMAN toolkit

- **Radar data**
- **Flight Plans**
- **ATC instructions**

Trajectories of reference + ATC instructions errors

Identification of horizontal maneuvers

Interpretation of maneuvers



Identification of speed maneuvers

Comparison maneuvers ↔ATC instructions

The BISCOT toolkit

Failures in ATC decision taking process
(conflict resolution?)

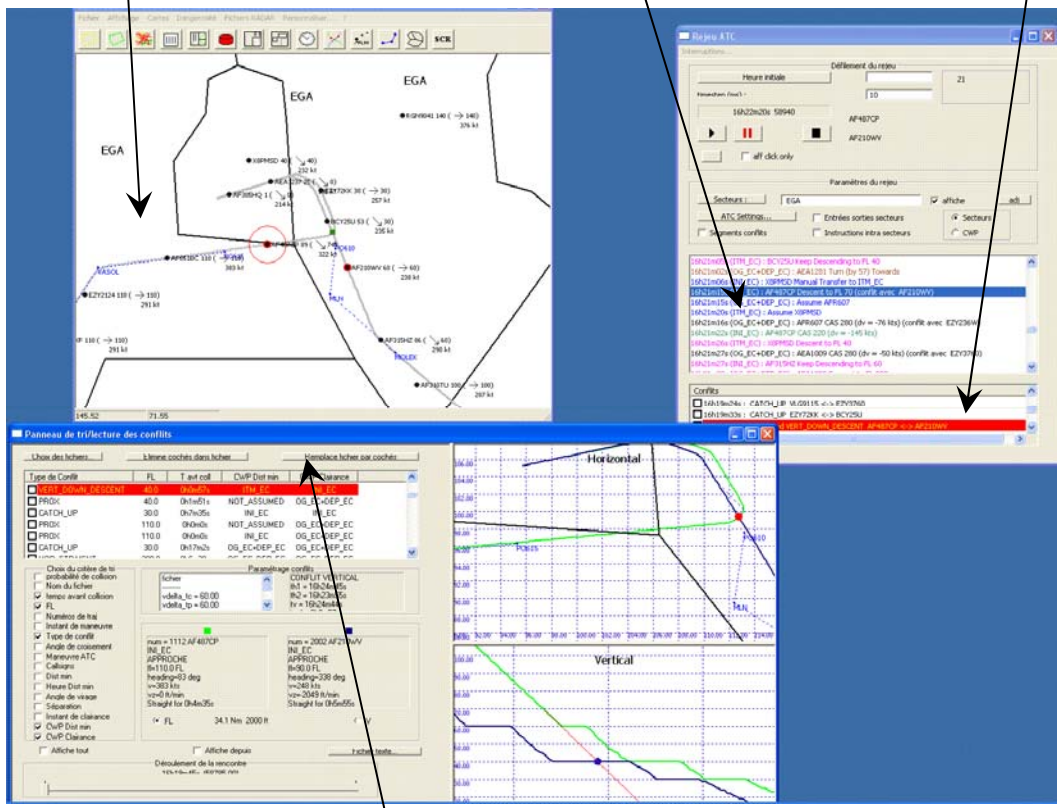
Failure in the "no decision" case
(proximate events)

« ATC oriented » traffic display

Traffic display

ATC clearances

Conflicts solved by ATC



fields associated to encounters

Application of IJAMAN and BISCOT to ATC evaluation

Applications to safety

Hazards:

1) **Initiators**
2) **Consequences**

- Proximate events : context and possible consequences?
- ATC instruction errors : context and possible consequences?
- Abnormally long TRANSFER/ASSUME: consequences?
- Failure in conflict resolution : context and possible consequences?
- Etc…

No "hidden independence" assumption: by getting the "movie" representation of the traffic, possible to distinguish the independent components:

1) **Geometry of the encounter (time uncertainties)**
2) **ATC workload/detection/intervention**

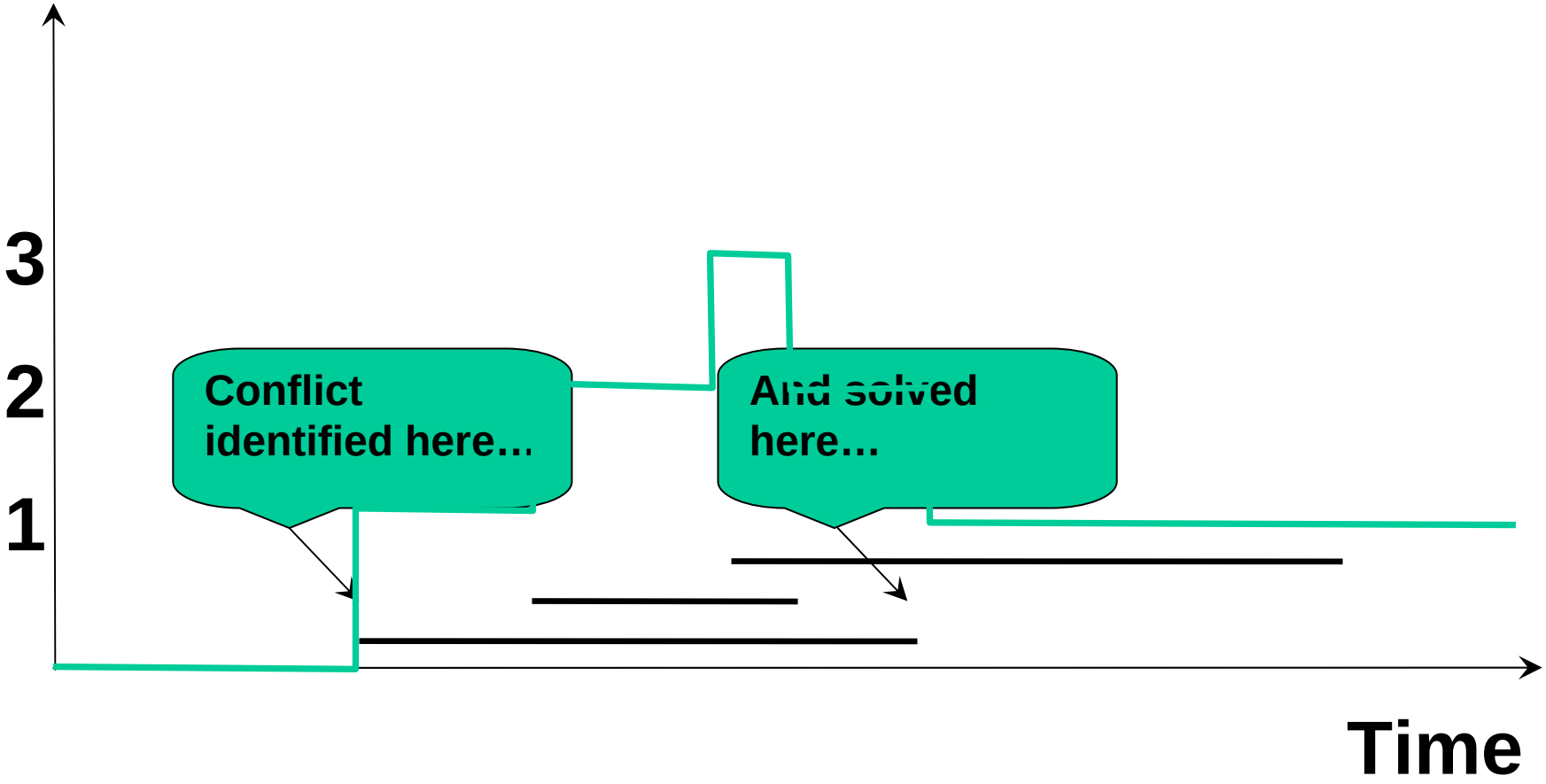
Qualitative estimation of ATC working practice

Fields associated to conficts:

- Min distance if no resolution: "ATC perceived" Gravity
- ATC intervention time in case of failed intervention : Risk of Collision
- Time of "Horizontal Closest Point of Approach without vertical separation" – Time of maneuver: ATC Anticipation/Urgency/Stress
- CWP for maneuver and at the time of the CPA (if any): collaborative working practice

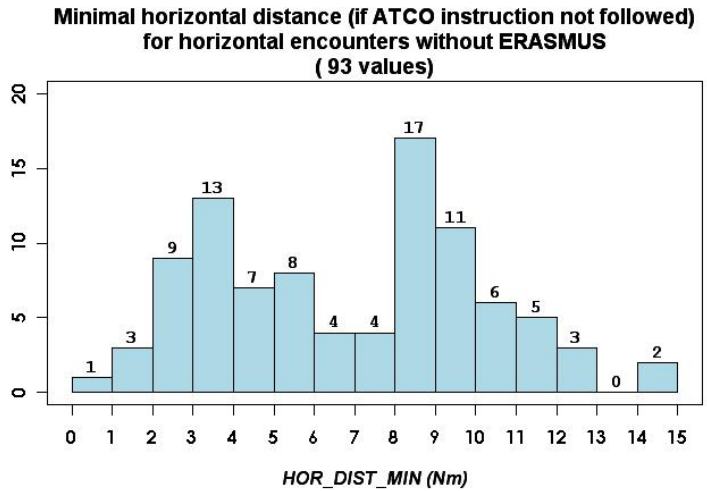
Underlying Cognitive model representation:

Cognitive resources in dynamic



Case study : the ERASMUS project

ATC instructions in horizontal



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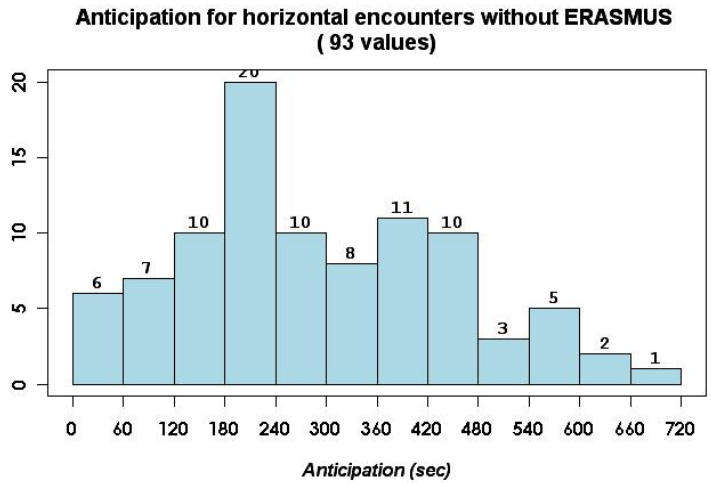
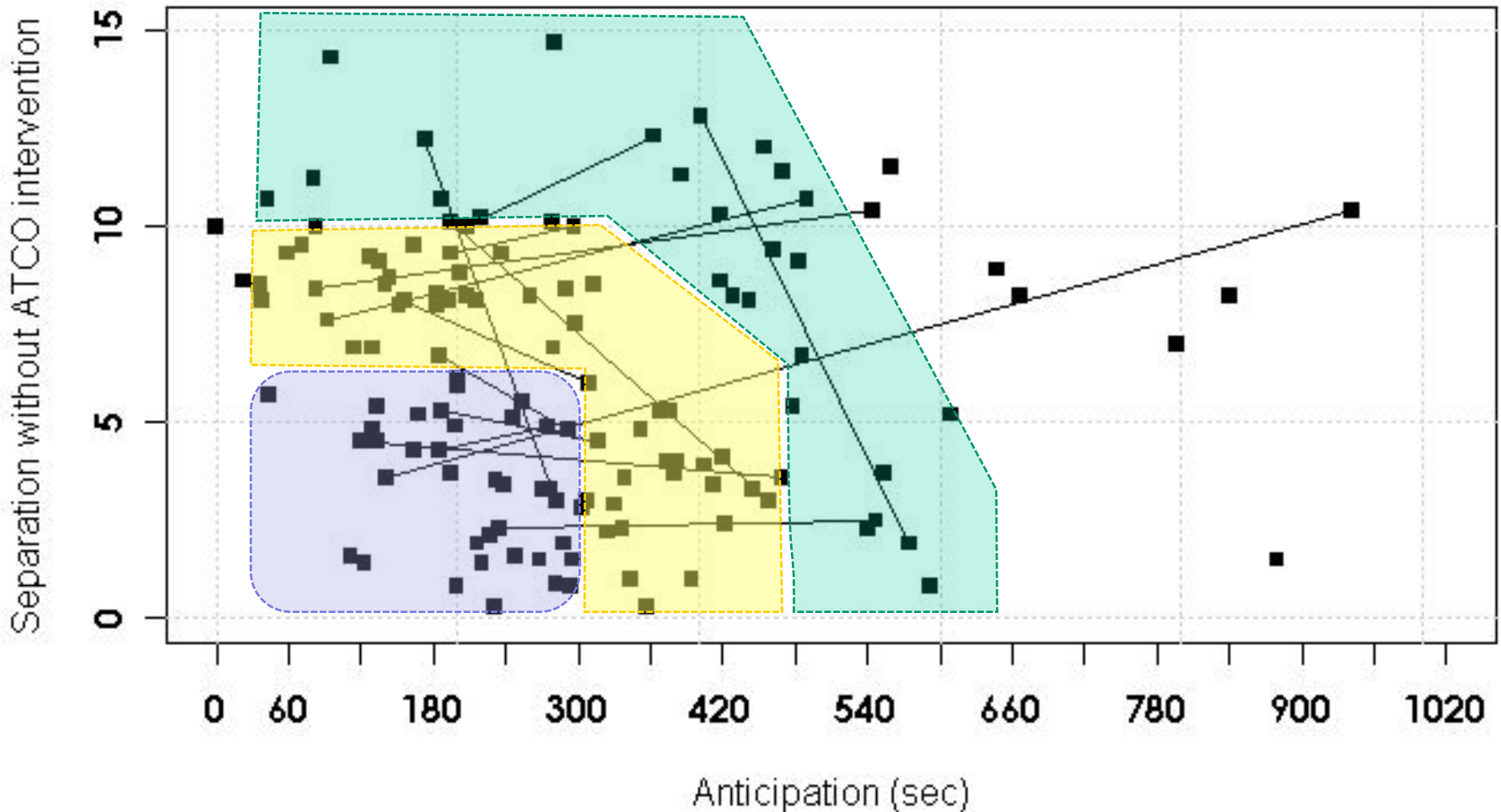
ATC anticipation in horizontal



Clusters of encounters without Erasmus (119 ATC Instructions)



Clusters of encounters with Erasmus
(48 ATC Instructions)