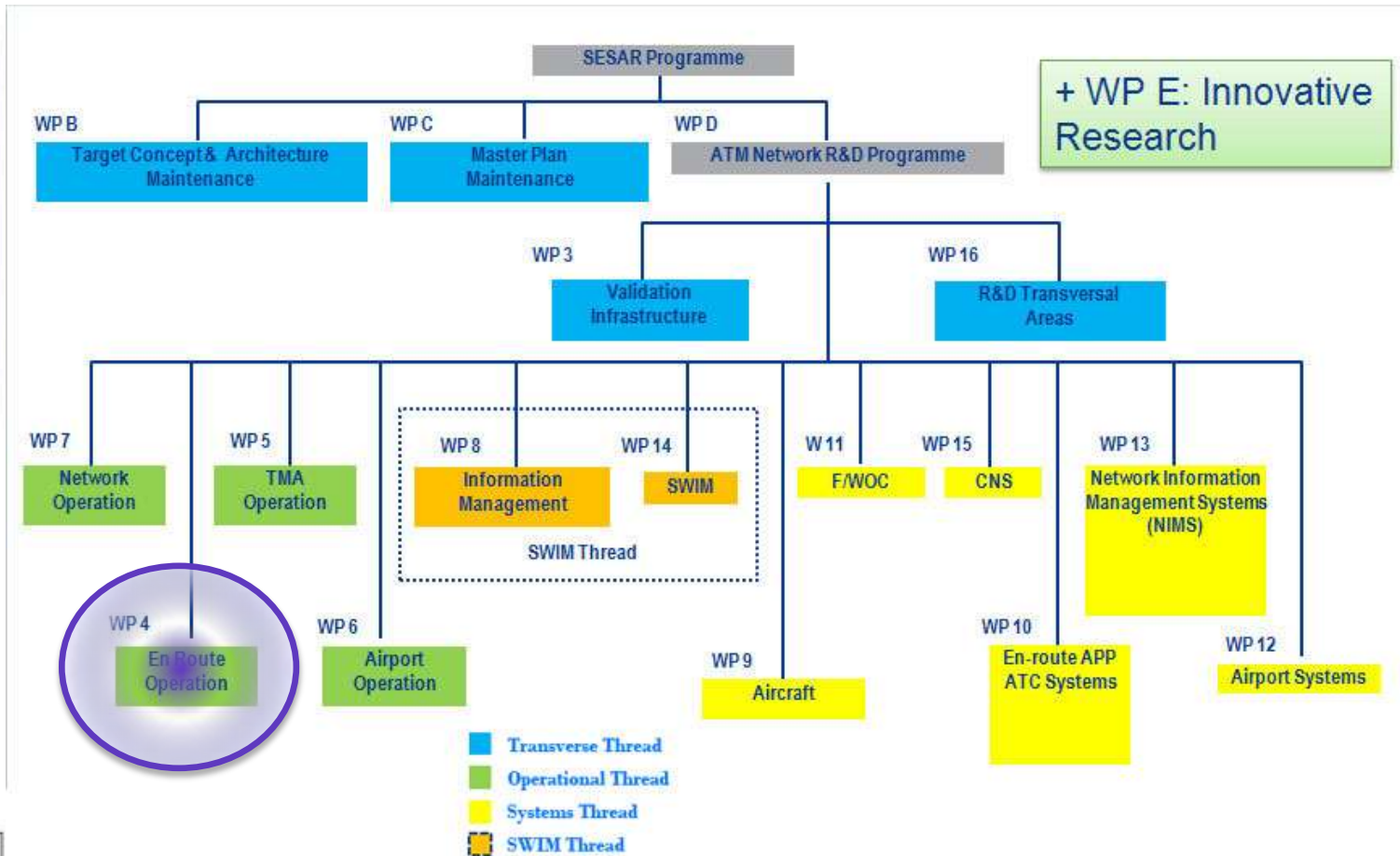


Introduction of a More Automated Environment in En-Route ATC

*Evaluation of impact generated
on the operator by mental
workload assessment*



SESAR PROJET AND THE STUDY PRESENTED



SESAR W.P.4.7.2: OBJECTIVE AND CONCEPT

Final objective:

- ✈ Development of an operational concept in the 4DTRAD environment
- ✈ Environment including CPDLC for 4D clearances
- ✈ To resume: Introduction of a partial automation
 - ✈ Resolution of a part of conflicts

How to assess the impact of this modification on controllers?

Concept of SESAR

- ✈ Including the following services in ATC working situation:
 - ✈ The conflicting service
 - ✈ The service: Conflict identification
- ✈ Make easier the detection and resolution of conflicts for controllers



INTRODUCTION

Pre-requisites:

1. Define the way to integrate these “solutions” to the ATC working environment:

- ✈ Integrate conflict aid services to the working situation
- ✈ Define the HMI (Human Machine Interface) that could be used

2. Determine which parameters make possible the evaluation of the impact generated on the controllers:

- ✈ The level of Mental Workload

CONTENTS OF THE TALK

Presentation of the experiment carried out and first results deducted:



Air Traffic Control situation built: working position and air traffic samples used



Experiment conditions evaluated



Participants



Experiment principle



Data recorded and analyzed



First results achieved

Objective: Assess mental workload felt by ATCo when working with conflict aid services

AIR TRAFFIC CONTROL SITUATION BUILT FOR THE EXPERIMENT



Including conflict aid services in the working position:



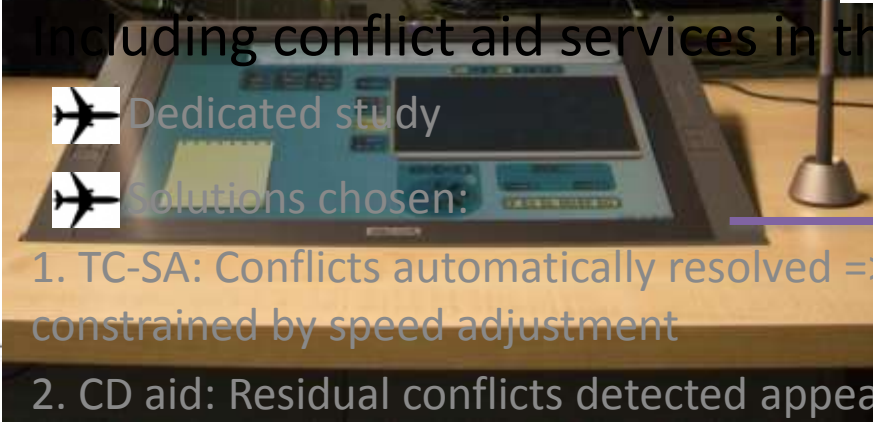
Dedicated study



Solutions chosen:

1. TC-SA: Conflicts automatically resolved => A green clock on the label of aircraft constrained by speed adjustment

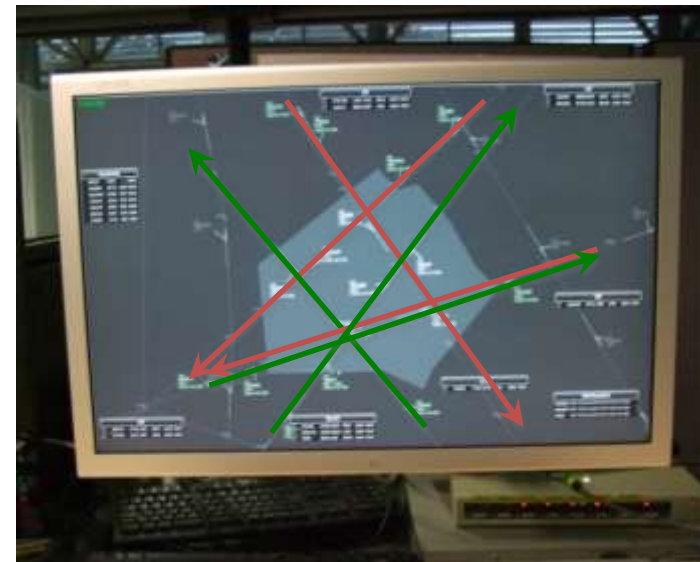
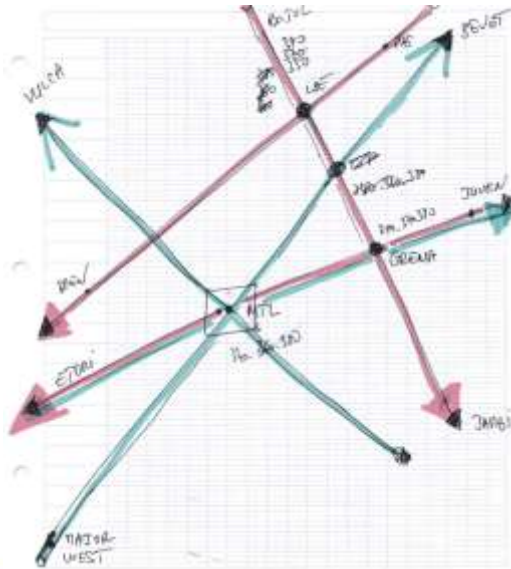
2. CD aid: Residual conflicts detected appear in a timetable



AIR TRAFFIC CONTROL SITUATION BUILT FOR THE EXPERIMENT

Air Traffic sector

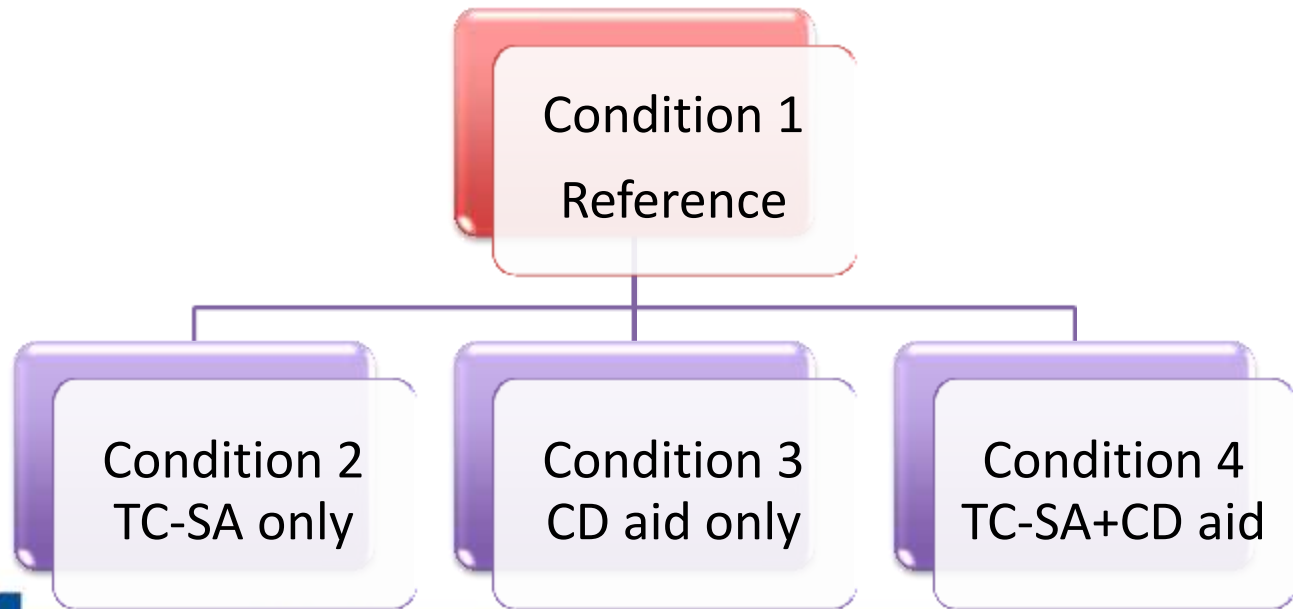
- ✈ Reflecting a futuristic air traffic control situation
- ✈ Use of a generic sector
- ✈ Futuristic rules and procedures applied (business trajectories)



EXPERIMENTATION CONDITIONS EVALUATED

4 experiment conditions:

- ✈️ Assess the impact of each service aid, independently and coupled
- ✈️ Conditions and air traffic samples order crossed between participants
- ✈️ Played with “equivalent” air traffic samples



PARTICIPANTS OF THE EXPERIMENT

12 European and qualified Air Traffic Controllers:

- ✈ 8 French ATCo coming from different French control centers
- ✈ 2 ATCo from MUAC, Maastricht
- ✈ 2 ATCo from Skyguide, Switzerland



All participants previously had a significant training (2 weeks) on HMI used, air traffic sector and ATC simulations



EXPERIMENT PRINCIPLE

For each experiment conditions

Manage a two-hours air traffic sample:

- ✈ Binomial of Air Traffic Controllers: TC & PC
- ✈ After one hour, role switching: TC ↔ PC



DATA RECORDED AND ANALYSIS CARRIED OUT

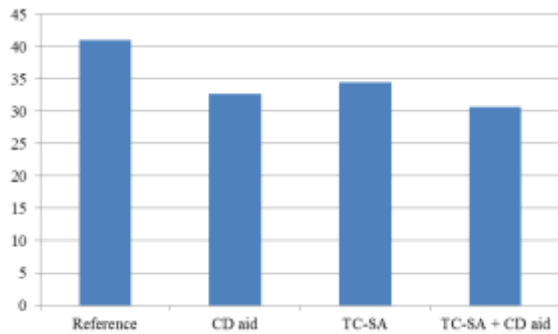
Three kinds of parameters have been recorded to assess mental workload felt by participants

- ✈ Performance assessment: Radio frequency data
 - ✈ Number of clearances and radio occupancy
- ✈ Subjective assessment: ISA assessment scale and AIM questionnaire
 - ✈ Evaluation of mental workload felt (from 1 to 4), each 5 minutes periods
 - ✈ Questionnaire to assess the impact of automation on mental workload
- ✈ Objective assessment: Eye-tracker data
 - ✈ Number and duration of eye fixations
 - ✈ Pupil diameter data

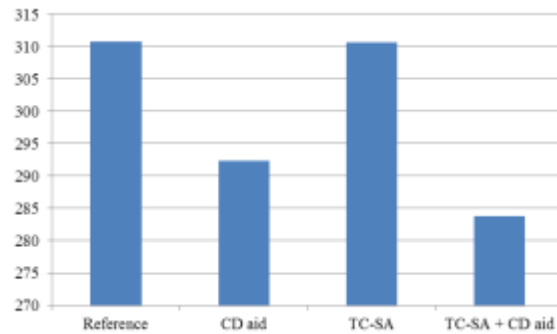


FIRST RESULTS ACHIEVED

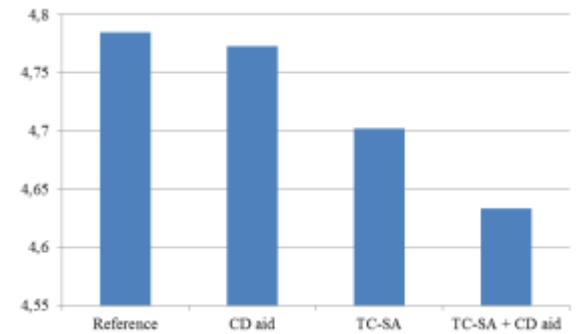
Three consistent mental workload evaluations:



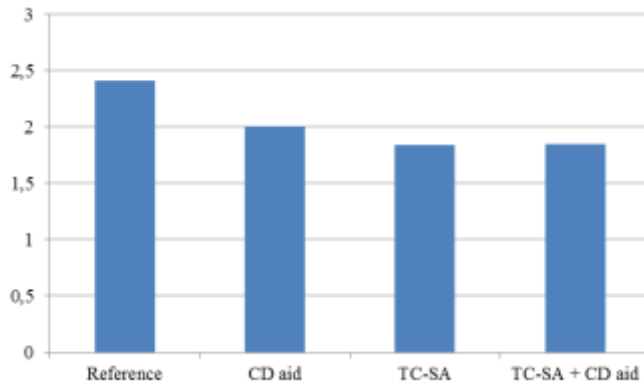
The average number of eye fixations on conflict aircraft according to experimental condition



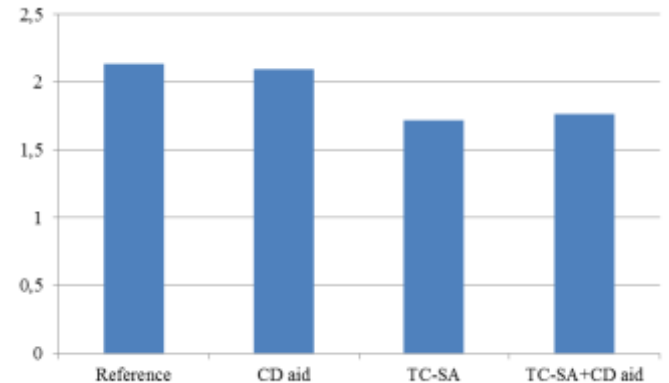
The average duration of eye fixations on conflict aircraft according to experimental condition



The average maximum value of pupil diameter during eye fixations according to experimental condition



The score of AIM questionnaire defined for each experimental condition



The average value of ISA scale for each experimental condition



CONCLUSION

Mental workload felt by Air traffic Controllers is lower with the use of conflict aid services:

- ✈ Especially for the TC-SA and TC-SA + CD aid services
- ✈ Consistent results have been obtained with several approaches

Perspective of this project:

- ✈ Proposing a new version of the CD aid service

Thank you for your attention!

Your questions?



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