

Feasibility Study of Flight Centric Mode of Operations



9th SESAR Innovation Days

A Human Performance Approach

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This work is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 734143 under European Union's Horizon 2020 research and innovation programme.

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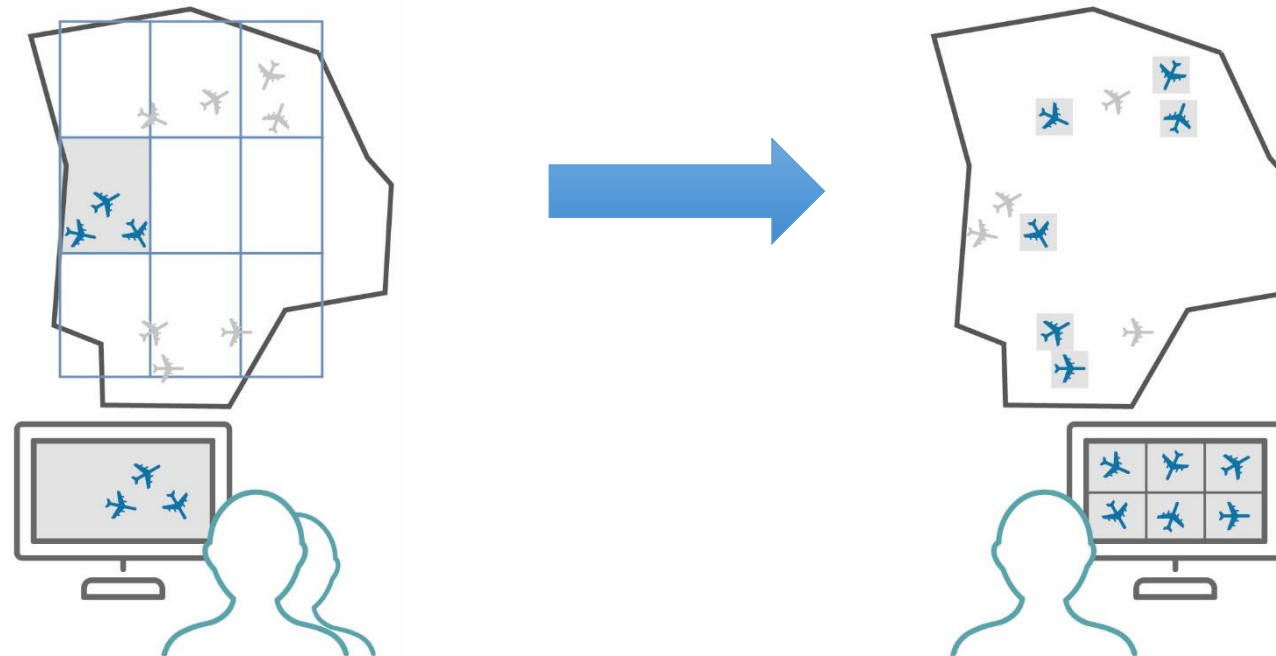
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FLIGHT CENTRIC ATC



PJ 
PROSA


Engage

founding members

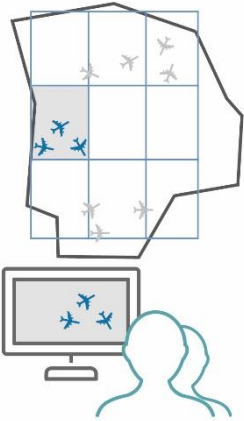


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FCA concept

Conventional

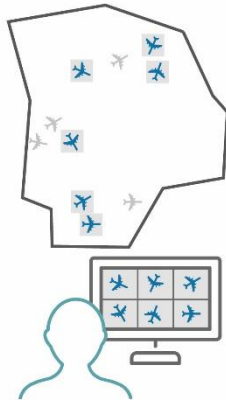


Planning Controllers and Executive Controllers

Geographical sectors, Free Route Airspace

Legacy system used

Flight Centric ATC



Single-person operations (FCA PECs)

Monitoring, CD&R, teamwork

System support is imperative

System support

TrafficSim



Dynamic, automated,
complexity-based
ALLOCATION

Filtering

Less-impacted flight algorithm (LIFA)

CD&R tools with advisory

System support



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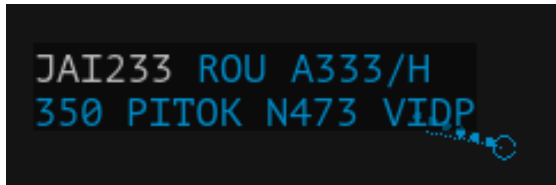


System support

Allocation

Assigned aircraft

- blue label with white callsign



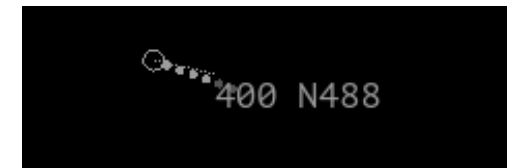
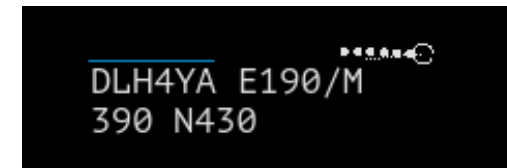
Assumed aircraft

- blue label with blue callsign



Filtering

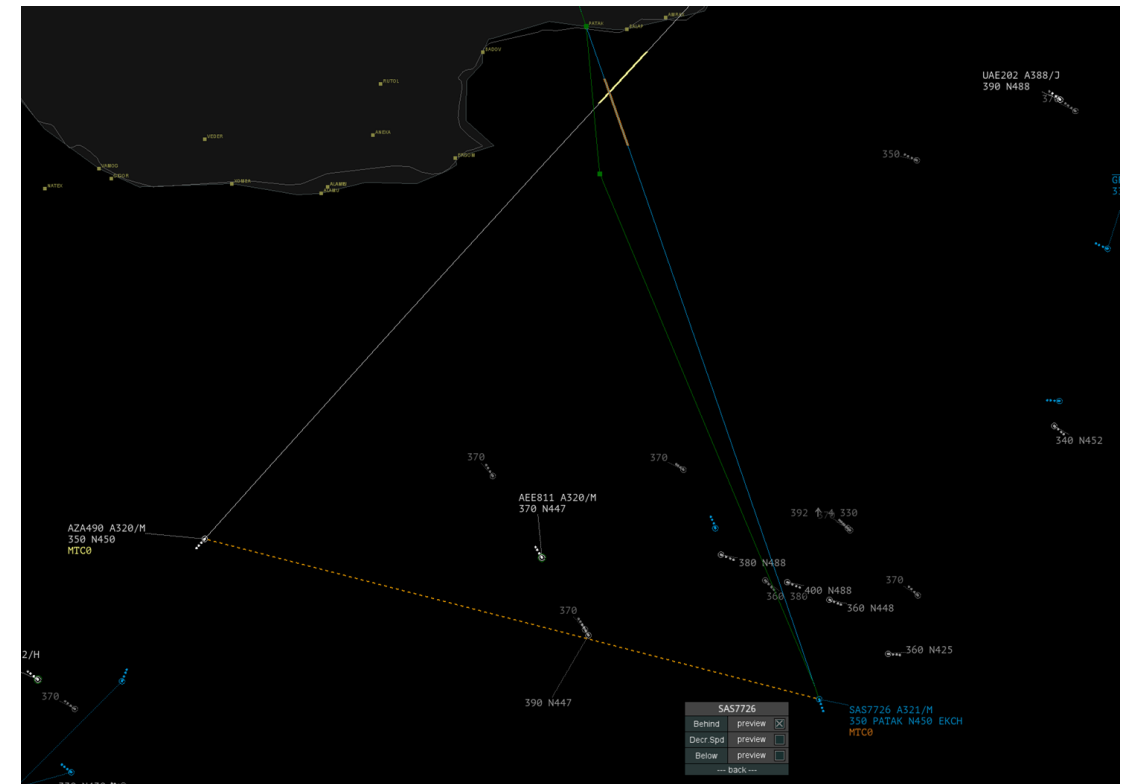
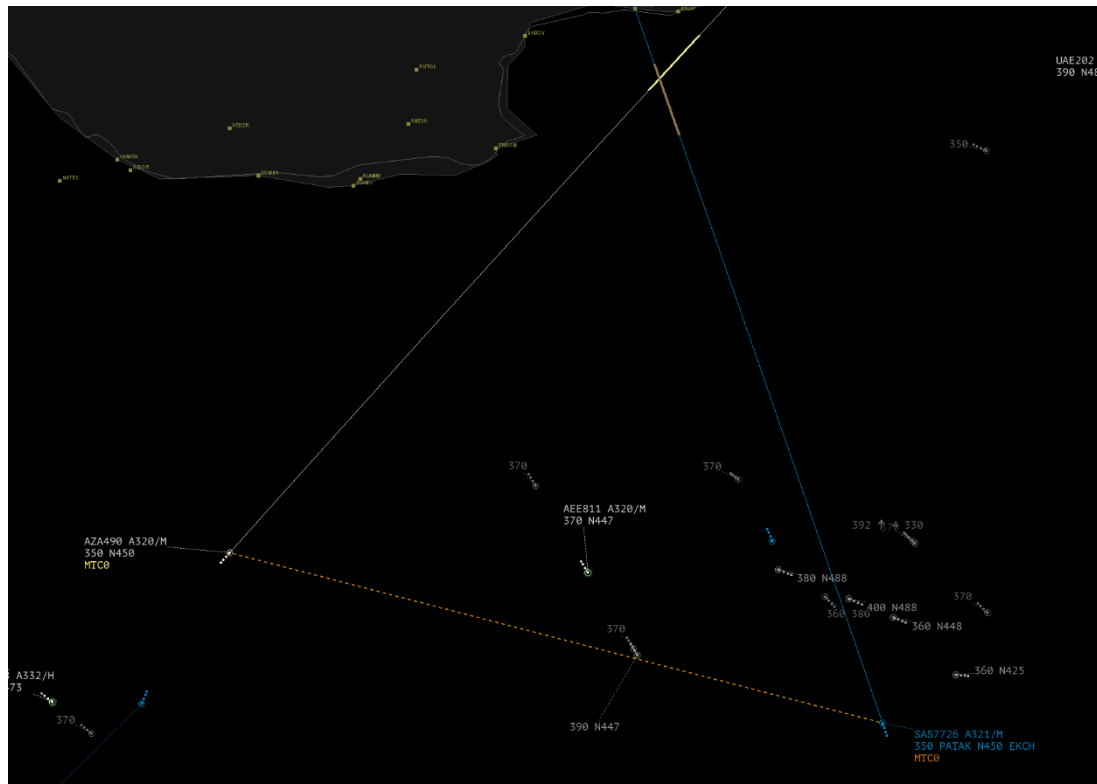
Amount of information about surrounding aircraft is filtered by relevance



System support

Less-impacted flight algorithm (LIFA)

- **orange** MTC indicates an acting role
- **yellow** MTC indicates an observing role



Key validation objectives



Suitability of set-up of **roles, responsibilities** and tasks allocation



Automated allocation of aircraft to controllers within an FCA



Display design for presenting FCA on the CWP



Concept for **conflict management** between controllers, both internal of the FCA and to adjacent sectors



Coordination between controllers both internal of the FCA and to adjacent sectors



Impact of FCA on safety and human performance including **controller workload** and **situational awareness** measurements

Validation design

- V2 Real-Time Simulation in January, 2019
- Budapest ACC, FL325+
- 2 days simulation, 8 runs
- 11 ATCOs ($M_{age}=36.2$, $SD_{age}=10.9$)



	Medium Complexity		High Complexity	
	Reference Scenario	Solution Scenario	Reference Scenario	Solution Scenario
Number of Sectors	5	1	5	1
ATCO per Sector	1 EC + 1 PC	10 Flight Centric PECs	1 EC + 1 PC	10 Flight Centric PECs
Number of Aircraft per Sector per minute	10-12	50-57	14-16	64-77

HF Assessment

Questionnaires:

- Workload (Bedford Workload Scale, Assessing the impact of automation on mental workload, Instantaneous Self Assessment)
- Situational awareness (SASHA-Q)
- Simulation Specific Questionnaires (Tools and Operating method)

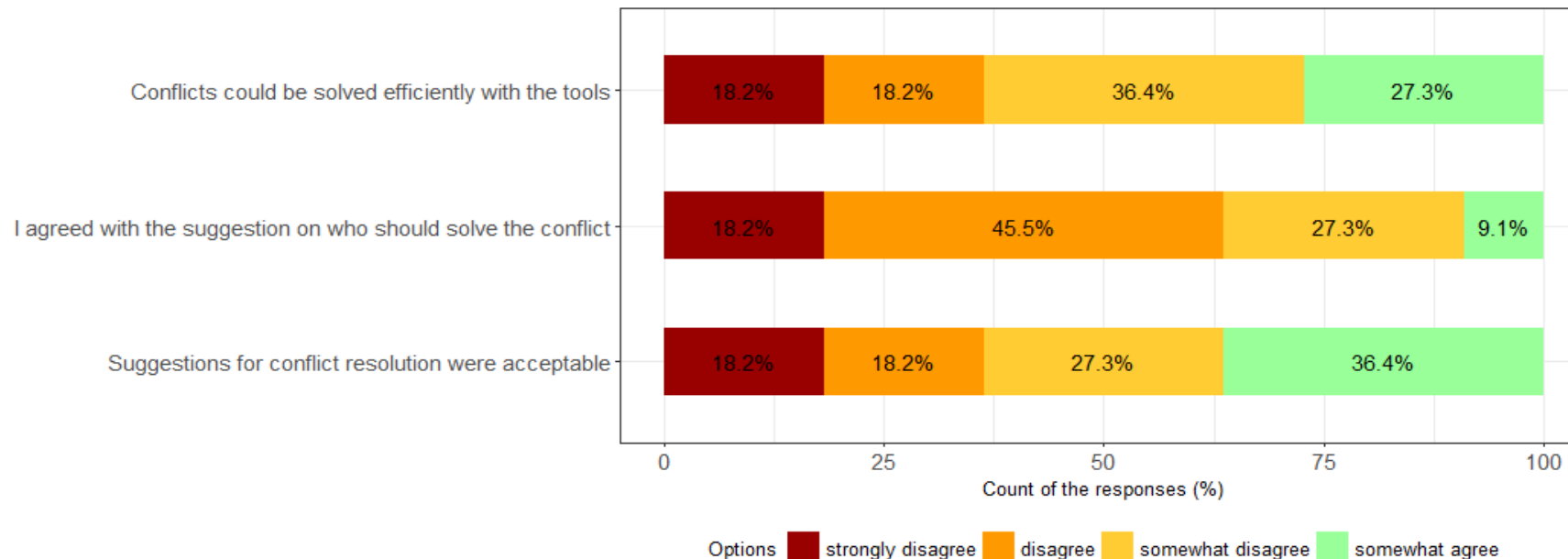
Debriefing sessions



Results

Tasks and operating procedures

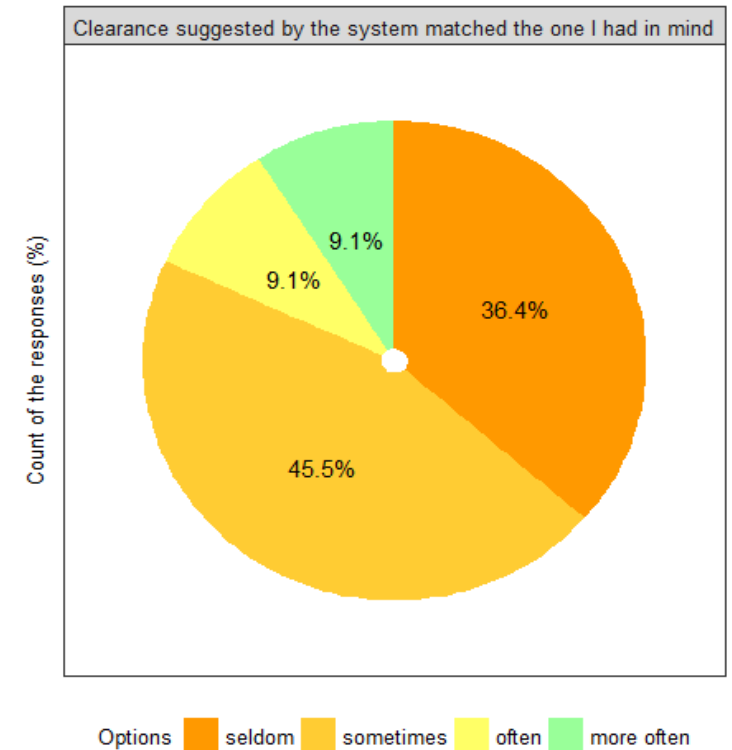
- Conflict detection deemed OK
- Conflict resolution advisories not very realistic
- Conflicts involving more than 2 controllers need to be further addressed
- Allocation acceptable, but further improvement would be appreciated



Results

Situational awareness

- Lack of full mental picture of the AoR
 - Filtering was not efficient for evolving flights and irrelevant flights
 - Difficulty in planning ahead (e.g. before entering, vertical movements)
 - The logic behind CR suggestions was not transparent



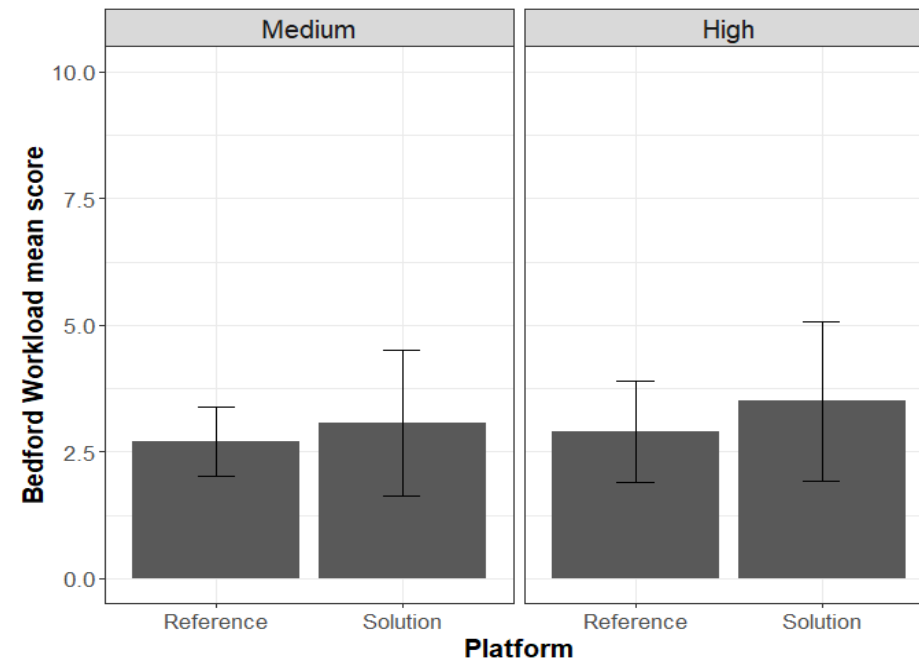
Results

Workload

- Low workload in medium complexity
- Acceptable workload in high complexity

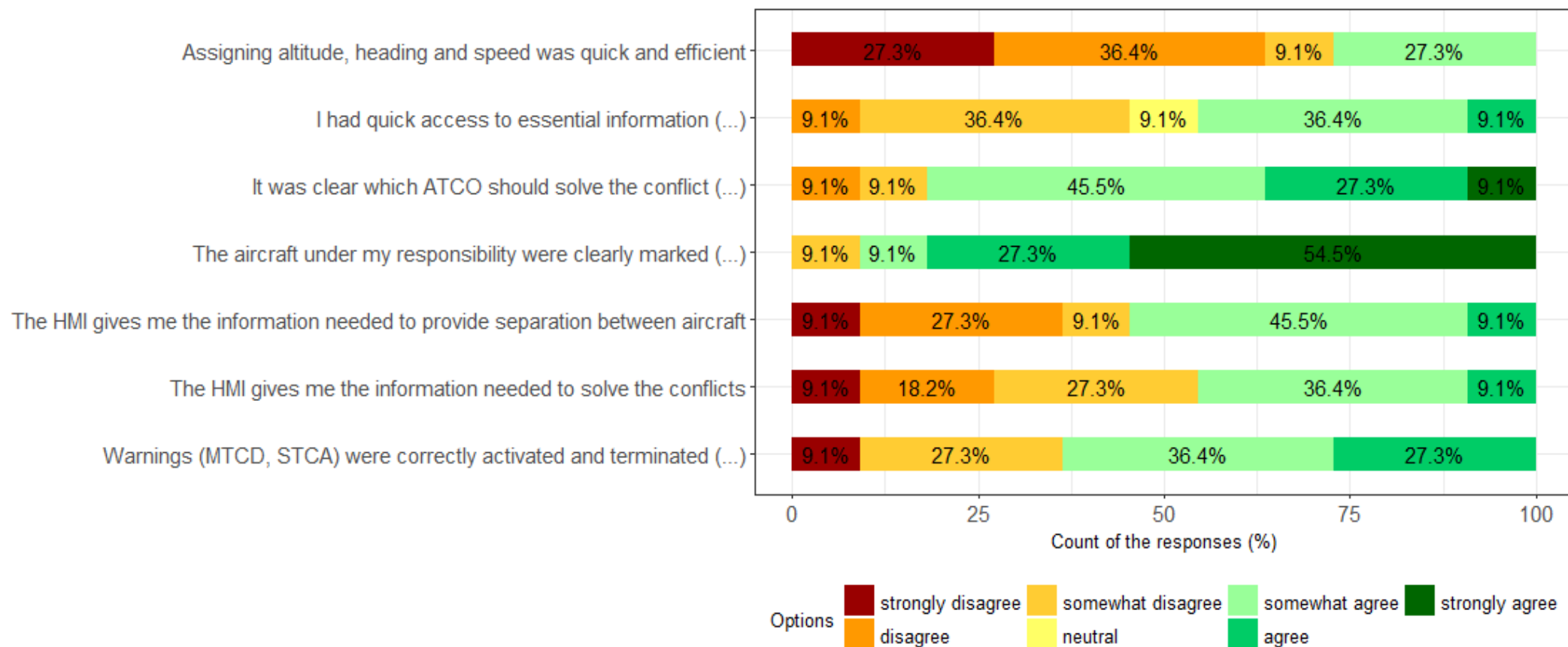
Contributors:

- Coordination/Communication
- Management of new tools and HMI



Results

HMI



Conclusions

- Changes in task allocation: conflict detection and resolution
 - LIFA: unambiguity as to who should act
- Situational awareness became fragmented
- Workload contributors identified
- HMI strengths and weaknesses analysed



Situational awareness must increase!

Transparent, explainable AI



IMPROVEMENTS FOR WAVE 2



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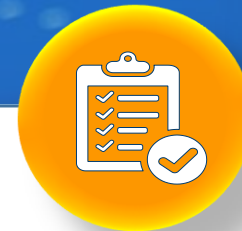




Dynamic filtering
(including Probe)



Advanced CR advisories
and improved HMI



More realistic
operational scenarios
(e.g. adverse weather,
TRA avoidance, FIR
exiting conflicts)



Iterative validation
(small and large-scale
RTS)



Improved situational awareness and trust



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