Automating Airport Airside Operations through Artificial Air Traffic Control

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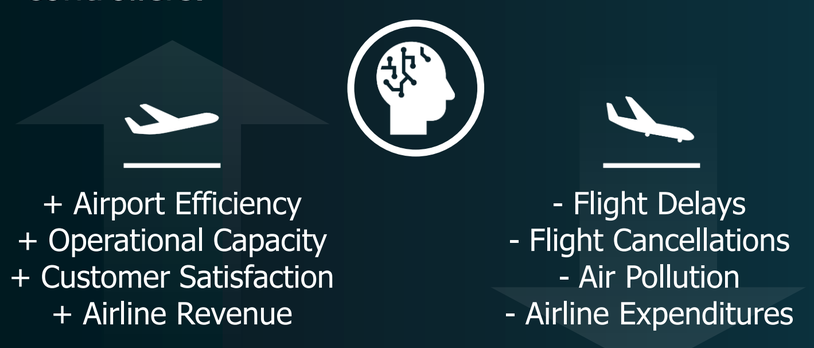
Air Traffic Control Today

Human ATCs cope with overwhelming constrains that open the opportunity for optimisation [1].

Methodologies & Milestones

This research project creates Artificial Air Traffic Control (ATC) agents that optimise Airport Operations, improving over current ATC human benchmark.

These agents are designed to assist and eventually substitute Human Air Traffic controllers.



Most advanced agent consist of AMOA* [2], [3] and a modified version of NSGA-II [4]. The latter creates different scenario candidates, while assessing real world constrains that were previously overlooked, resulting in optimised **and** feasible solutions. Human Machine Interfaces are also developed for operators to follow the Artificial ATC commands (Fig. 1)

Artificial Air Traffic Control Agent

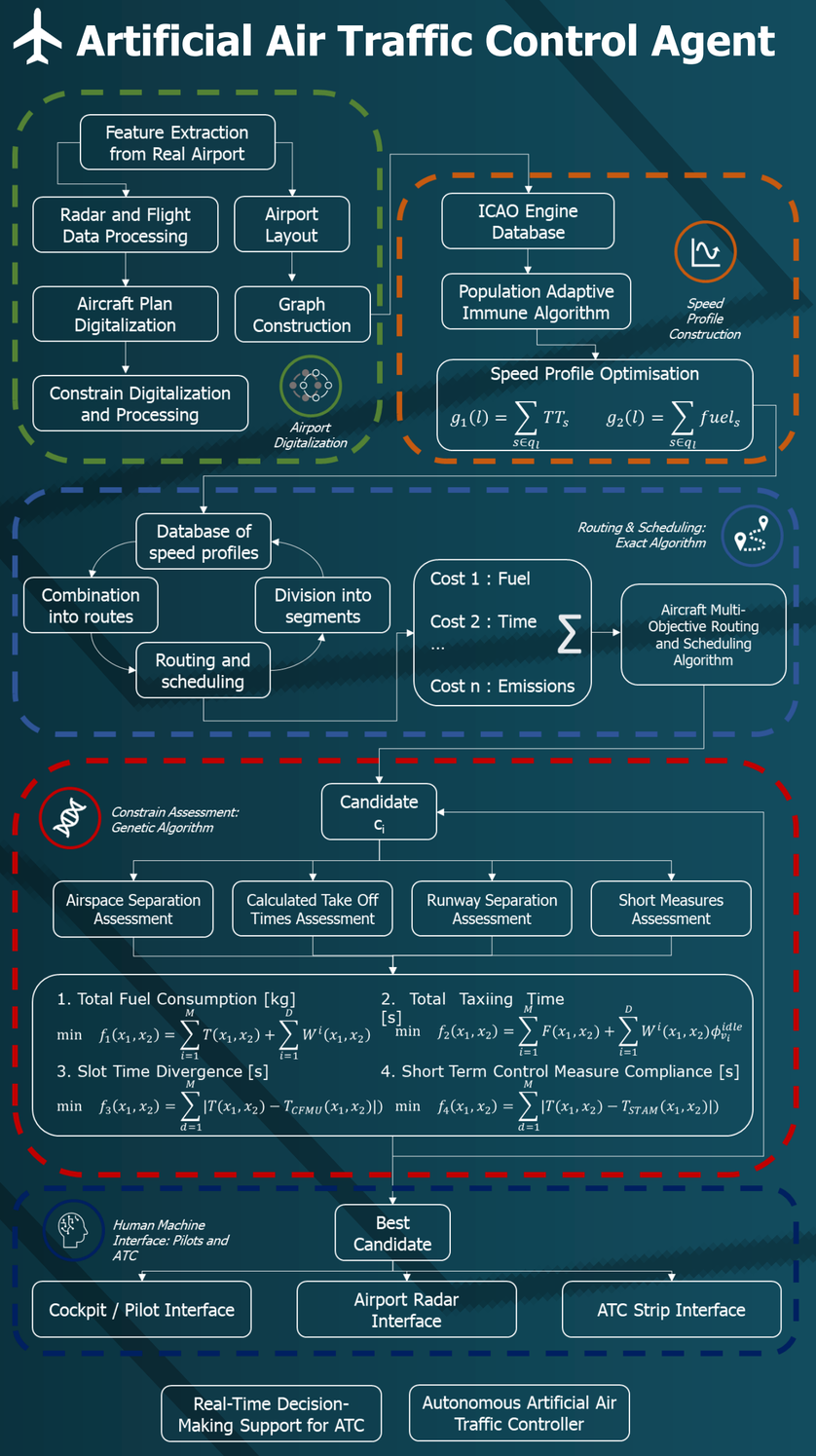


Fig 1. AMOA-RS 3 PL & GA SI architecture: Airport Digitalization, Speed Profile Generation, Routing and Scheduling, Genetic Algorithm and Human Machine Interface.*

Results

Our Artificial ATC Agent achieve the following performance under heavy traffic while complying with previously overlooked constrains.

Case Study	Taxiing Time [s]	Fuel Spent [kg]	Total Cost [€]
Real	3270.00	665.78	2006.33
Benchmark Algorithm	1538.77	456.24	1045.61
AMOA*-RS 3 PL & GA SI	1575.58	410.37	1030.31

Fig. 2 Different agent performance on Stansted Airport from 07-12-2021 07:40:00 to 08:10:00 (UTC)

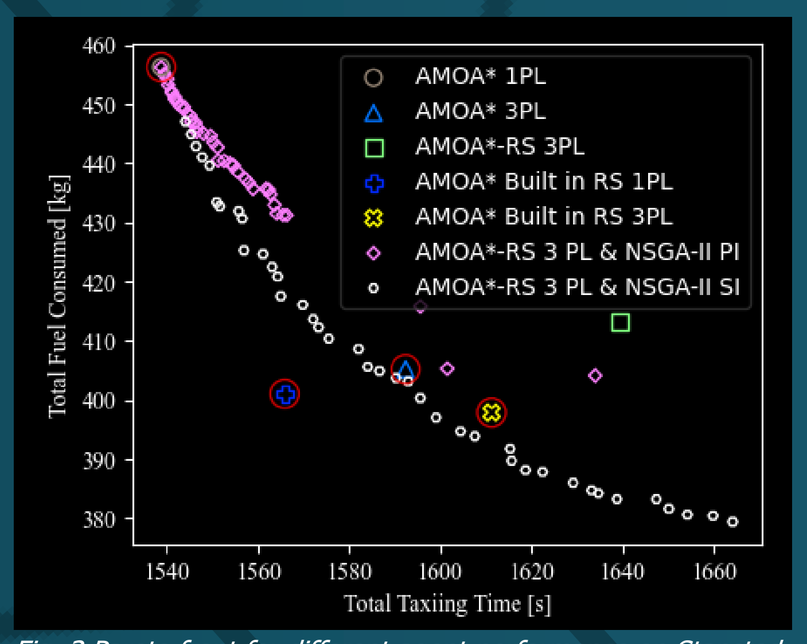


Fig. 3 Pareto front for different agent performance on Stansted Airport from 07-12-2021 07:40:00 to 08:10:00 (UTC)

Conclusions

On average, current agent achieve the following performance over a 1-hour period in busy traffic conditions, without violating any safety regulations:

- 13 Flights prevented from being delayed
- 40% Fuel and taxiing time reduction
- 100% Feasible Solutions

Fig. 4 Air Traffic Control Airport Radar (ASMGCS) used to visualize Futuristic Air Traffic Control's airport management.

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1st Published Paper and Demonstration Video

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