DART
Data Driven Aircraft Trajectory Prediction Research

Vision & Concept.

DART aims to deliver understanding on the suitability of applying data-driven models for enhancing our abilities to compute predictions of aircraft trajectories, accounting also for ATM network complexity effects concerning multiple correlated aircraft trajectories.

DART will explore the applicability of a collection of data mining, machine learning and agent-based models and algorithms to derive a data-driven trajectory prediction capability, accounting also for ATM network complexity effects.

DART aims at high-fidelity aircraft trajectory prediction capabilities, supporting the trajectory life-cycle at all stages efficiently. As part of this objective DART emphasizes the role modern visualization techniques can have in facilitating trajectory predictions.

Outcomes

To achieve this high-level main research objective, the following specific research objectives have been defined:

- Definition of requirements for the input datasets needed. The requirements will consider the trajectory prediction accuracy expected;
- Application of big-data techniques to trajectory related data gathering, filtering, storing, prioritization, indexing or segmentation to support the generation of reliable and homogenous input datasets;
- Study of different data-driven learning techniques to describe how a reliable trajectory prediction model will leverage them;
- Formal description of the ATM complexity network to support correlated multiple trajectory predictions;
- Study of the application of agent-based models to the prediction of multiple correlated trajectory predictions considering the ATM complexity network;
- Description of visualization techniques to enhance trajectory data management capabilities;
- Exploration of advanced visualization processes for data-driven model algorithms formulation, tuning and validation, in the context of 4D trajectories.

At a glance

Call:	SESAR-2-2015
Objective	Data Science in ATM
Duration	June 2016-June 2018
Budget	598,523.75 €
EC Contribution	598,523.75 €

http://www.dart-research.eu

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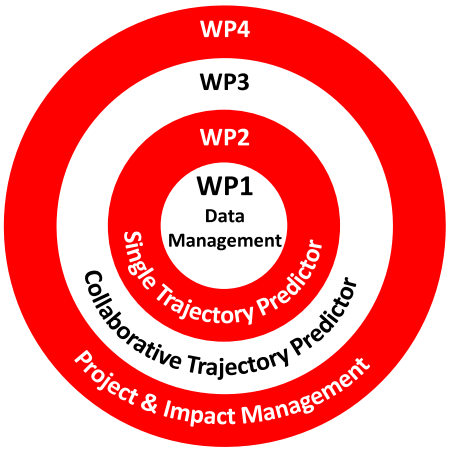
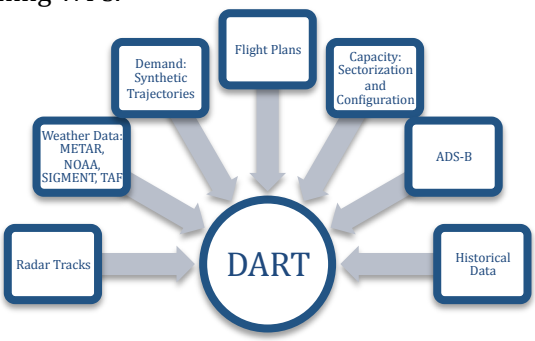
Research Approach

DART project has been structured in four WPs following a layer-based approach.



The core **WP1 will provide especially designed datasets** to the remaining WPs.



Upon this WP, the **WP2 evaluates the suitability of proposed machine learning techniques** to elucidate which is the best alternative **to enable robust and accurate data-driven trajectory prediction capabilities**, and under which conditions. This WP2 will make use of the outputs of WP1 and provide inputs to WP3.

The **WP3** will leverage the outputs from previous WPs to **devise and evaluate a mechanism for detecting the influence of surrounding traffic on a trajectory prediction and enhancing the prediction capabilities of algorithms towards a collaborative trajectory prediction process**. This mechanism, based on **collaborative reinforcement learning techniques** will account for network complexity effects and will return updated predictions by considering the complexity of the actual ATM environment. Finally, WP4 will provide the project management activities required for the overall coordination of the defined WPs, including the dissemination and project impact activities.

Operational Context & Scenarios

DART aim at advancing single and multiple trajectory predictions at the pre-tactical planning phase according to two well defined scenarios:

Single Trajectory Prediction

The objective of this scenario is to demonstrate how DART predictive analytics capability can improve trajectory prediction in support of Demand-Capacity Balance processes at planning phase. For a given flight plan, the objective is to compute the predicted trajectory that an aircraft will fly during an operation day.
This WP2 scenario aims at analyzing and evaluating machine learning algorithms for trajectory predictions from an individual trajectory perspective (i.e. without considering traffic) from the airspace users' point of view.

Collaborative Trajectory Prediction

The scenario objective is to demonstrate how DART predictive analytics capability can help in trajectory forecasting when demand exceeds sectors' capacity. Thus, WP3 scenario aims to study and determine the complexity to be considered in a trajectory prediction due to the influence of the surrounding traffic.
This scenario shows ANSP's point of view, and aims to compute and evaluate collaborative trajectory predictions.
The scenario does not consider conflicts: Resolutions adopted by controllers won't be in the scope of this scenario.

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