

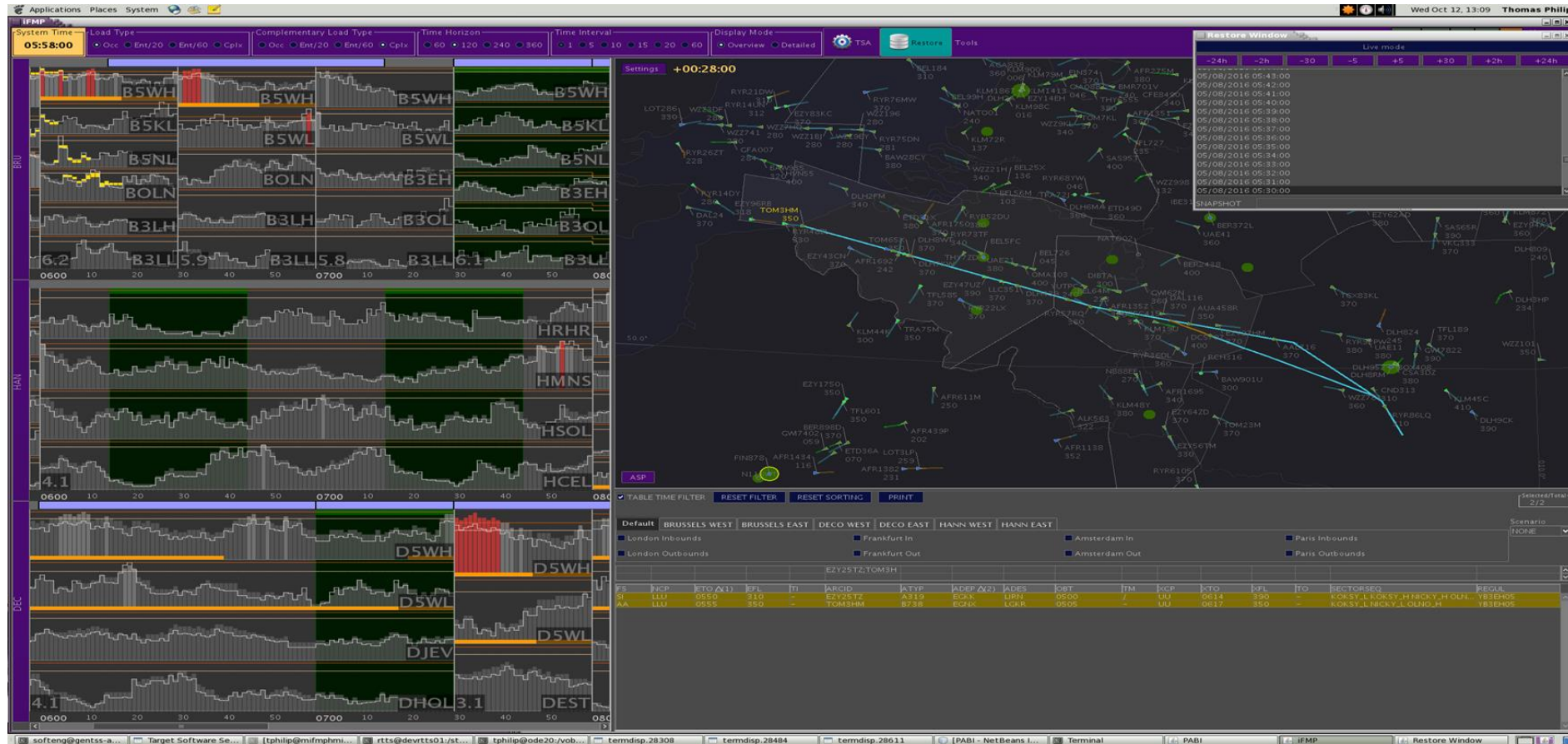


Machine Learning in complexity management

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Trajectory Prediction Improvement (TPI)

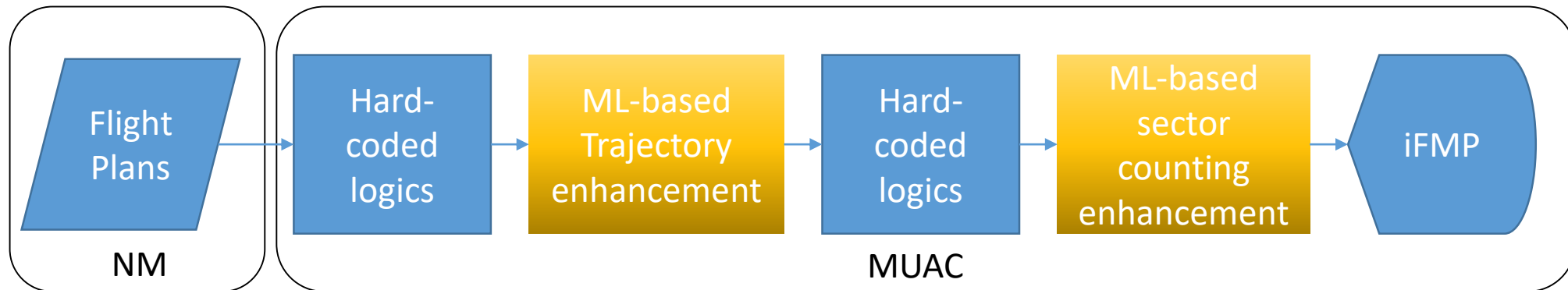


Current status

- Version 1.0 implemented since 2018 on East/South-West Flow
 - 4 new flows (after ATCO validation session) added in December 2019
 - Cover ~15-20% of traffic
- Version 2.0 include two complementary algorithms
 - ALG#1 implemented for September 2020
 - ALG#2 planned for early 2021
 - Will allow to extend TPI to all flows

Important notes

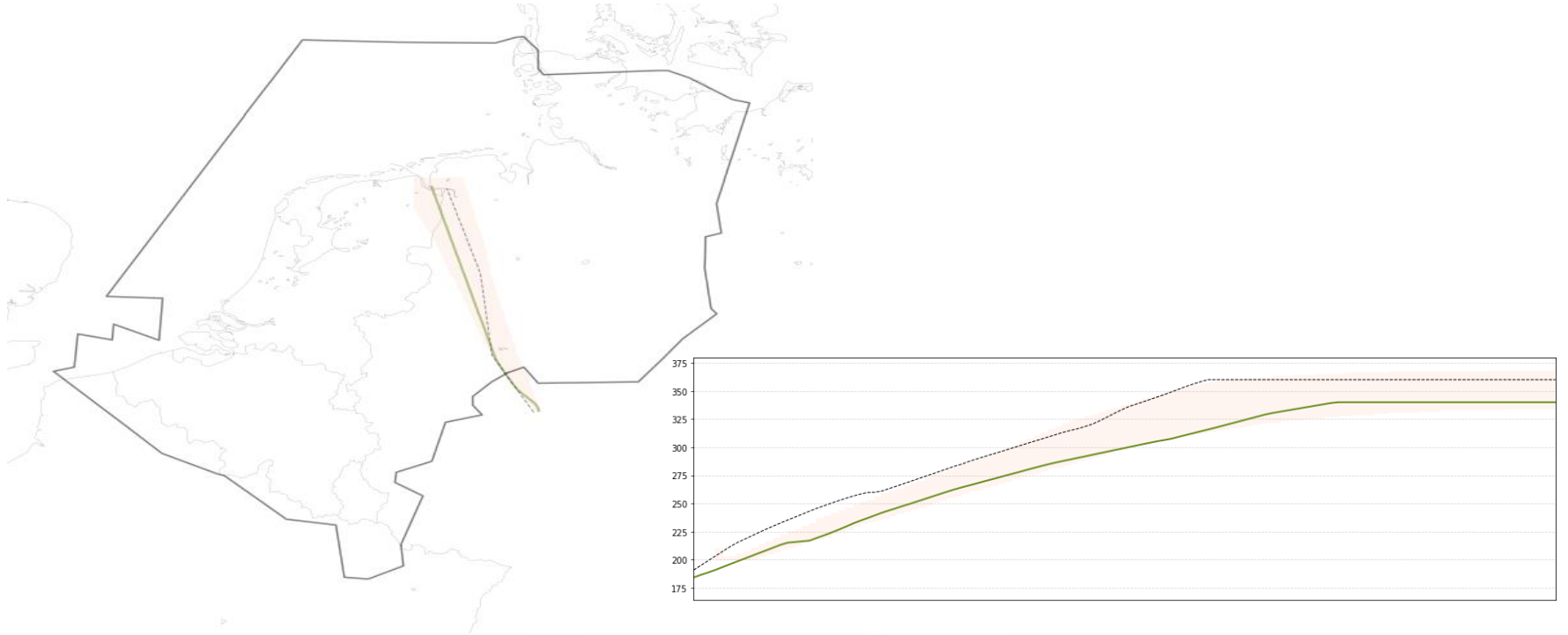
- Reactive to Military activation changes
- Validation/Monitoring is automated
- Integrate deterministic “hard-coded” logic (increased stationarity)
- Cascaded implementation:



Complexity Project

- Complexity is based on what “might” happen.
 - **Necessity of having several possibilities/scenarios per flight.**

Probabilistic
trajectories



Case studies

Interaction probability calculation:

$$\max_k (P(\|X - X_k\| \leq \theta_L, T = t, T_k = t) \cdot P(|Z - Z_k| \leq \theta_V, |T = t, T_k = t))$$

⇒ Random sampling

- Multiple opportunities:
 - **Basic vs. complex flights**
 - **Sector complexity assessment**
 - **Clusters identification**

Validation (Current status)

- 400 snapshots assessed by 3 ATCOs over 2 different sectors
 - **Several iterations to tailor interaction definition parameters and to fit complexity measure function**

