



Lufthansa Airbus A340-600
LUFTHANSA GROUP

Harnessing Trajectory Based Operations

Lufthansa Group Airlines ATM Development team embraces operational benefits

Air traffic is growing worldwide but the European airspace continues to be inefficient with the urgent need to mitigate capacity shortages and inefficient routings. In light of these developments, the need for modernisation in Air Traffic Management (ATM) is more pressing than ever.

Trajectory Based Operations (TBO) stand out as a pivotal strategy in this modernisation effort, promising quick wins and substantial benefits. TBO offers a comprehensive approach to managing air traffic by optimising flight paths based on real-time data and predictive analytics. This method enhances situational awareness for both controllers and pilots, ensuring safer and more efficient flight operations. The potential for automation within TBO further aids in reducing the workload on operational entities, pilots and air traffic controllers, allowing them to focus on critical tasks without being overwhelmed by routine procedures.

Win-win for airlines and air navigation service providers

One of the most compelling aspects of TBO is its ability to create a win-win situation for airlines and air navigation service providers (ANSPs). By improving the predictability and efficiency of flight trajectories, TBO contributes to enhanced safety and sustainability of flights. However, airborne and ground deployment levels need to be high to harvest the benefits. Extended flight plan information and the real-time optimisation and exchange of aircraft trajectories will be the foundation for future air traffic management. The resulting increase in airspace capacity due to TBO implementation translates directly to fewer delays for passengers, thus improving the overall travel experience.

Showcasing operational benefits

The Lufthansa Group has been at the forefront of this modernisation effort, integrating new aircraft equipped

with ADS-C Extended Projected Profile (EPP) capabilities ahead of regulatory mandates. This proactive approach has yielded significant positive impacts in real-world operations. Since the deployment of ADS-C EPP in the Maastricht Upper Area Control (MUAC) airspace in 2023, equipped Lufthansa Group aircraft have been actively collecting data, showcasing remarkable improvements in flight efficiency and sustainability.

Analyses conducted by MUAC, supported by Lufthansa Group's own findings, reveal several key benefits:

- aircraft are achieving their Top of Climb (ToC) an average of 4 nautical miles (NM) earlier,
- experiencing slightly shorter routings, saving 2 to 8 Nautical Miles, which for an Airbus A320 corresponds to 8 to 24 kilograms of fuel,
- maintaining their cruising level for up to an additional 18.5 NM on the most common descent profiles.

These advancements underscore the positive impact of ADS-C EPP on optimising flight operations, demonstrating how TBO can drive meaningful improvements in the aviation sector. The success experienced by Lufthansa Group and MUAC highlights the urgent need for a collaborative effort among airlines and ANSPs to implement TBO widely in Europe. Agile and stepwise deployment of technological and procedural changes is key. By joining this coalition of willing organisations, the benefits of TBO can be scaled further, leading to widespread improvements across the industry significantly improving flight efficiency. The collective adoption of TBO not only enhances operational efficiency but also contributes to the sustainability goals of the aviation sector, reducing fuel consumption and emissions.

TBO enhancing situational awareness can not be overstated

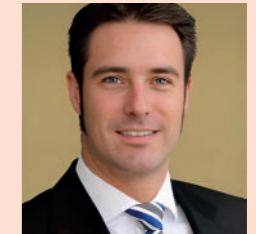
The protection and support of frontline workers in air traffic management — controllers and pilots — cannot be overstated. Enhanced situational awareness and automation enabled by TBO empower these professionals with better tools and information, allowing them to perform their duties more effectively and safely. This, in turn, ensures a more resilient and

LH ATM DEVELOPMENT TEAM

The ATM Development team is responsible for all operational areas of the LH Group Airlines that facilitate further developments of air traffic management (airspace structures, technologies, procedures, etc.) in technical connection to the process owner flight operations policies, procedures & technology.



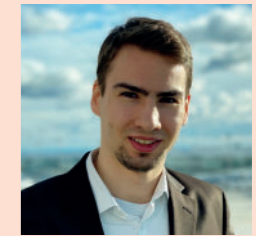
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reliable air traffic management system. In conclusion, the ATM modernisation in Europe through TBO is not just a necessity to fulfill regulatory roadmaps but an opportunity to achieve quick and impactful wins. The proactive steps taken by the Lufthansa Group demonstrate the tangible benefits of TBO, paving the way for a more efficient and sustainable aviation future.

Time to act to embrace advanced flight trajectory management

By fostering collaboration among airlines and ANSPs, we can scale these benefits, ensuring that the entire industry reaps the rewards of TBO. Technology is there. The time to act is now, and with a united effort, the operational stakeholders can transform the European air traffic landscape for the better.



ABOVE: Lufthansa Airbus A320-200 in departure LUFTHANSA GROUP