TASAR
Traffic Aware Strategic Aircrew Requests

NASA Flight Deck Application for En Route Flight Optimization

Timothy Lewis
NASA Langley Research Center
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Operating Environment for Airborne Rerouting

SUA – Special Use Airspace
SWIM – FAA System Wide Information Management
WX – Weather
Traffic Aware Strategic Aircrew Requests (TASAR)
Leveraging Cockpit Automation and Connectivity for Airborne Rerouting

Better Informed Reroute Request

Coordinated with Dispatch

Increased Likelihood of ATC approval

Flight Re-optimized

Requested / Approved Reroute

Approved and Flown!
• Interactive rerouting “app” used directly by the pilot to enhance flight operations

• Converts data connectivity into immediate operational benefits

• Powerful optimization function able to find both non-obvious and common reroute solutions

• Handles complex, dynamic constraints of nearby traffic, weather, and restricted airspace

• Multi-dimensional optimization provides flexibility unmatched by other optimization tools

• Versatility to change optimization objective in real time during the flight

• Adaptable, low-cost implementation with proven appeal to early adopters
TAP "Auto Mode"

<table>
<thead>
<tr>
<th>Lateral</th>
<th>996 lbs</th>
<th>11m 12s</th>
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<tbody>
<tr>
<td>KP75E MLP</td>
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<table>
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<tr>
<th>Vertical</th>
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<table>
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<tr>
<th>Combo</th>
<th>1394 lbs</th>
<th>7m 58s</th>
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<tbody>
<tr>
<td>FL360 / KATES MLP</td>
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Message

<table>
<thead>
<tr>
<th>Objective</th>
<th>Trip Cost</th>
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<tr>
<td>Limit</td>
<td>MLP</td>
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<tr>
<td>ALT Limit</td>
<td>Auto</td>
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<tr>
<td>Max WPTS</td>
<td>Two</td>
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ATC Approved  ATC Denied  Dispatch  Flag Event  Winds FL 340  Layers
TAP “Auto Mode” (Video Demo)
Flight Tested in the National Airspace System

Nov 2013, Jun 2015

Flown in Aircraft Certified for Normal Operations
AdvAero Piaggio Avanti

Operated in Congested Airspace

Evaluated in Flight by Senior Airline Pilots

Tested on Airline Hardware

Also Assessed from ATC Perspective
TASAR Flight Trial #3 (April 2018)

- Goal: Develop and test TAP functionality for
  - Integrating onboard weather radar with ground-based weather data sources
  - Integrating turbulence data into route optimization

- NASA proofs-of-concept for onboard and ground-based weather data polygonization under development

- In the future, weather polygons should be provided by weather service providers (ground) and/or avionics vendors (airborne)
Basic weather data needs for TAP

- TAP knows how to interpret 4D polygons (WX, SUA, etc.)
  - Lateral shape, top and bottom altitudes, and start and end times
- We need someone to define, generate, and provide these polygons!
  - Or some other hazard definition that suitable for use by an algorithm

Current NEXRAD radar reflectivity

Prototype polygon avoid areas
Operational Evaluation with Alaska Airlines

- Trials starting Fall 2017
- Three Boeing 737-900ER aircraft
- Revenue service operations
- Validate the utility and benefits of TAP in an airline operational environment
- Accelerate technology transfer to the commercial sector
More information

• Contacts:
  – Timothy Lewis, timothy.a.lewis@nasa.gov
  – David Wing, david.wing@nasa.gov

• TASAR Technology Transfer:
  – https://technology.nasa.gov/patent/LAR-TOPS-148

• Airspace Technology Demonstration 3:
  – https://www.aviationsystemsdivision.arc.nasa.gov/research,strategic/atd3.shtml