

**DRAPER**

# **Enhancing Capabilities and Reducing Workload in UAV Operations**

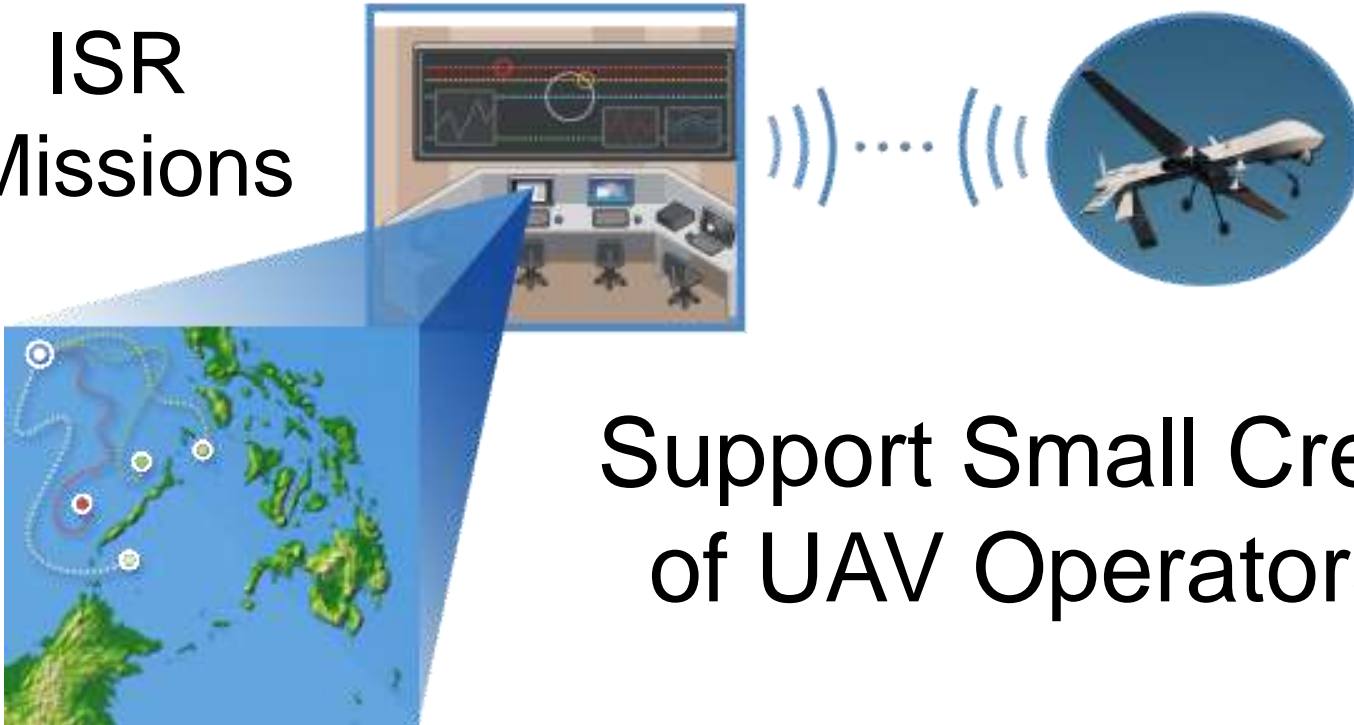
Zahar Prasov

NDIA Human Systems Conference

February 09-10, 2016

# Background

ISR  
Missions



Support Small Crew  
of UAV Operators

# Challenges

## High Operational Cost



3-Operator  
Crew : 1 UAV

## Waypoint Navigation

# Ideal Scenario

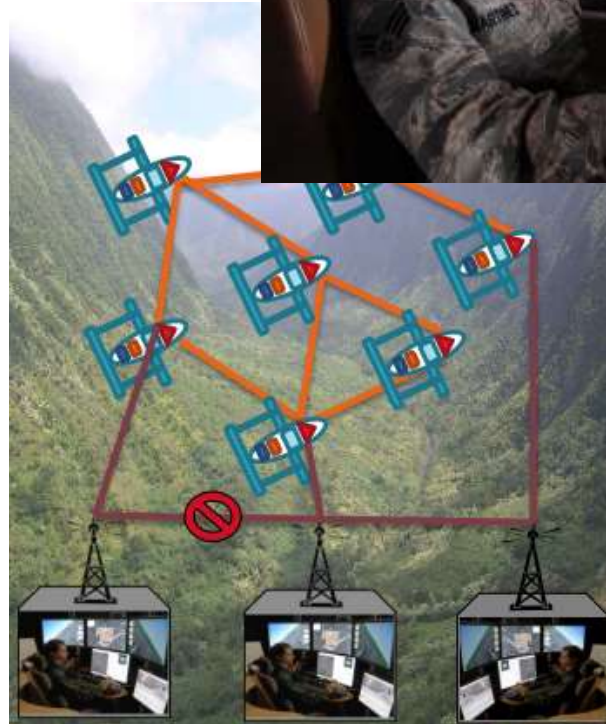
Supervisory Control  
of Multiple UAVs



(U.S. Air Force photo by Val Gempic/Released)

Pooled Resource  
Allocation

Enhanced Mission  
Capability



# How to achieve the ideal scenario?

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1. Enhance effectiveness of single UAV (single crew) missions
2. Reduce operational cost
3. Multi-UAV operations

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**Solution Approach via Multi-Agent Autonomous Reusable Software (MAARS)**

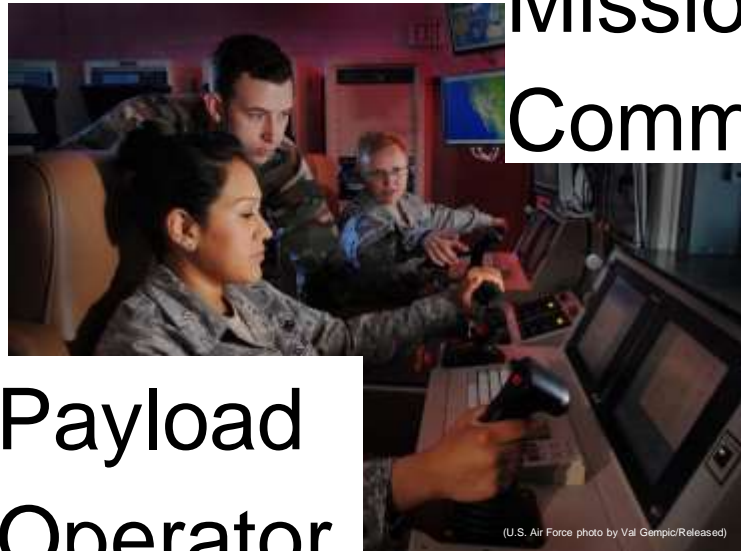
# Workflow Analysis

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Pilot

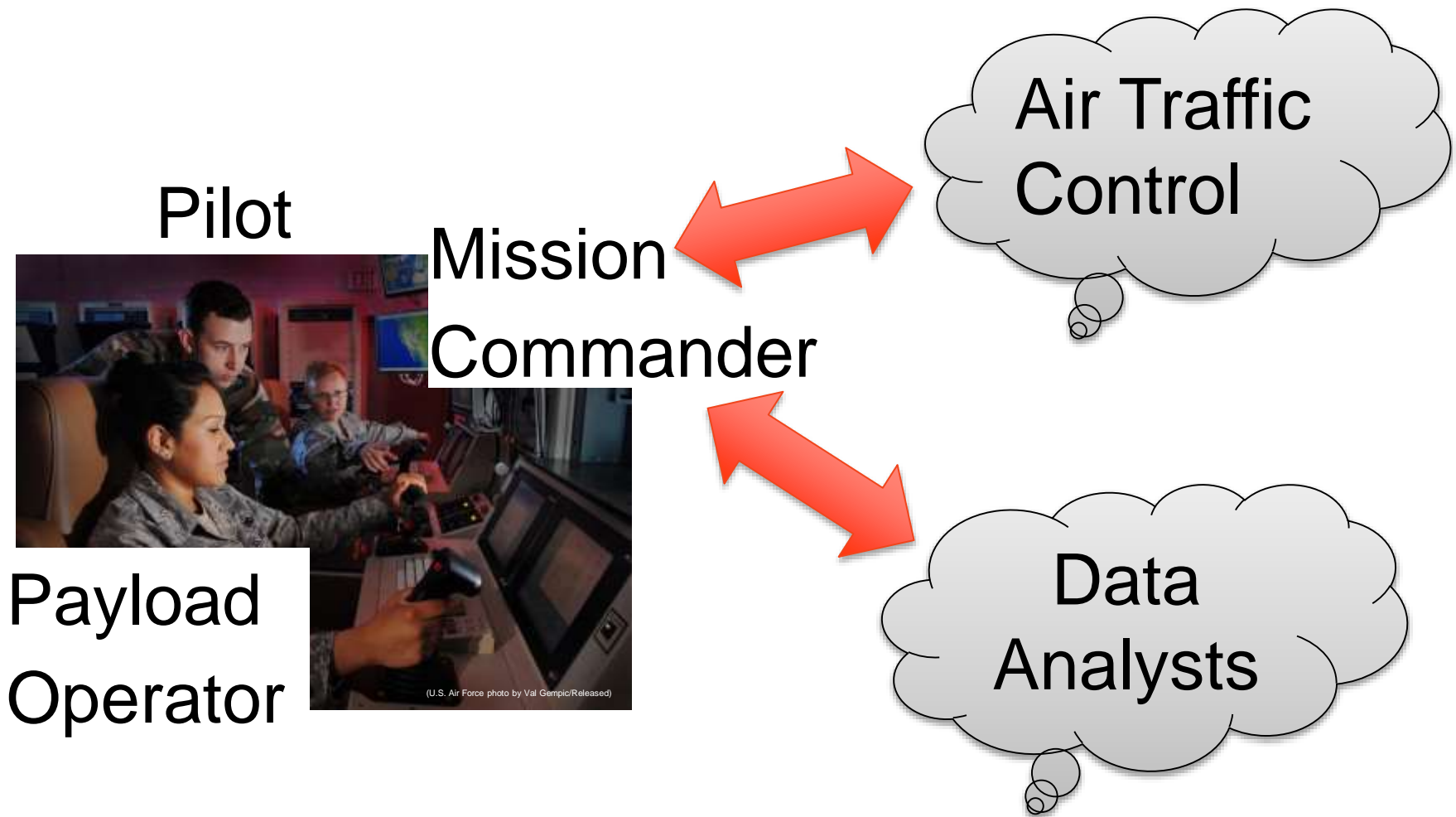
Mission

Commander

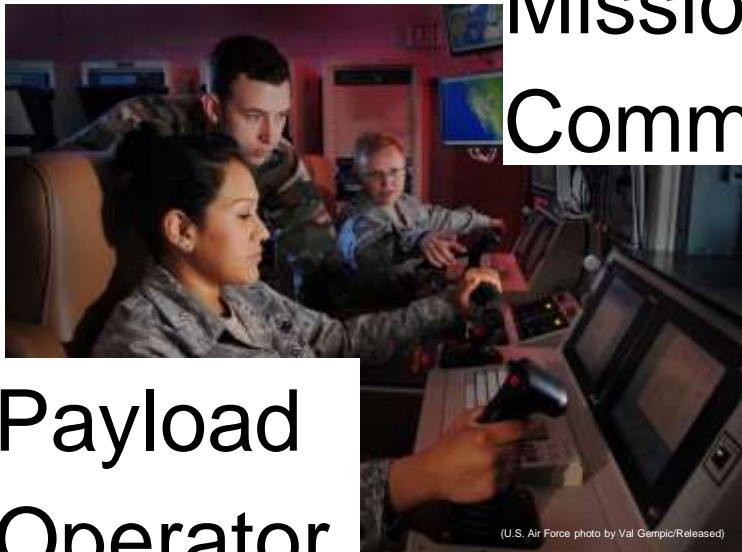


Payload  
Operator

# Mission Stakeholders



Pilot



Mission  
Commander

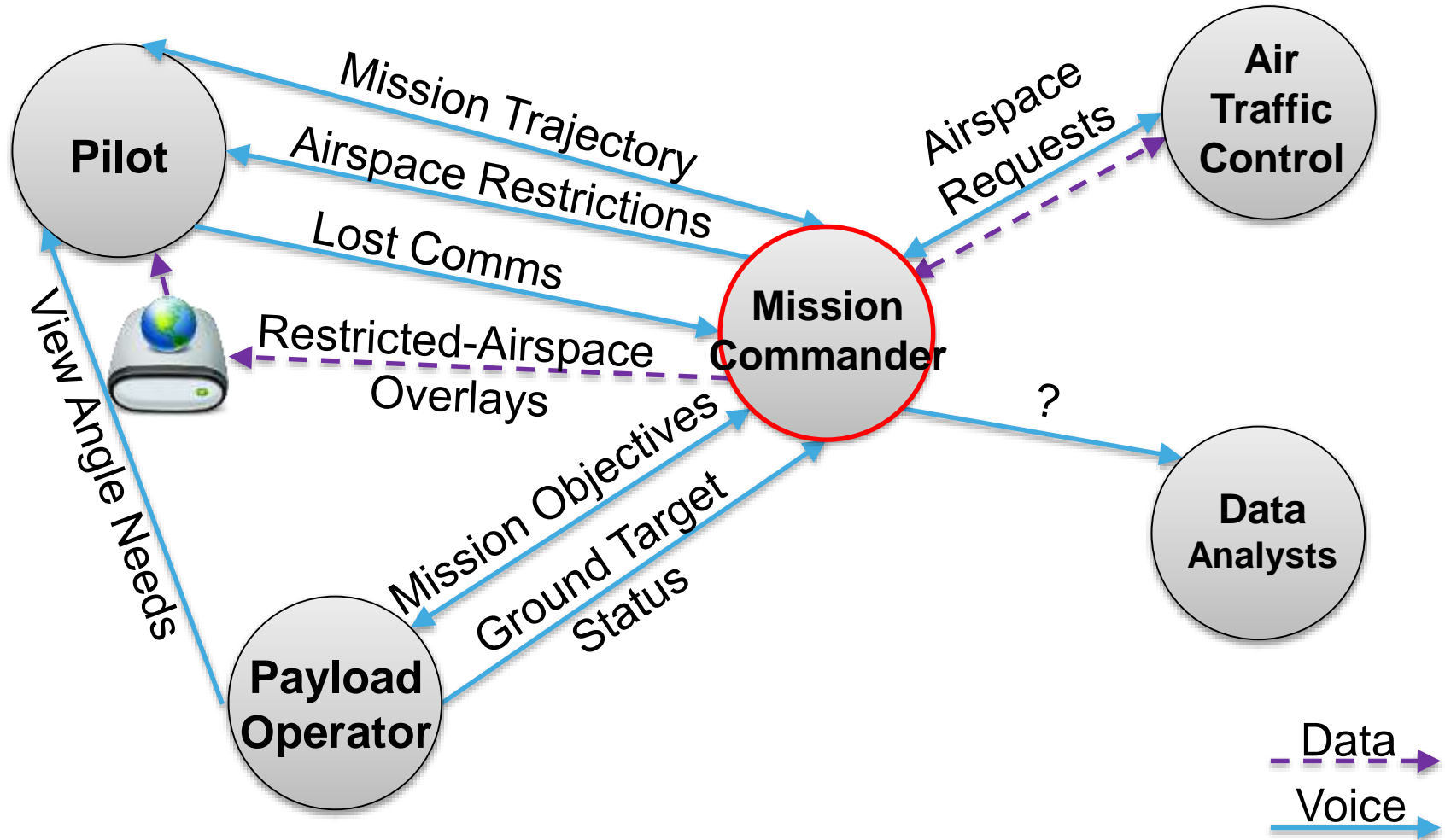
Payload  
Operator

Air Traffic  
Control

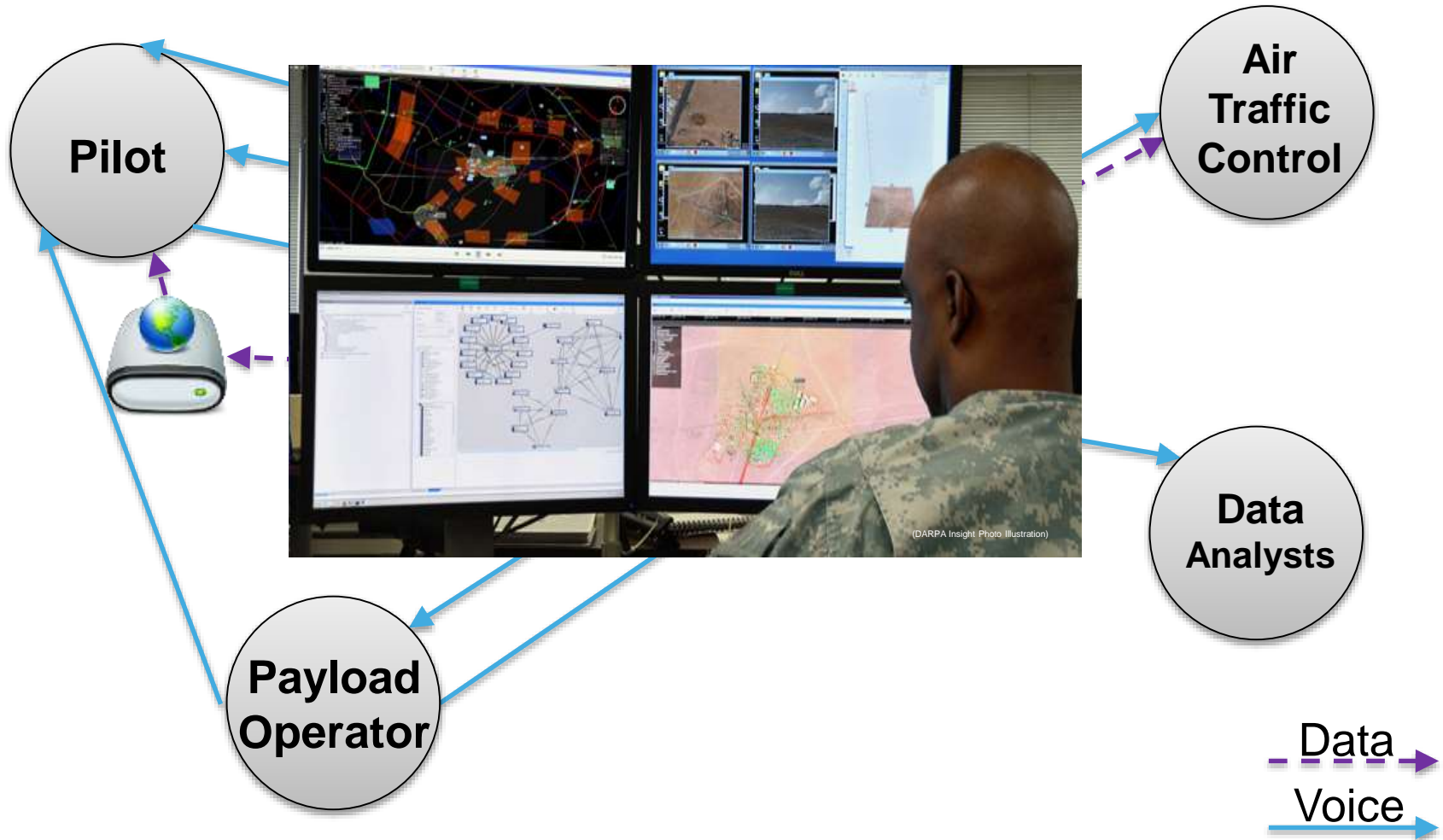
Data  
Analysts



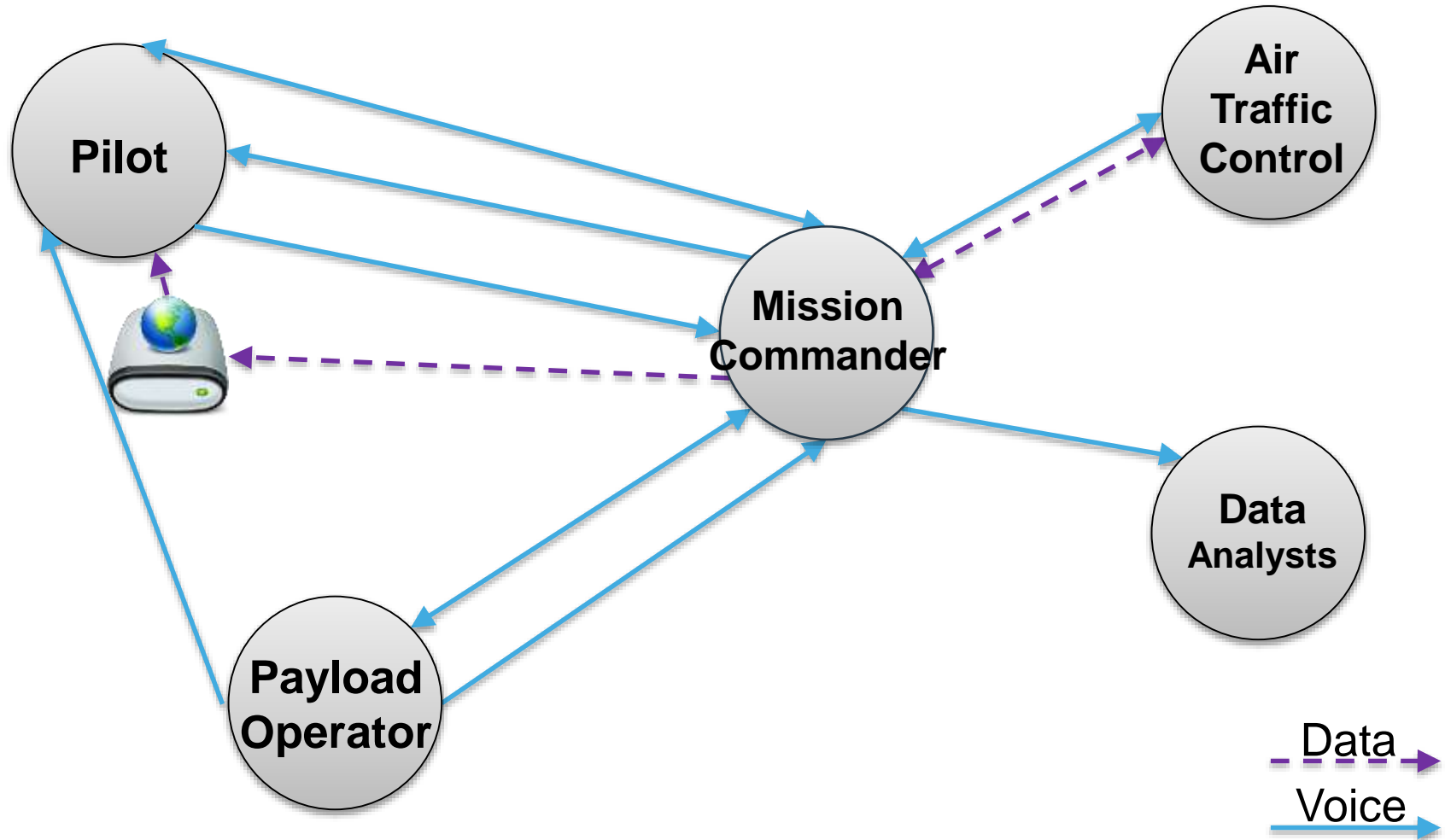
# Information Flow



# The Mission Commander is Overloaded!



# Primarily Voice-Based Coordination



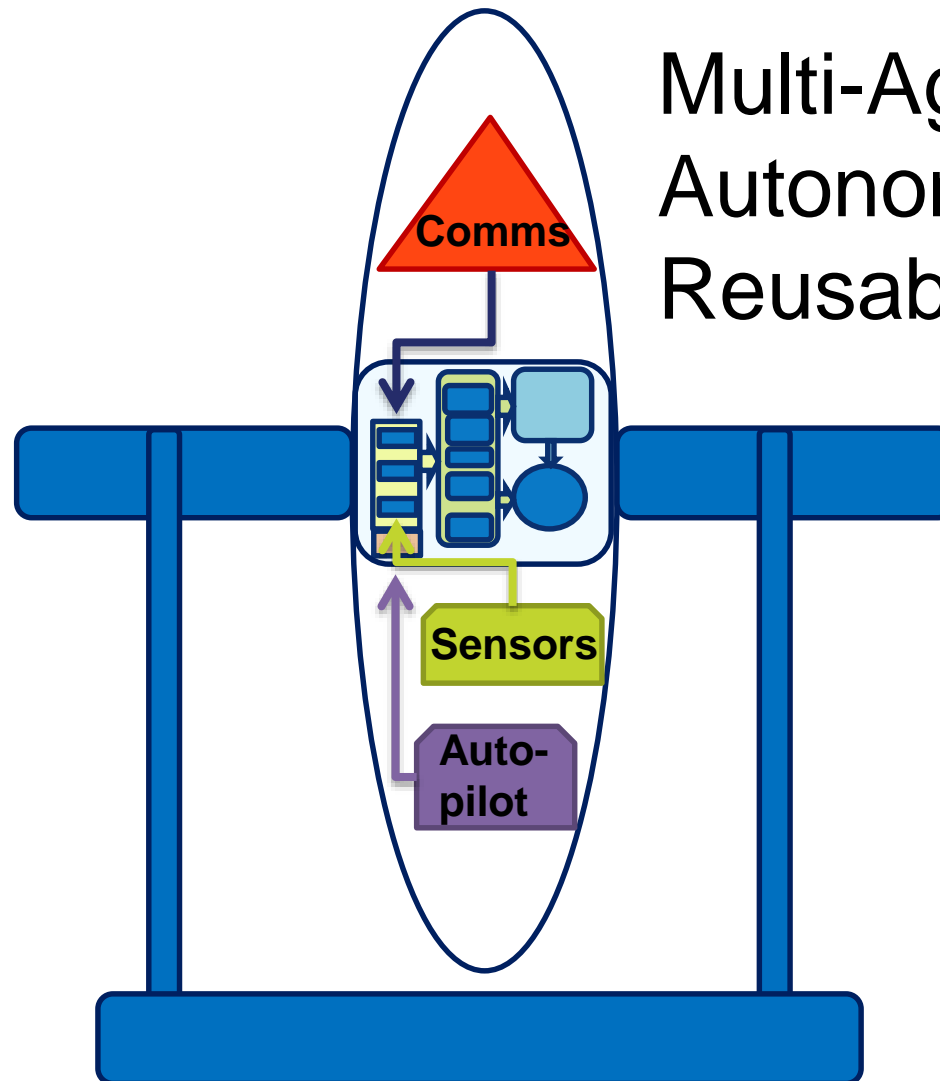
# Enhance Current Single Crew/UAV Operations

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Reduce Mission Commander Load:

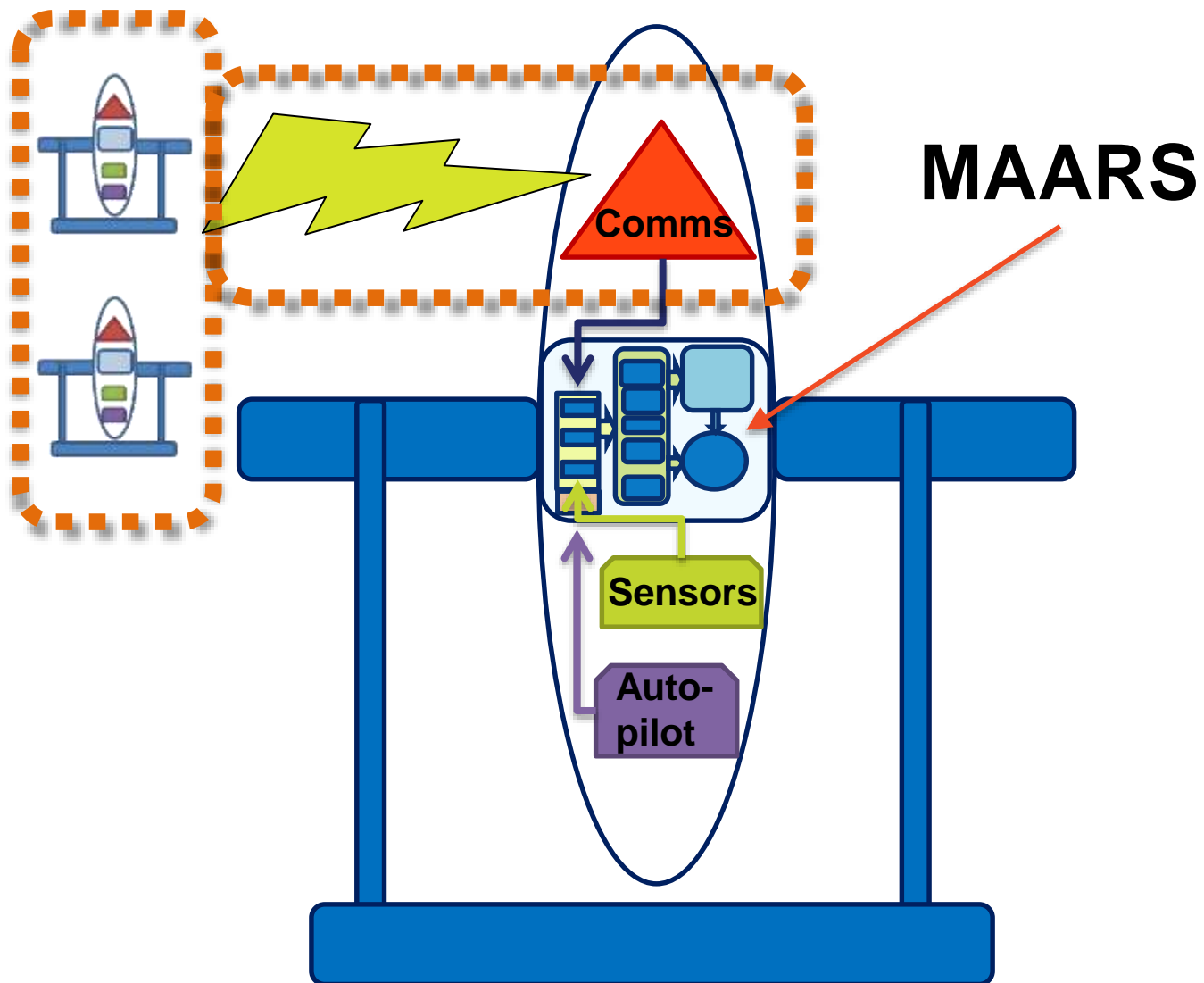
- Waypoint navigation
  - high-level mission planning
- Voice-based coordination
  - digitally-assisted coordination

# ... via MAARS



Multi-Agent  
Autonomous  
Reusable Software

# MAARS Architecture



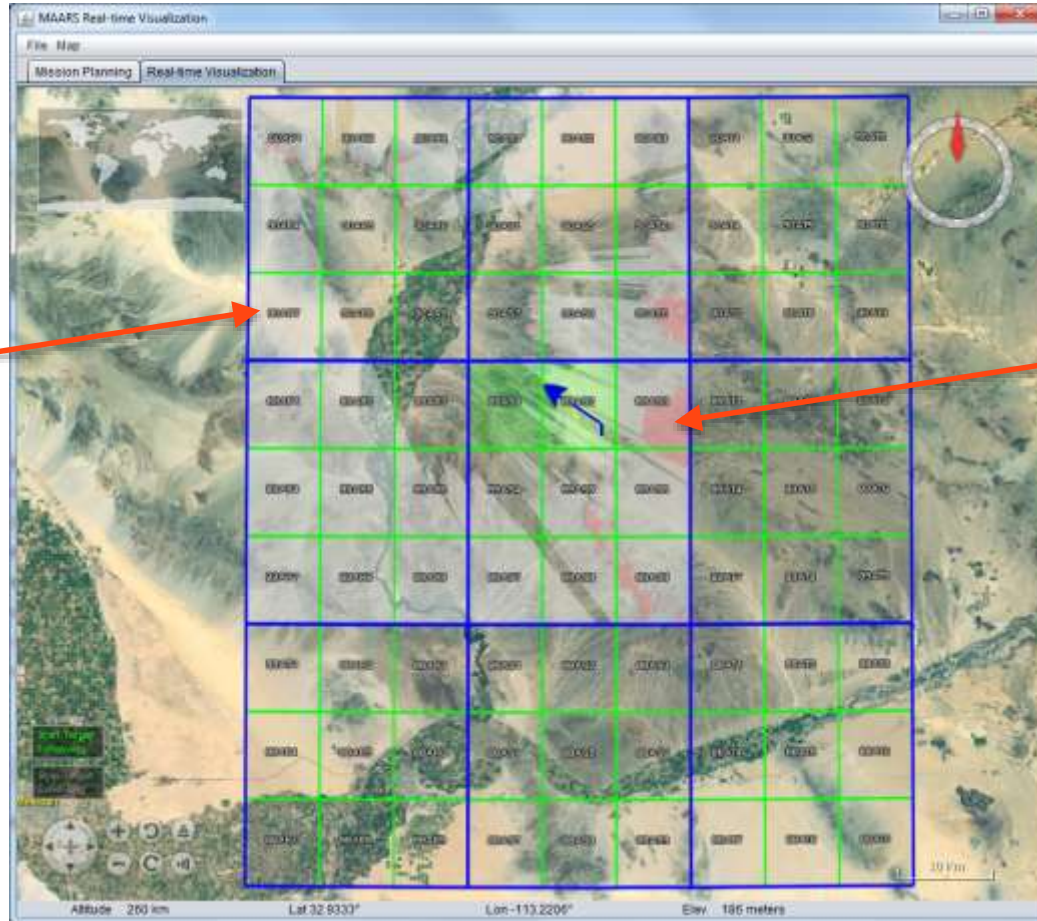
# Capabilities Developed in MAARS

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- Adherence to geospatial constraints
  - Avoiding terrain
  - Maintaining communication
- Adherence to mission constraints
  - Ground-target following
  - Airspace management

# Adherence to Geospatial Constraints

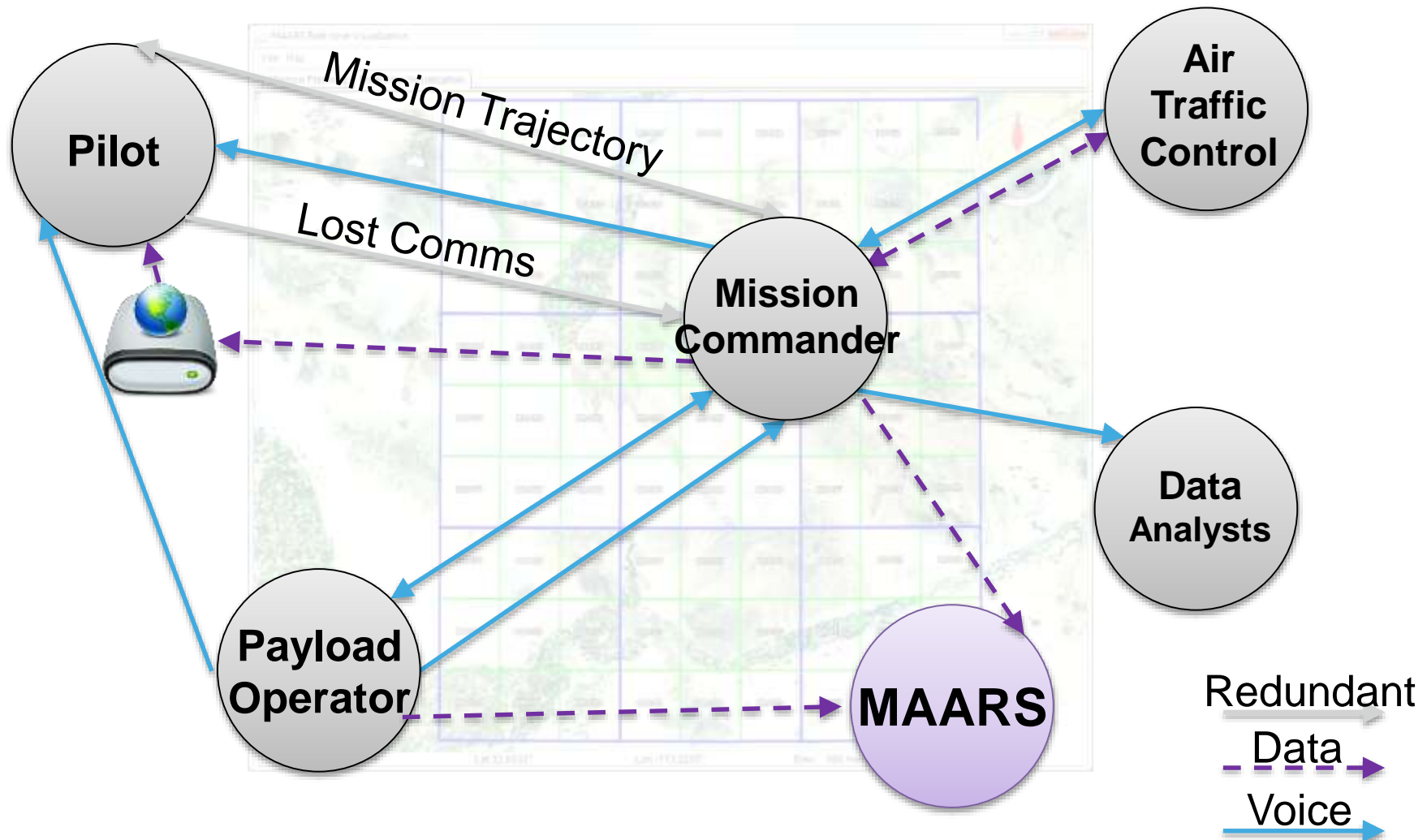
Line-of-Sight  
Avoidance  
Zone



Terrain  
Avoidance  
Zone



# Adherence to Geospatial Constraints



# Ground-Target Following

Payload  
Interaction

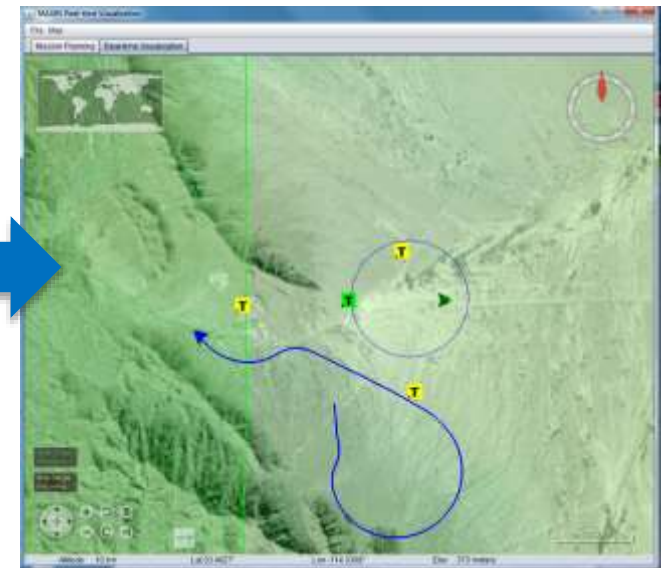
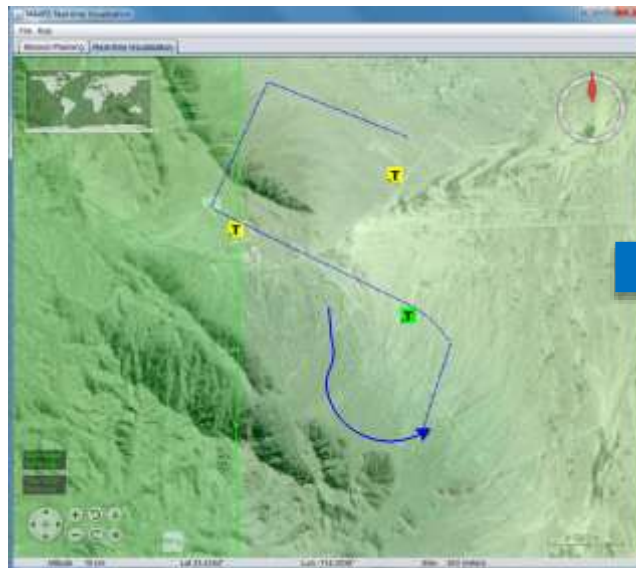


# Ground-Target Following

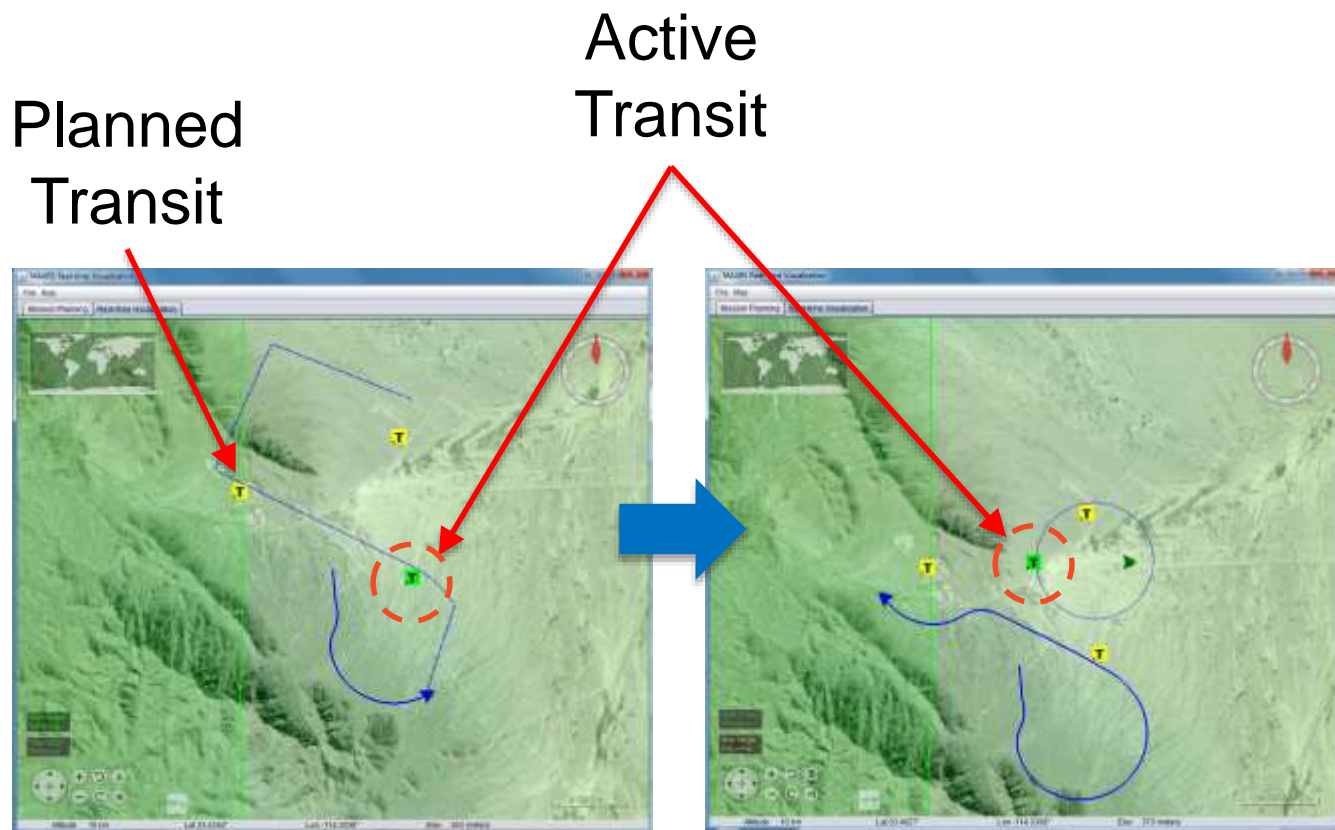
Payload  
Interaction



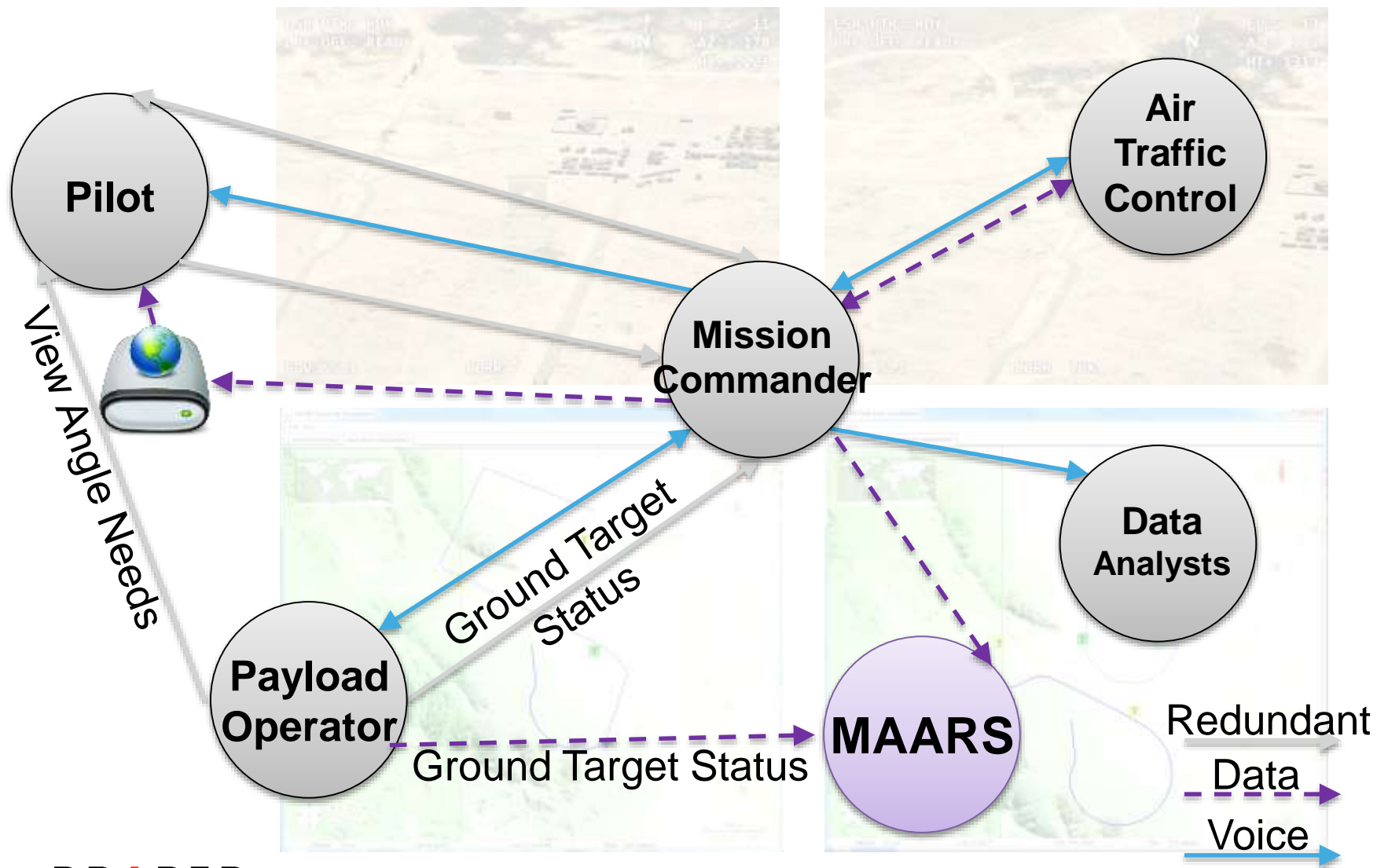
Autonomy  
Visualization  
Interaction



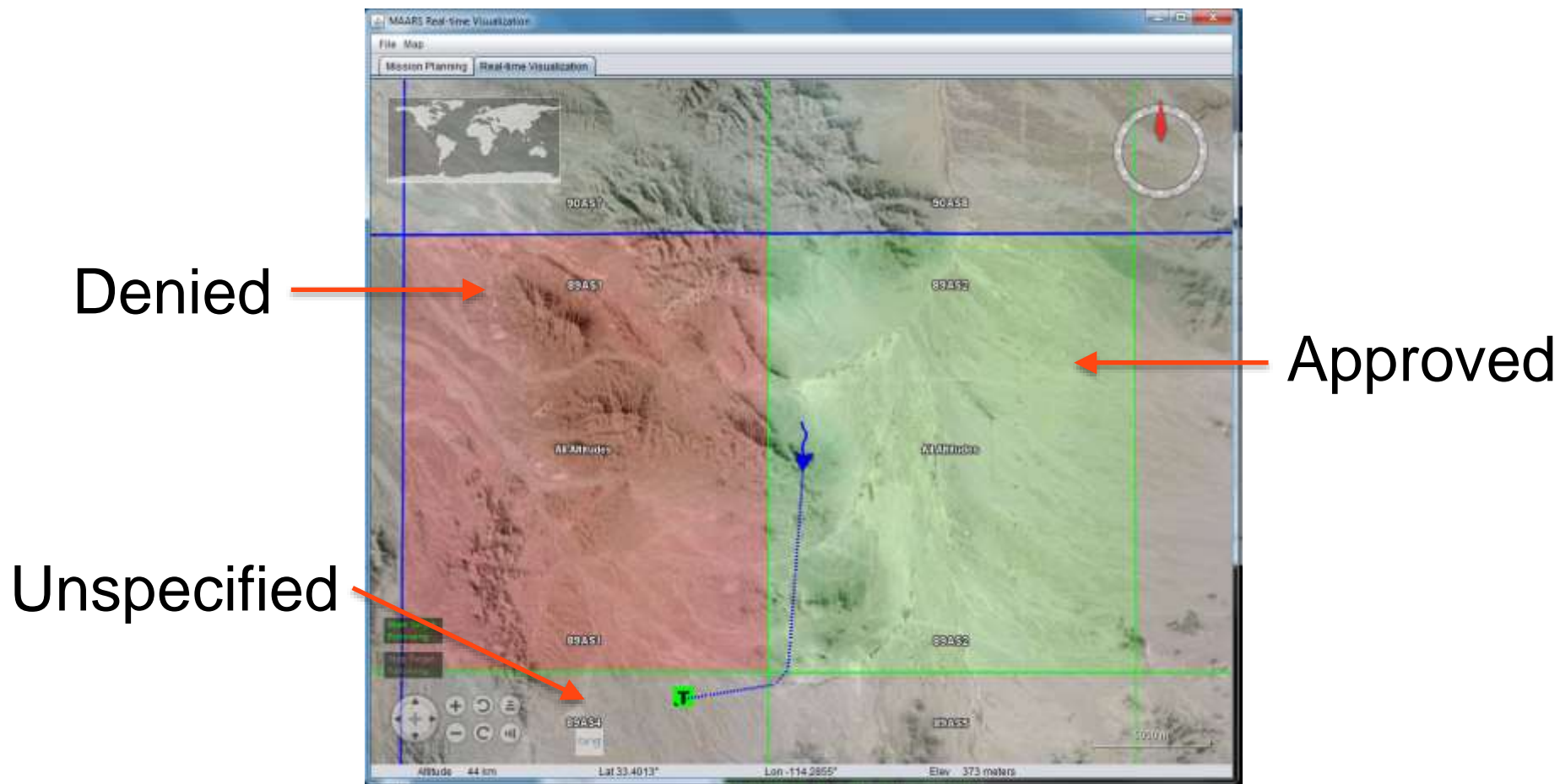
# Ground-Target Following



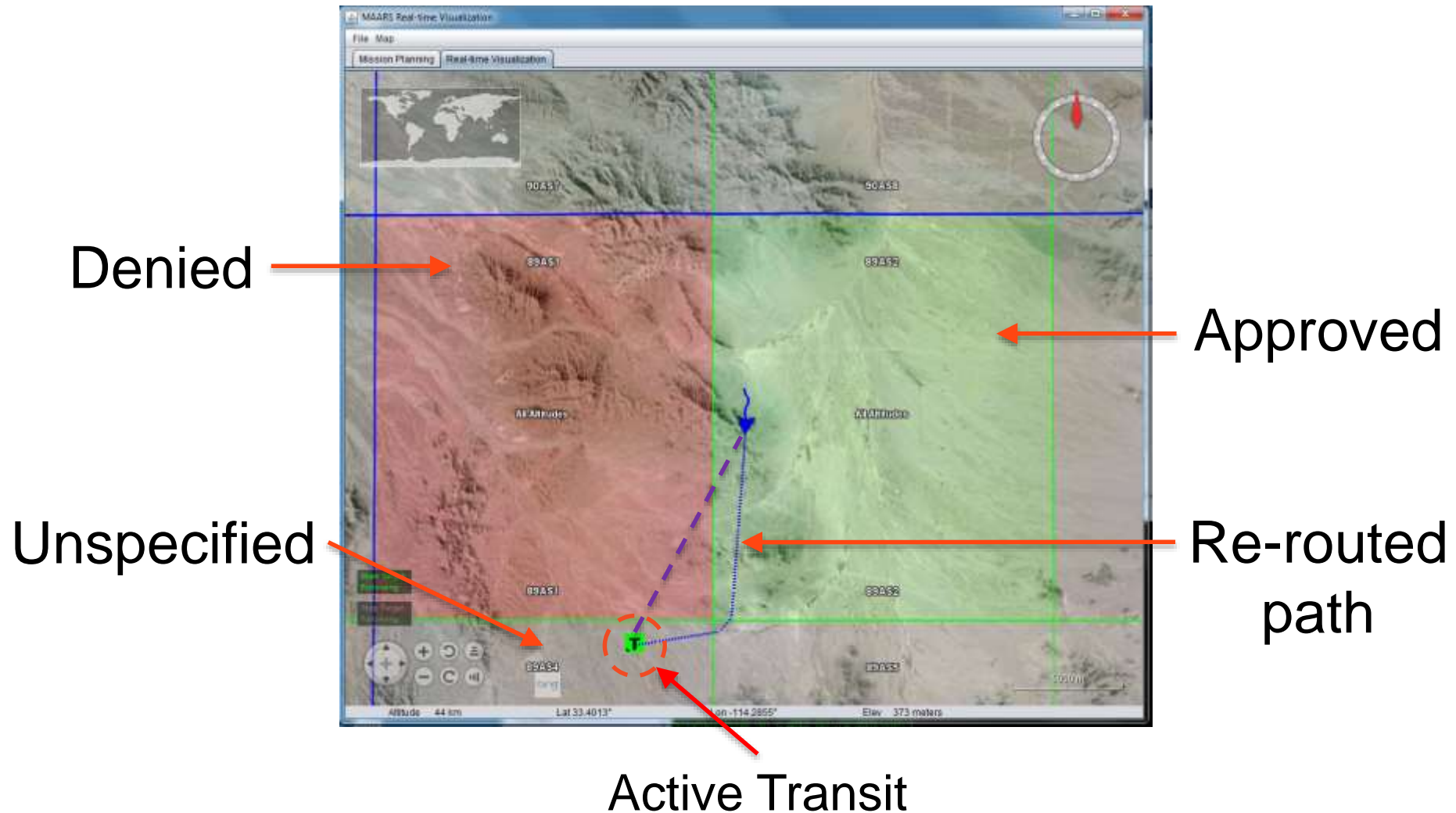
# Ground-Target Following



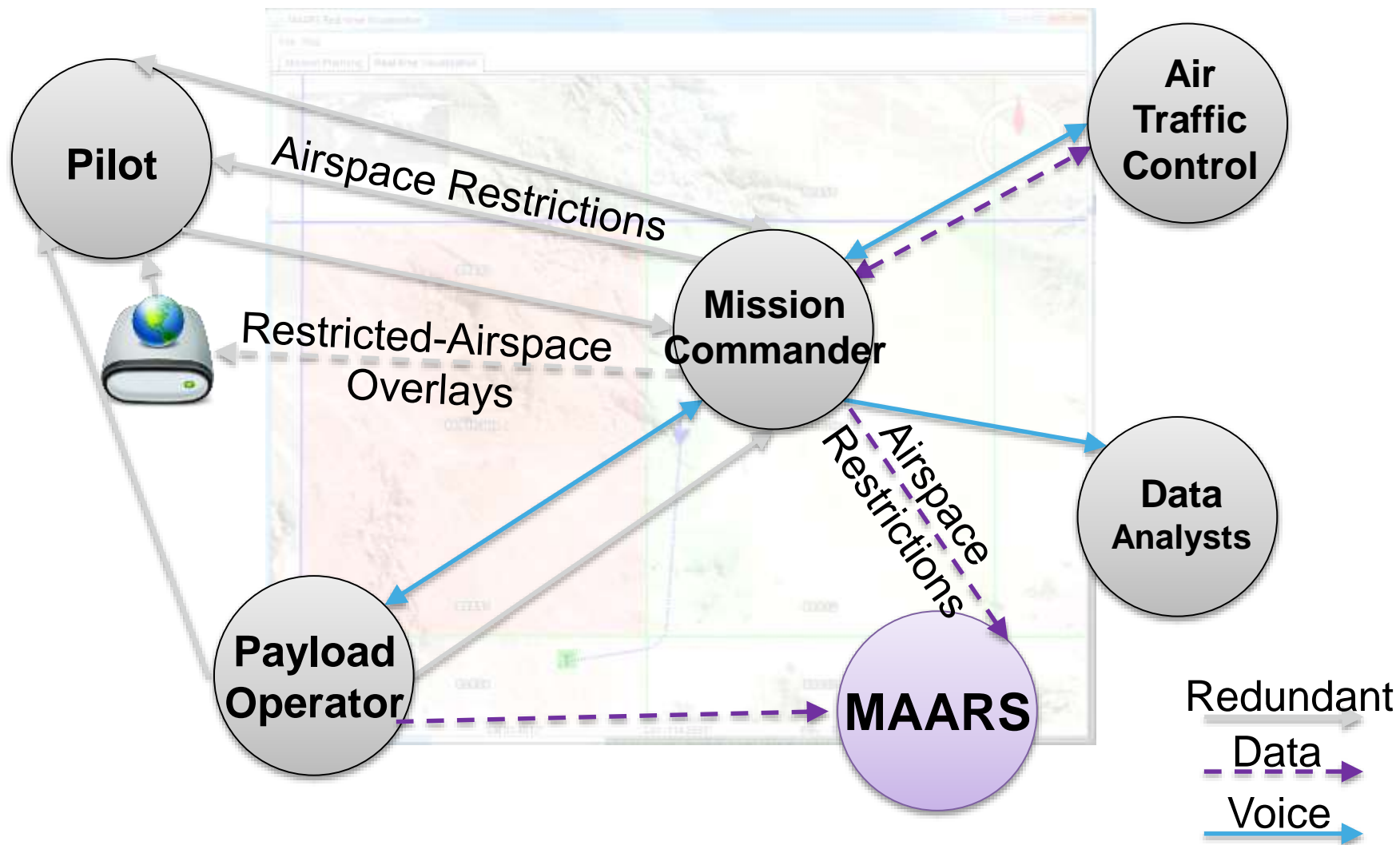
# Airspace Management



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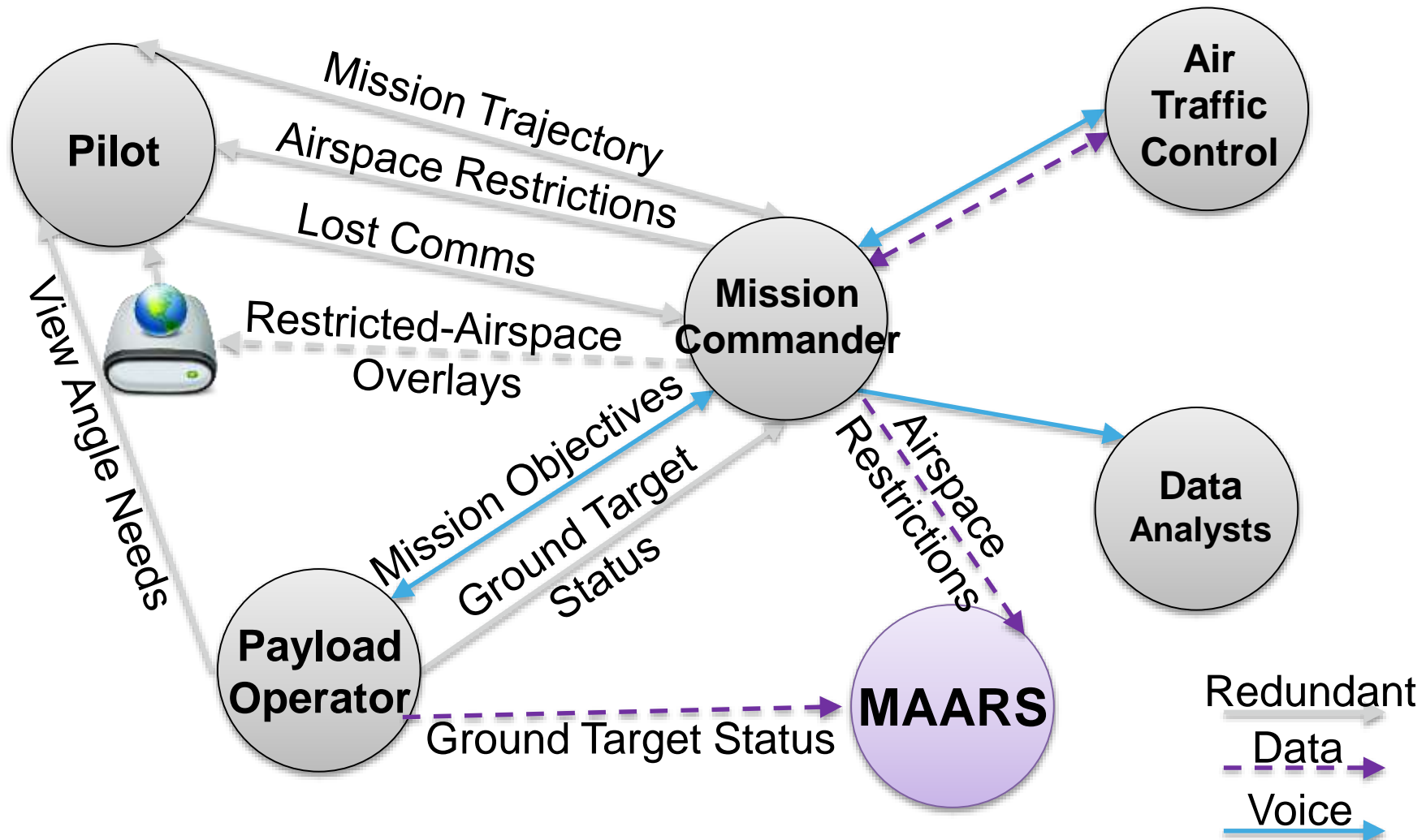


# Airspace Management

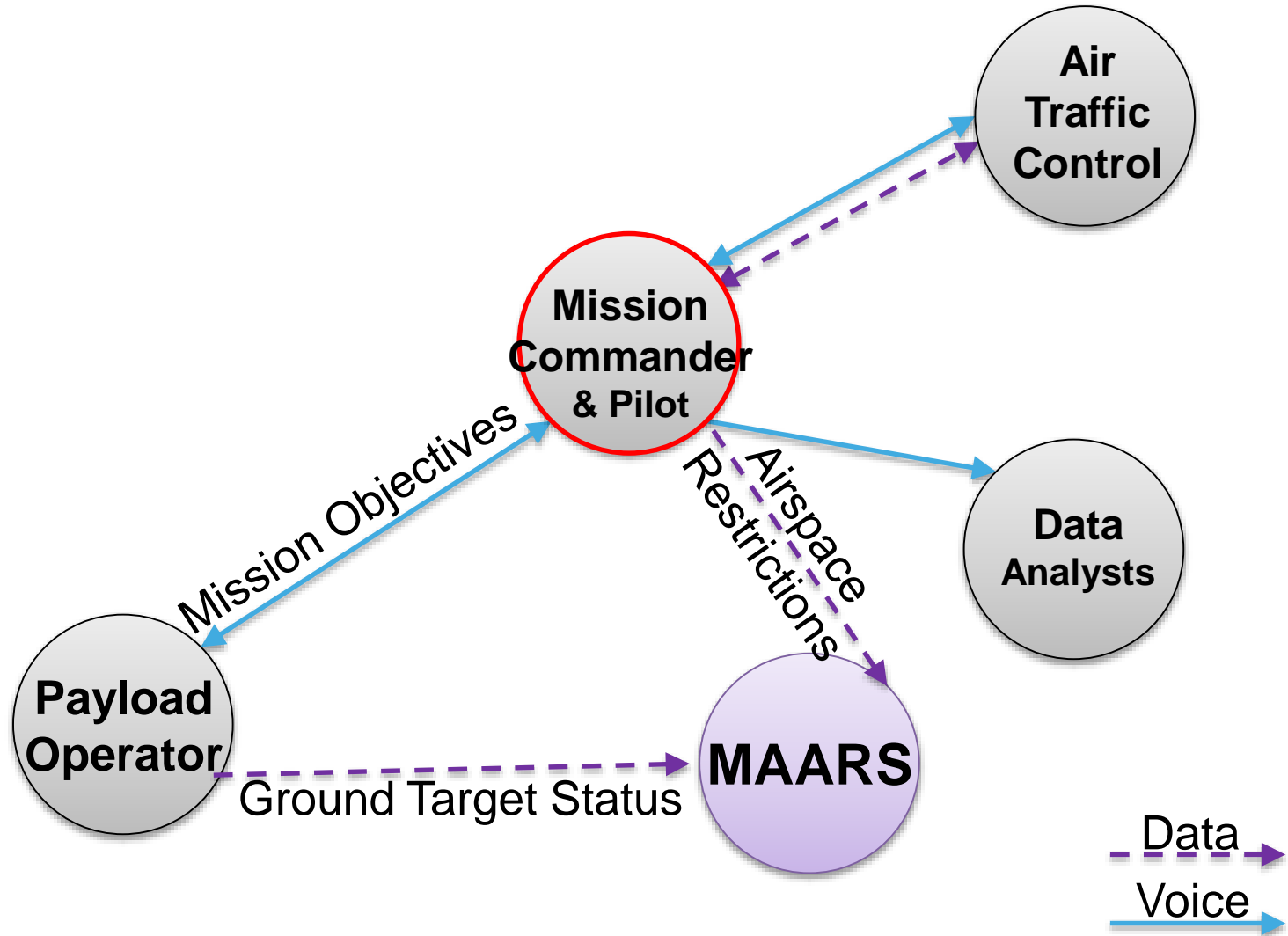




# Resulting Workflow: Reduction in MC and Pilot Load

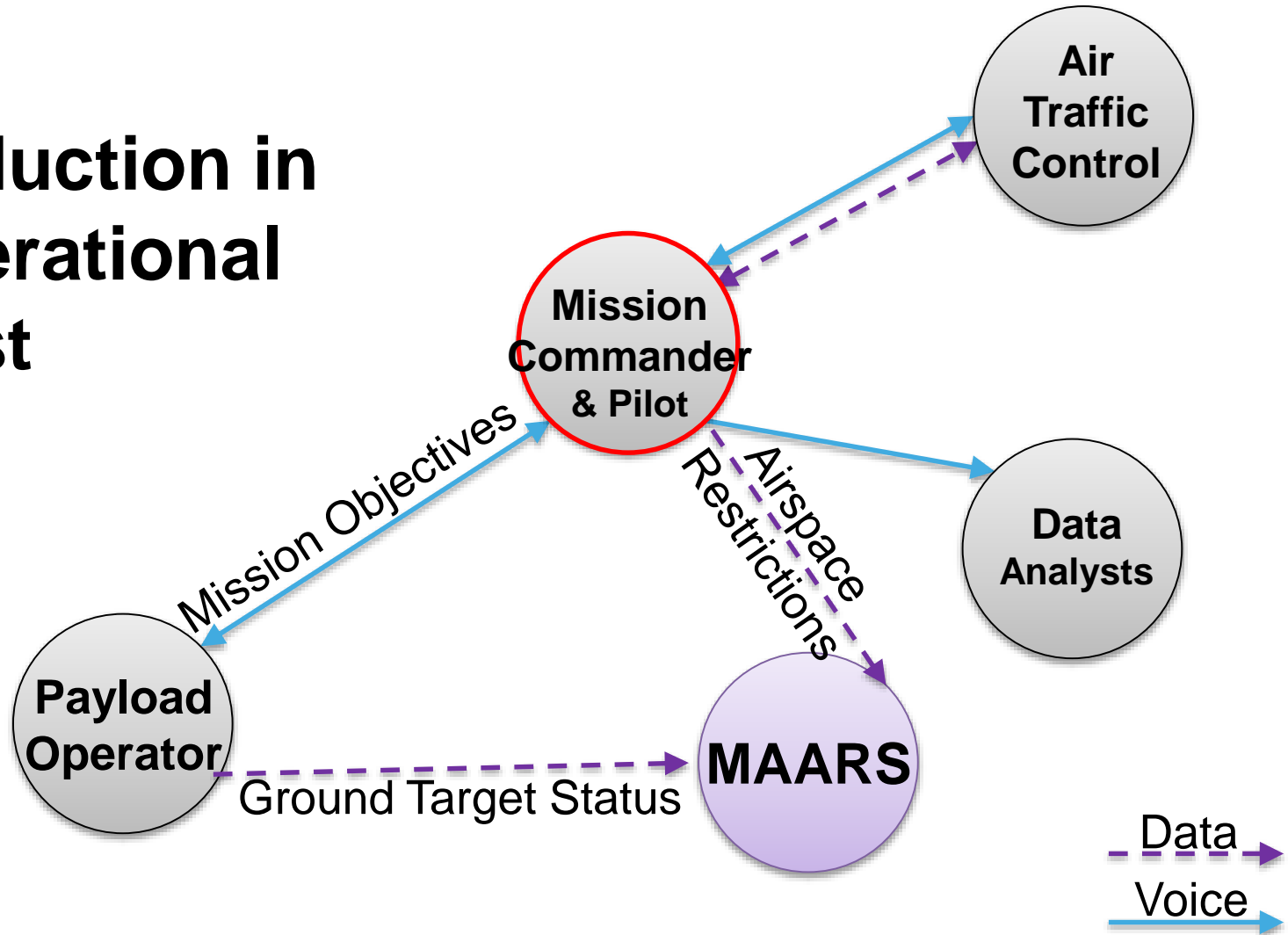


# Combine MC/Pilot into One Role



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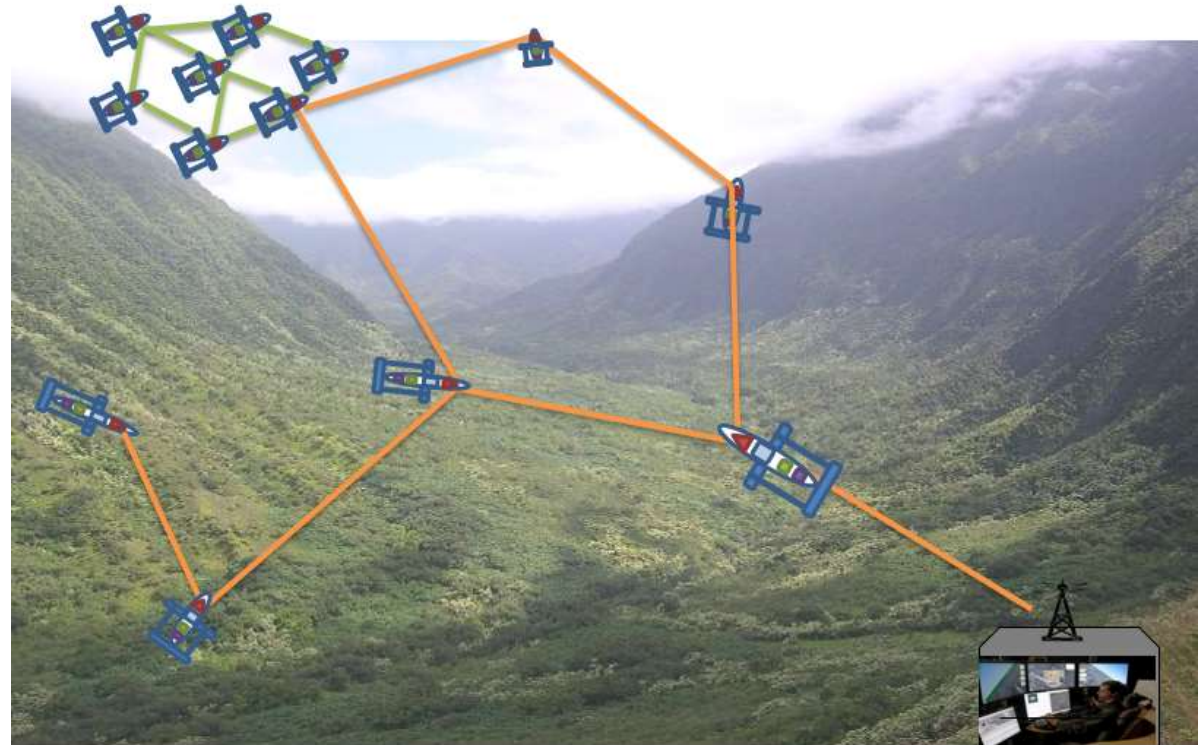
## Reduction in Operational Cost



# Future Work

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Enable Single Crew to Perform multi-UAV Operations



Enable Dynamic  
(real-time)  
Mission Planning

# Acknowledgements

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## Contributors:

- Dr. Rahul Chipalkatty
- Matt Grammes
- Tim Gomeringer
- Arch Owen

## Contact:

Dr. Zahar Prasov  
Research Engineer  
Draper

617-258-1724

[zprasov@draper.com](mailto:zprasov@draper.com)

# Thank You!

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## Questions?