



Sharing Operational Intent with Containment Confidence Level for Negotiating Deconfliction in Upper Class E Airspace

Hyo-Sang Yoo*, Jinhua Li, Christopher O'hara

Universities Space Research Association (USRA) - NASA Academic Mission Services (NAMS)

NASA Ames Research Center, Moffett Field, CA

Richard H. Jacoby and Ray Torres

ASRC Federal Data Solutions

NASA Ames Research Center, Moffett Field, CA

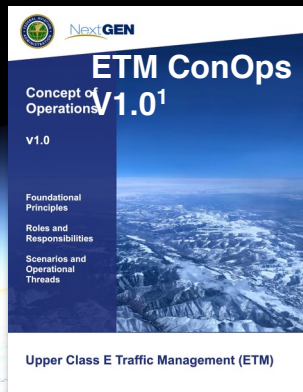
** Hyo-Sang.Yoo@nasa.gov*

The need for Upper Class E Traffic Management (ETM)

New types of operations in
Upper Class E airspace



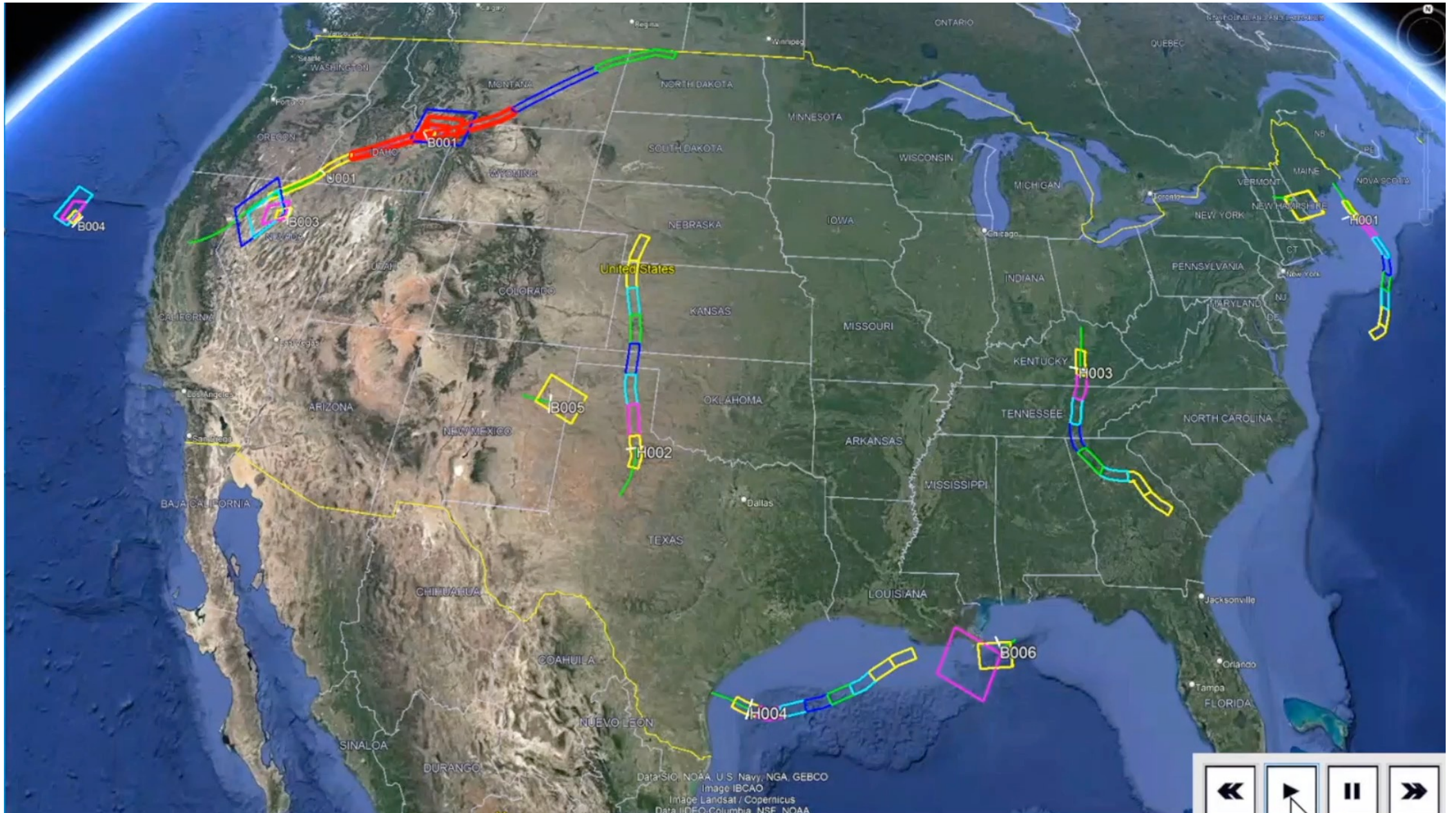
“In the United States, there are no airspace management provisions specific to civil aircraft operations above FL600¹”



The ConOps¹ states the opportunity of the alternative traffic management concept, which must:

- “Scale beyond the current NAS infrastructure and manpower resources to meet the needs of market forces”
- “Support the management of operations where no air navigation service provider (ANSP) separation services are desired, appropriate, and/or available”
- “Promote shared situation awareness among Operators”

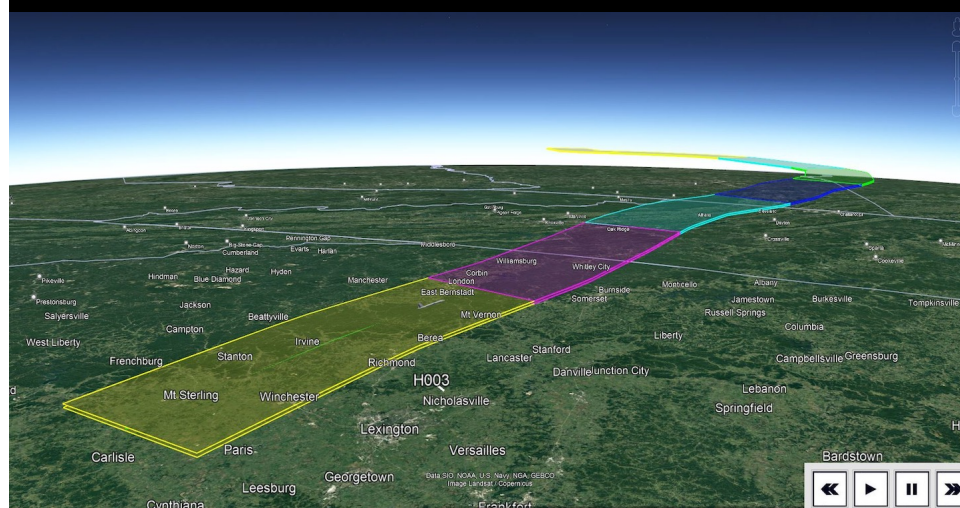
Operational Intent Sharing



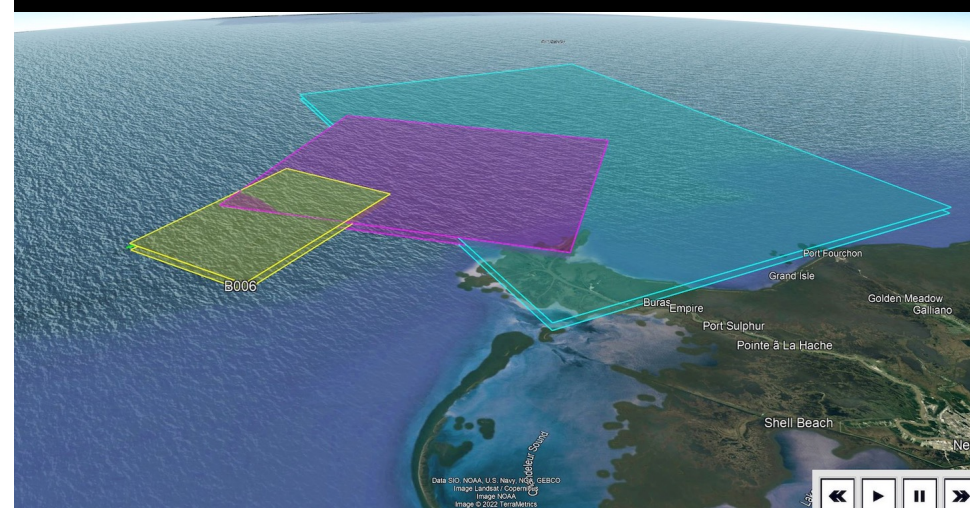
Problem Statement

There are various attributes of Operation Intent Sharing that must be comprehensively addressed and agreed among the ETM community for standardization to enable Cooperative Traffic Management

Operational Intent of a vehicle with high maneuverability



Operational Intent of a vehicle with low maneuverability



Inefficient and unfair airspace access

Purpose

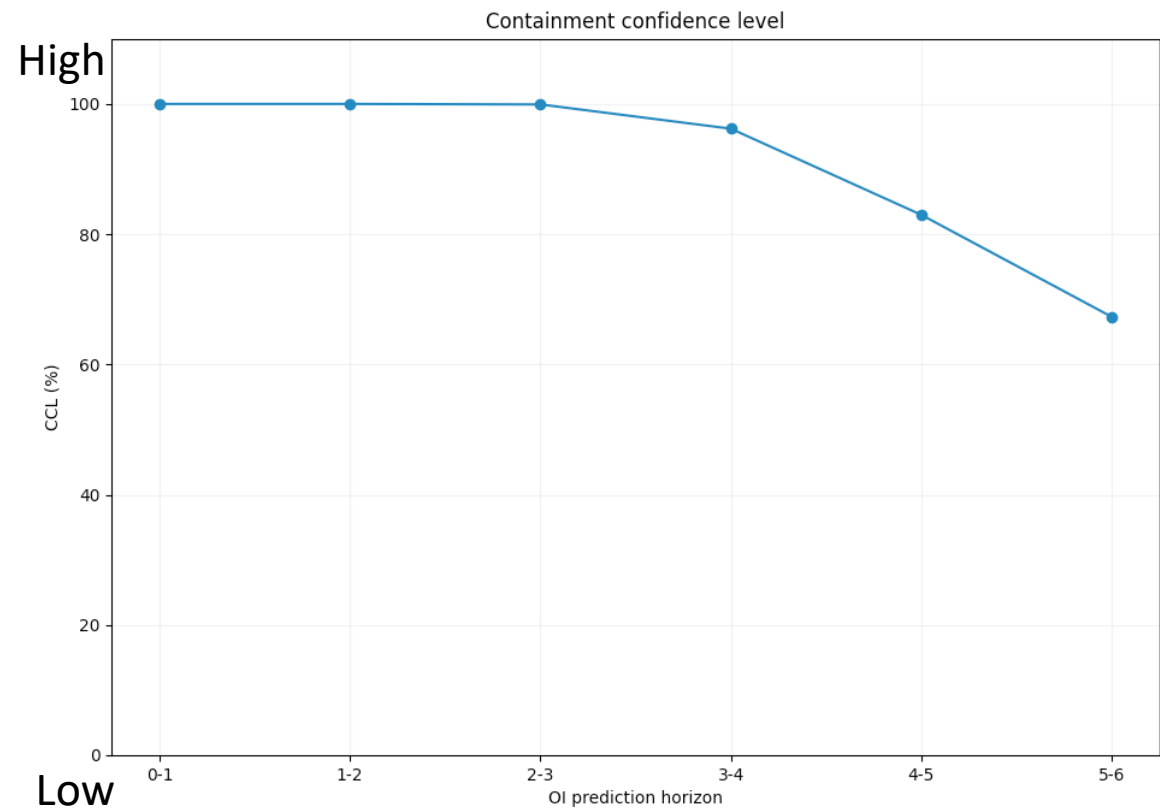
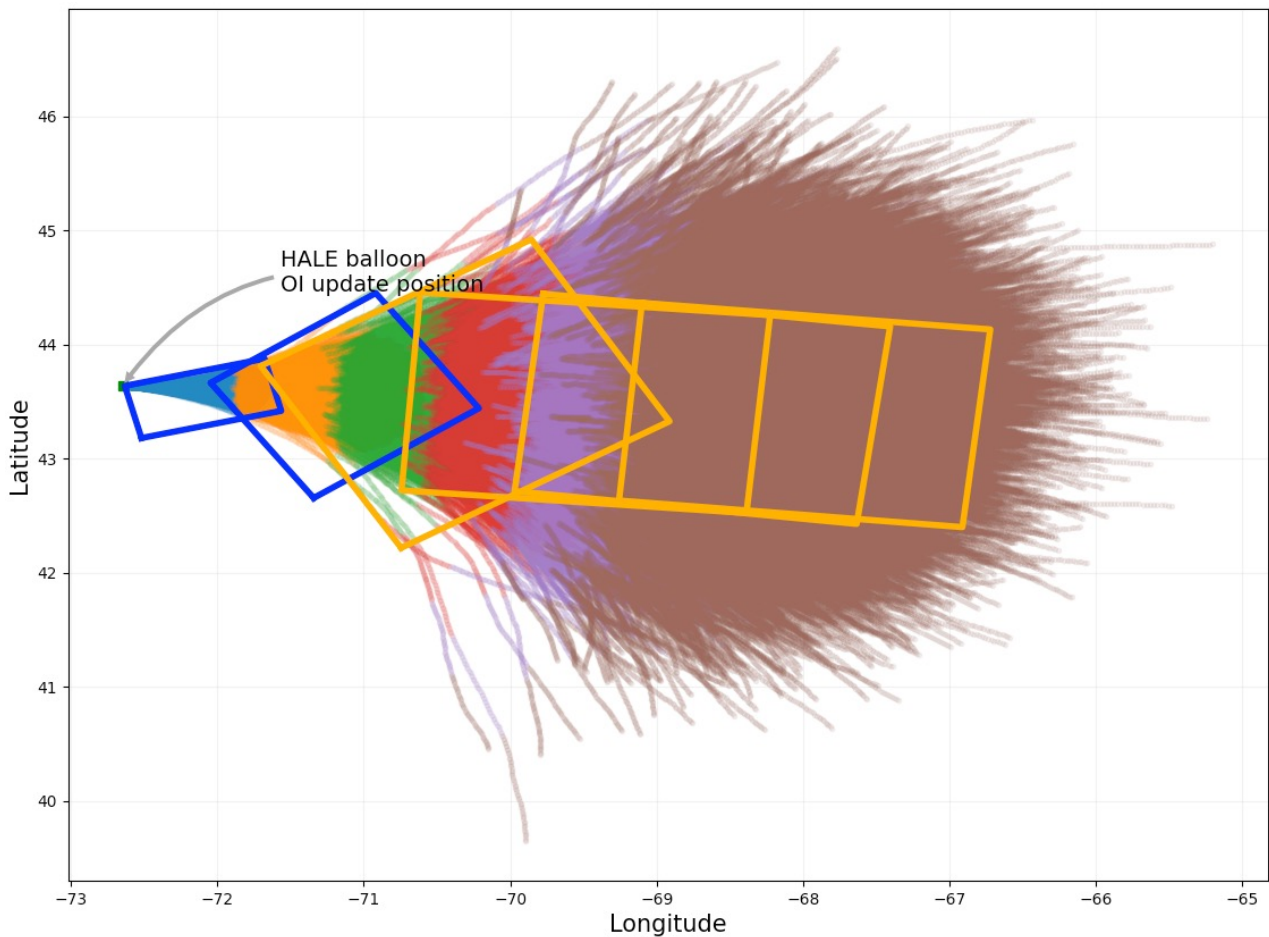
To present how Containment Confidence Level (CCL), i.e., one of the attributes of Operational Intent, can be computed under varying size restriction and utilized in the Cooperative Traffic Management Environment

What does the paper include?

- A method for generating Operational Intent for the High Altitude Long Endurance (HALE) balloon
- An algorithm that generates Operational Intent while meeting the size restriction
- A method for computing the known level of confidence, i.e., referred to as Containment Confidence Level (CCL) in this paper
- A framework that shows how the CCL information could be used to decide which resolution action to be executed
- The outcome of a feasibility evaluation of the method proposed for using the CCL using the simulation experiment

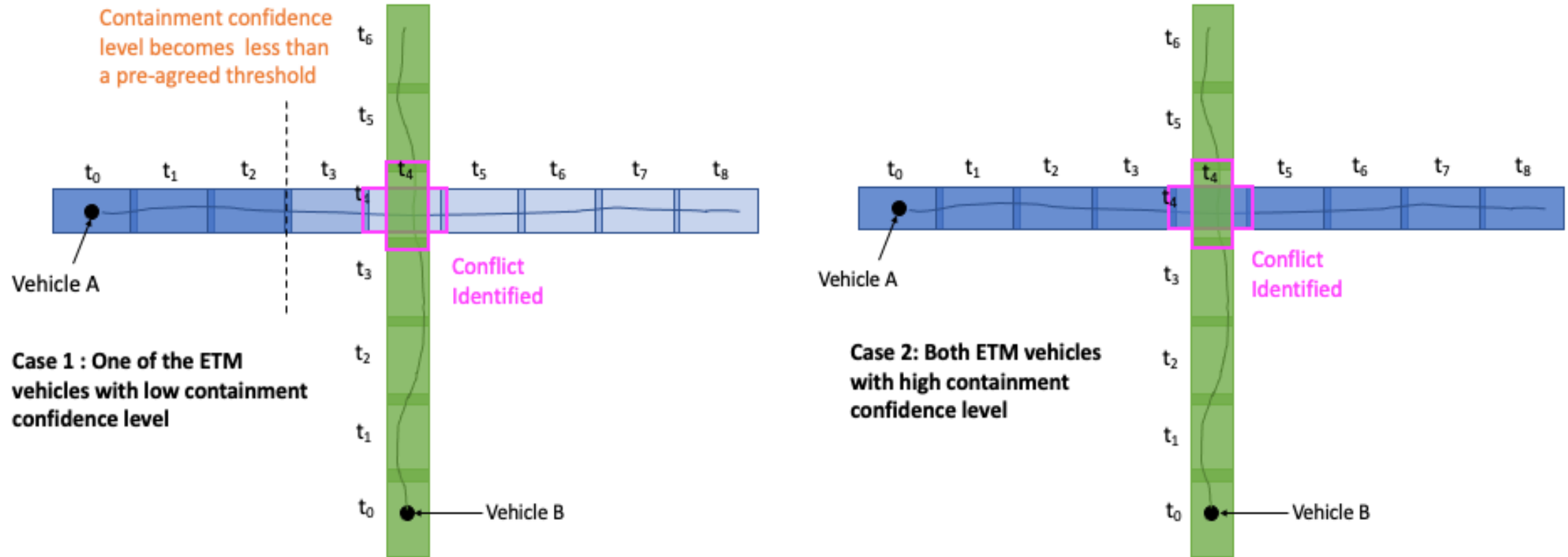
Operational Intent Generation with Size Restriction and CCL Computation

An example of HALE balloon OI generation



Containment Confidence Level (CCL)
= 1 - (likelihood that an ETM vehicle exits Operational Intent boundary)

Framework for Utilizing Containment Confidence Level Information



“Wait-n-watch” can be executed, if one or both of the intersecting OI segments’ CCL value is lower than the negotiated threshold value prior to operations

Summary

- Showed how Operational Intent could be generated with Containment Confidence Level while meeting the Operational Intent size restriction
- Demonstrated the framework that utilized the Containment Confidence Level and assessed the feasibility in the simulation environment