NAS Exploratory Concepts & Technologies (NExCT)
Upper Class E Traffic Management (ETM)
Collaborative Evaluation #1 (CE-1)

ETM Industry Workshop

Outline

- ETM Collaborative Evaluation #1 (CE-1)
  - Overview
  - Key Details
  - Connectivity Test and Demonstration Schedule
- ETM CE-1 Demonstration
  - Simulation Environment
  - Scenario Descriptions and Associated COPs for Operational Intent and Strategic Conflict Negotiation
- Initial Findings and Feedback
- Summary and Next Steps

ETM Collaborative Evaluation #1 (CE-1)

- NASA hosted the first collaborative evaluation for the Upper Class E Traffic Management (ETM) concept
- Participants from NASA, Aerostar, and AeroVironment demonstrated the connectivity between the NASA-developed ETM Service Supplier (ESS) and the industry partners' software to explore notional procedures and information exchange requirements
  - Operational Intent (OI)
  - Cooperative Operating Practices (COPs)
- The simulation was conducted at the Airspace Operations Laboratory at NASA's Ames Research Center in connection with the two partner sites on June 25th – 27th

ETM CE-1 Key Details

- ETM community partners with Non-reimbursable Space Act Agreements (NRSAA) and Interconnect Security Agreements (ISA)
  - Aerostar
  - AeroVironment

- Partners provide and submit Operation Plans with Operational Intent (OI) Volumes to NASA's prototype ETM Service Supplier (ESS)

- Traffic setup with 4 high-altitude vehicles in / near a 40-mile x 40-mile region over Dixie County, FL

- 4 scenarios
  - OP/OI submission
  - Strategic Conflict and Resolution: Wait-and-See
  - Strategic Conflict and Resolution: Maneuver
  - OI conformance monitoring
  - Loiter Scenario (Bonus)

ETM CE-1: Connectivity Tests and Demonstration

Preparation

- Establish connectivity
  - OAuth2 token
  - Operator API
    - bi-directional communication
    - Post, Get, Put
    - object schema
    - receive notifications and State changes from ESS
  - Verify ETM OI sharing on prototyped NASA ETM Client (not evaluated)
- Construct scenarios and research questions on COPs

Execution

- CE-1 held June 25-27, 2024
  - 2 ½ days of simulation and data collection
  - 4 Scenarios
    - 40 to 70-minute simulation runs
    - 30-minute discussions on COPs
    - 15-minute questionnaires (Engineers and Subject Matter Experts)
  - Post-simulation debrief and questionnaire

ETM CE-1 Simulation Platform

Airspace Operations Laboratory

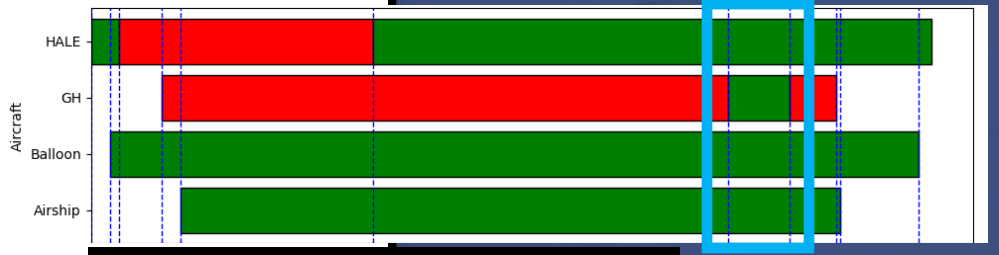
Participants from NASA, Aerostar, and AeroVironment demonstrated the connectivity between the NASA-developed ETM Service Supplier (ESS) and the industry partners' software to explore notional procedures and information exchange requirements

ETM CE-1 Simulation

4 ETM operations submitted to ESS

Test Area

All 4 operations inside
40-mile by 40-mile test area

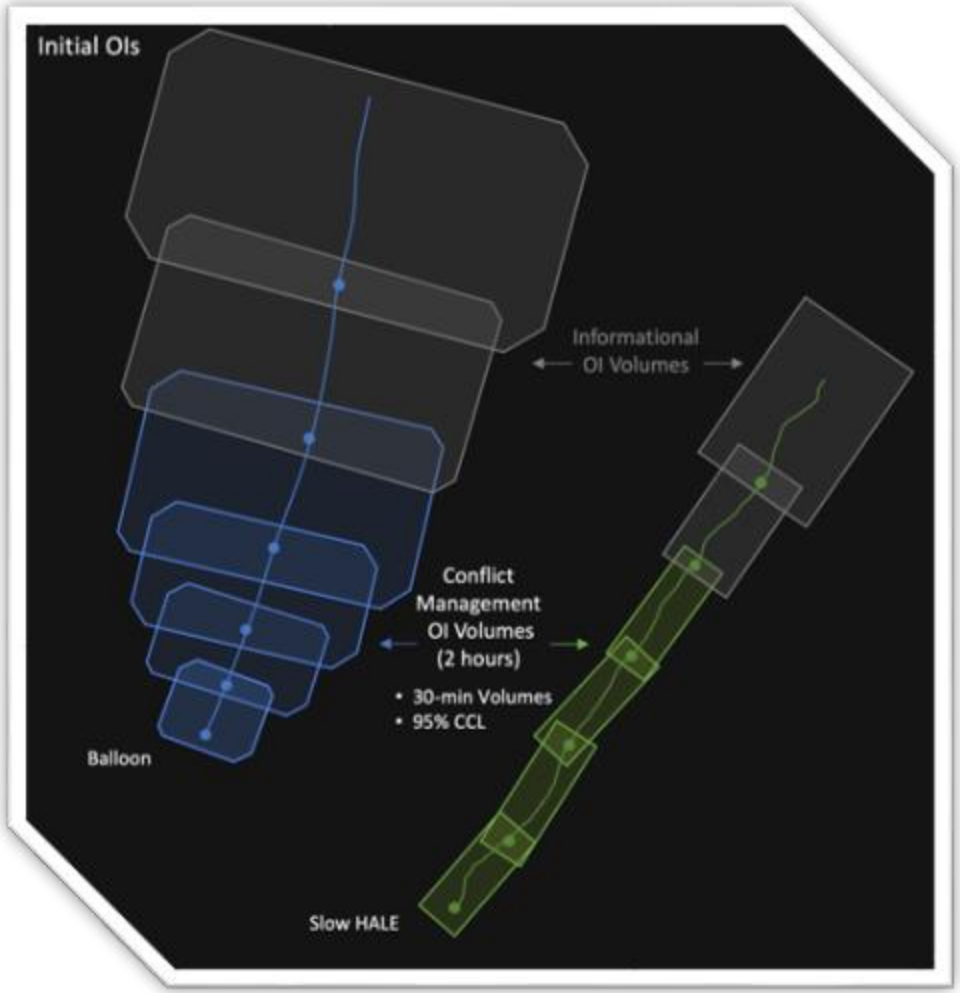


Simulation time progression

HALE balloon (Aerostar)
Solar-powered HALE fixed-wing (AeroVironment)
HALE airship (NASA-generated)
High-speed uncrewed (NASA-generated)

Research Question: Utilizing Cooperative Operating Practices (COPs), what information, capabilities, and procedures are needed to safely improve airspace access for high-altitude operations?

Scenario 1
OP/OI Submission



- What is an effective way to share operational intent (OI) volumes for various types of vehicles?
- Can the operators share OIs with high confidence - confidence containment level (CCL)?
- Can they gain sufficient common situational awareness using ETM Service oriented architecture?

Conflict Management and Informational OI Volumes

Operational Intent Volumes

COP

Conflict Management OI: To support prompt and accurate **Strategic Conflict Detection**, OI Volumes *within* the Minimum Lookahead Time Window are required to be:

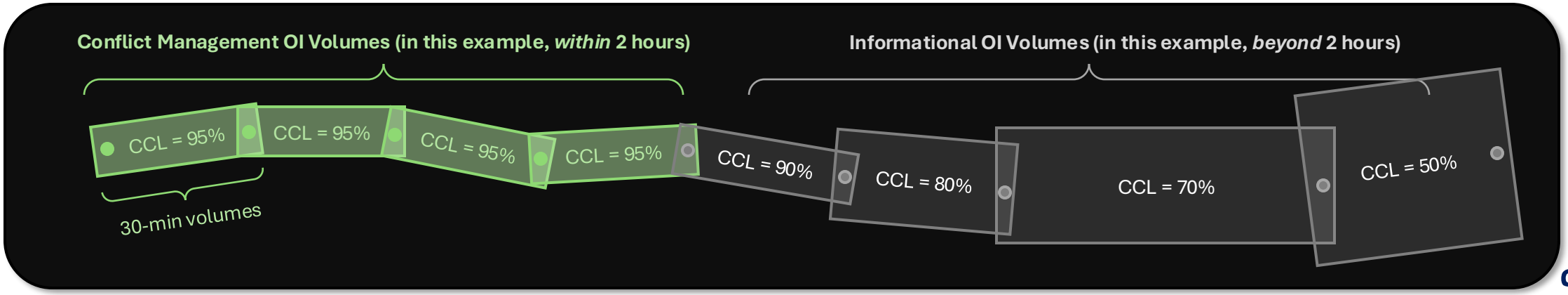
- **Accurate**: OI size not larger than operationally required
- **Regularly** updated
- **95% or greater** Containment Confidence Level (CCL)
- Not be longer than **1-hour duration**.
- Must assess Strategic Conflict and resolve if needed

COP

Informational OI: Operational Intent Volumes *beyond* the Minimum Lookahead Time Window:

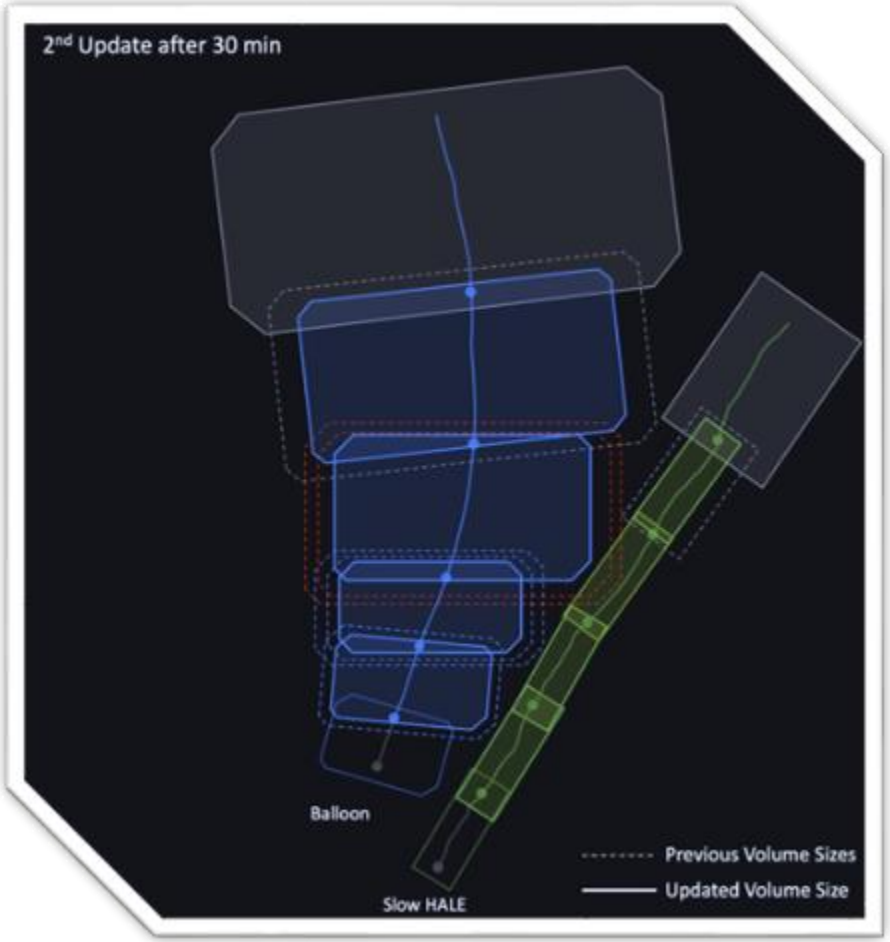
- Can be **larger in size**: may include future intent
- Can be **longer duration**
- Can be **less than 95%** Containment Confidence Level (CCL)
- No Strategic Conflict Resolution required

Minimum Lookahead Time Window



Research Question: Utilizing Cooperative Operating Practices (COPs), what information, capabilities, and procedures are needed for strategic conflict identification and resolution? (Low-likelihood conflict)

Scenario 2A
Strategic Conflict and Resolution: Wait-and-See

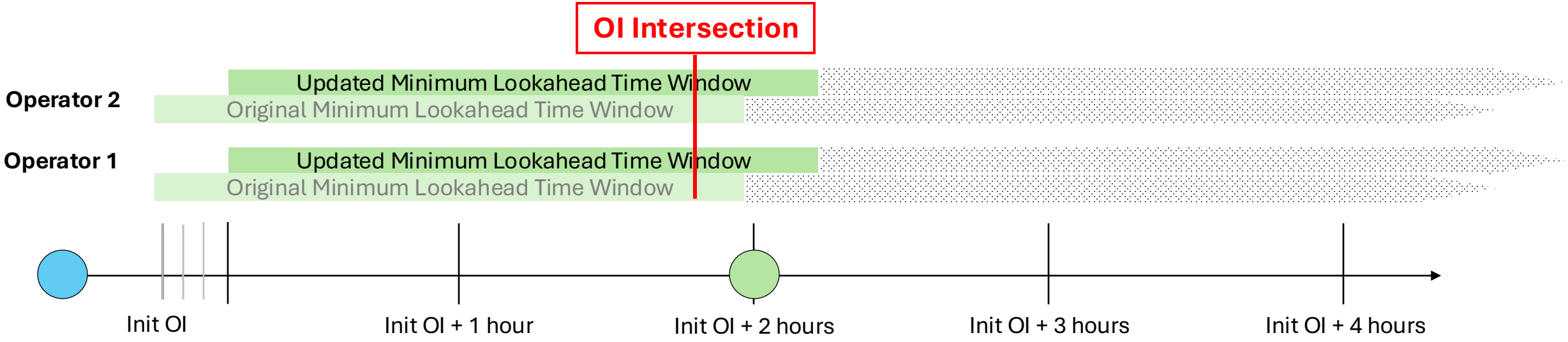


- What is an effective way to identify strategic conflict for various types of vehicles (e.g., using OI intersection)?
- What are the proper parameters for conflict detection and notification?
- What are the effective procedures to cooperatively negotiate and resolve potential conflict?

Initiation of Negotiation and an Immediate OI Update

COP

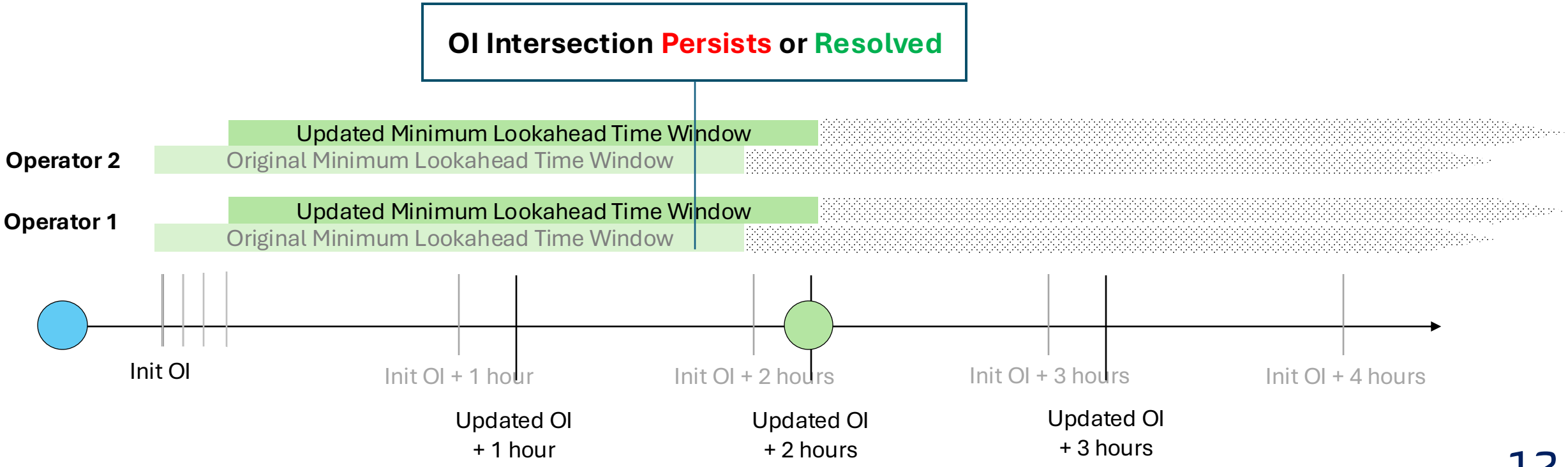
- **When an OI intersection occurs <u>within Minimum Look-ahead Time Window</u>,** the first step for all impacted Operators is to **<u>immediately increase the OI updates rates</u> within the Minimum Look-ahead Time Window** to see if the OI intersection goes away with the updates.
- If the OI update does not resolve the OI intersection, OIs need to be updated at the regular, specified intervals until the conflict (i.e., OI intersection) is resolved.



Decision to Wait and Subsequent Monitoring

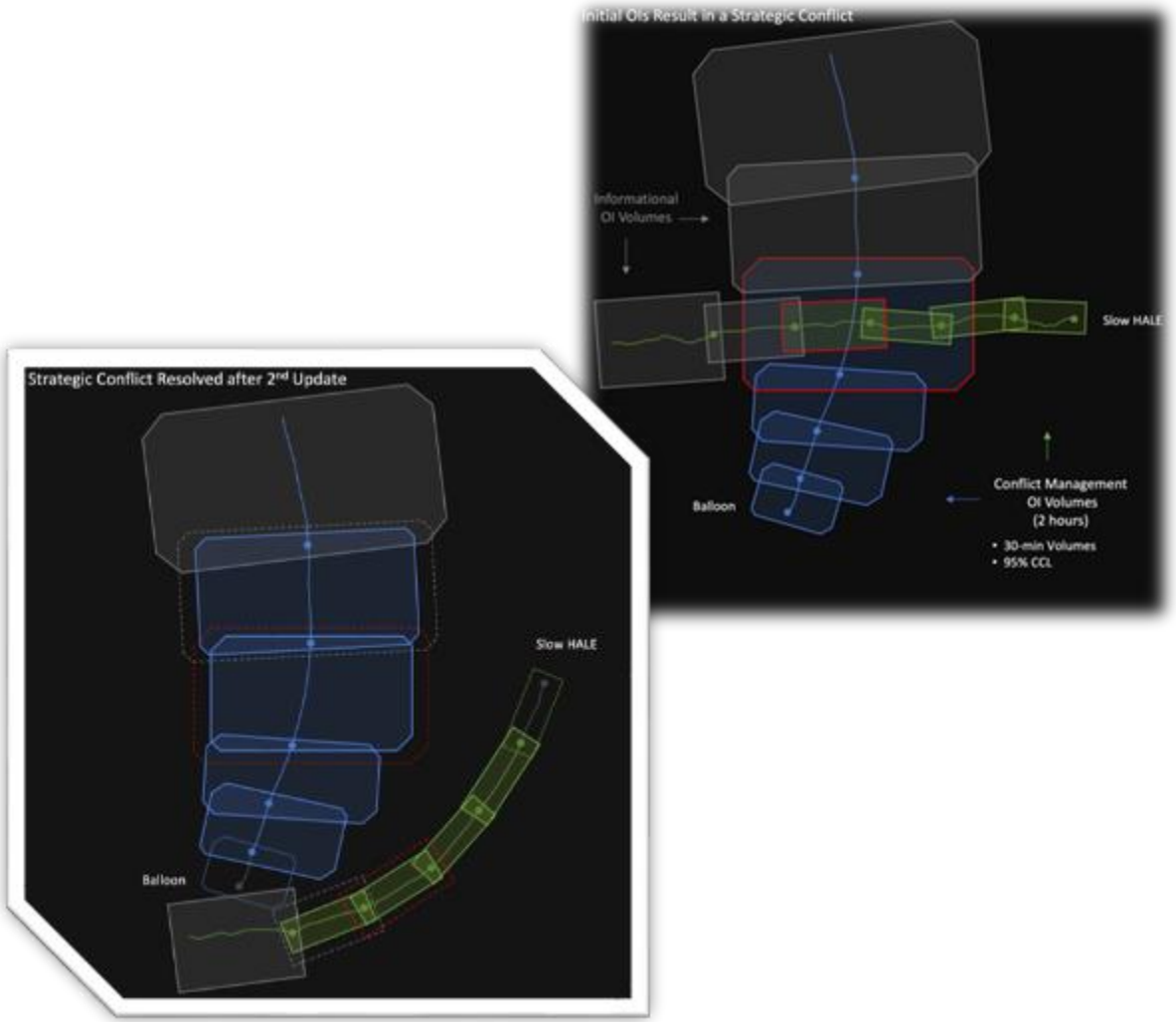
COP

- **Operators must determine whether to wait-and-see or initiate coordination.**
- Check if the OI updates resolve the OI intersections. If the OI intersection persists, decide whether to wait for another update cycle or to resolve them right away, according to the COPs for negotiation.



Research Question: Utilizing Cooperative Operating Practices (COPs), what information, capabilities, and procedures are needed for strategic conflict identification and resolution?
(High-likelihood conflict)

Scenario 2B
Strategic Conflict and Resolution: Maneuver

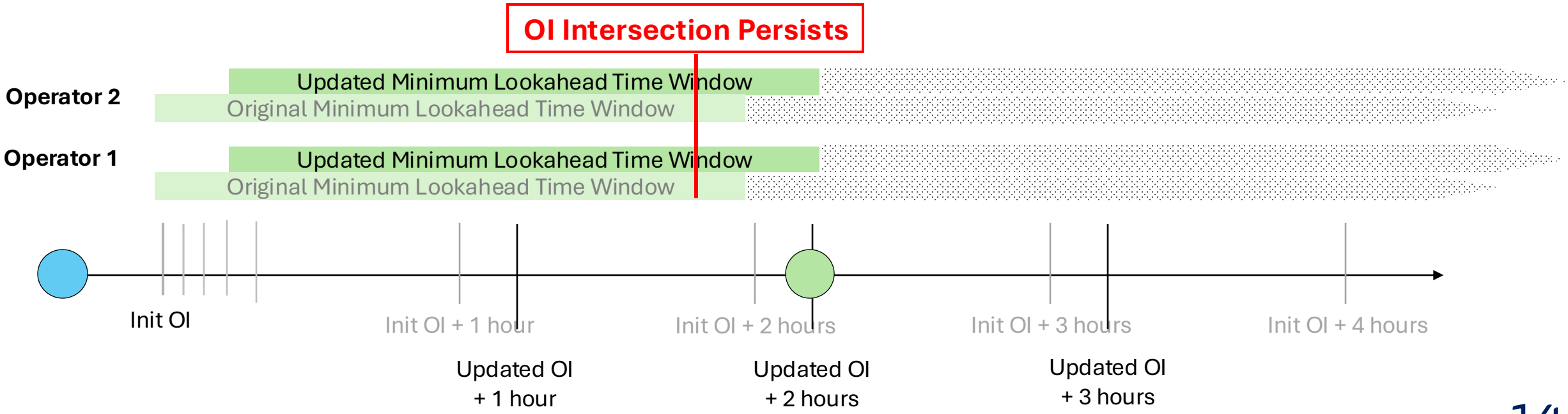


- What are the proper parameters for conflict detection and notification? Are they the same based on conflict likelihood (High vs. Low)?
- What are the effective procedures to cooperatively negotiate and resolve a potential conflict?
- What are the information needs for cooperative negotiation?
- What are the maneuvers or options to resolve high-likelihood strategic conflicts?

Strategic Conflict Resolution

COP

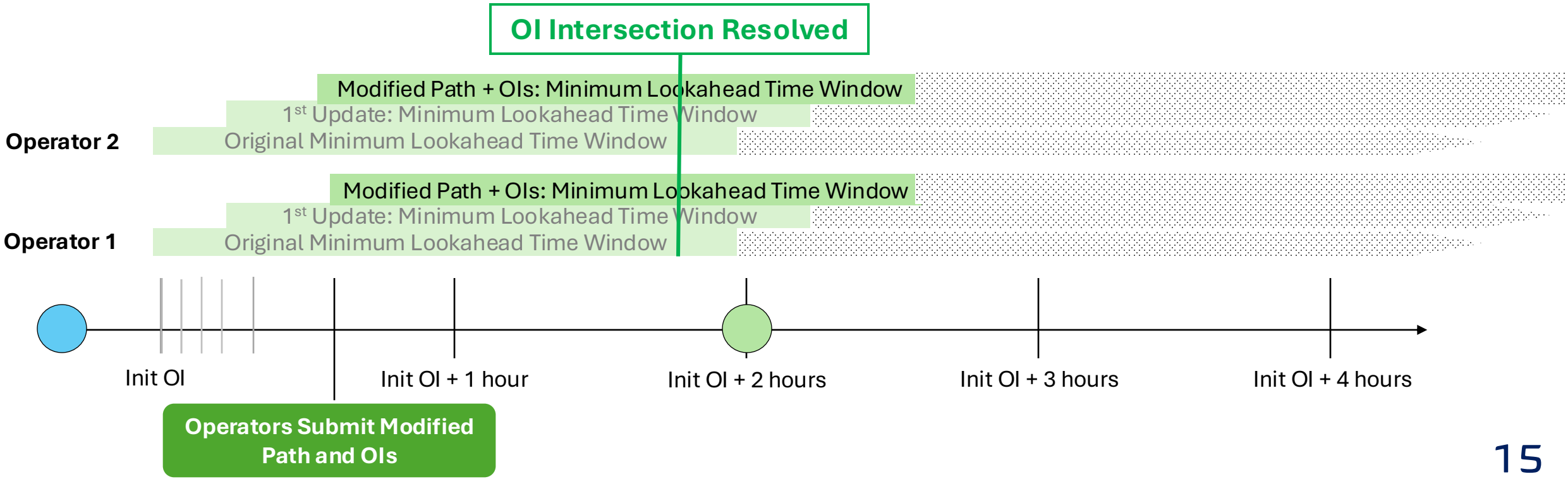
- **If OI intersection persists, Operators must engage in negotiation to resolve the conflict.**
- Decision to resolve the conflict right away is based on community-agreed upon guidelines.
- **If the OI intersection needs to be resolved right away, one of the Operators notifies the other to determine which actions will be taken.**
  - The negotiation could be ad-hoc, free negotiation or pre-coordinated negotiated resolutions.
  - The resolution can be done by either or both of the Operators, depending on the rules of the negotiation process.



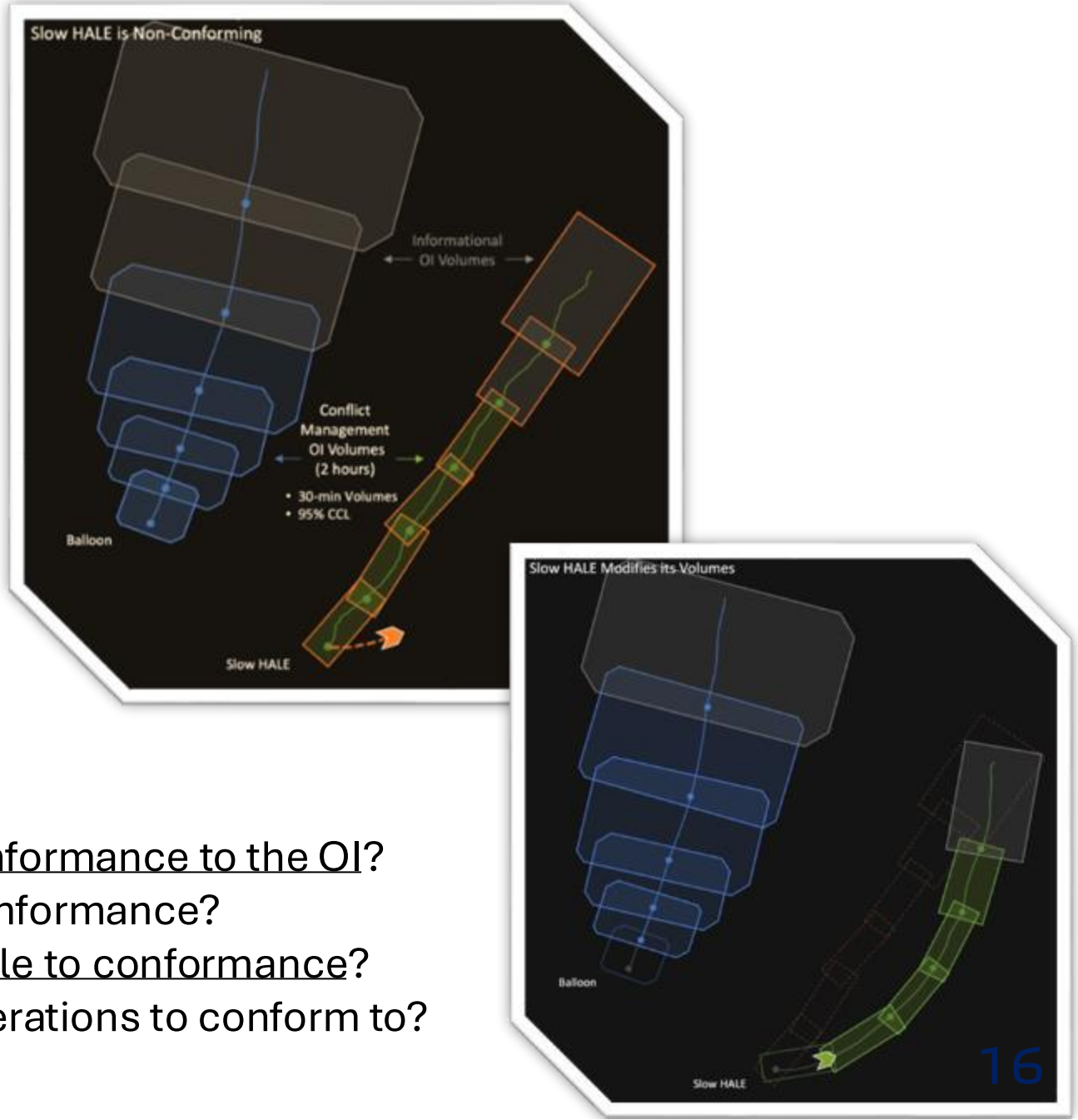
Submit Modified OIs and Monitor the OI Intersection Status

COP

- An OI intersection can be resolved by adjusting the OIs along a different intended path. Following are the resolution options:
  - Reduction of each OI volume size by applying tighter control actions
  - Change in altitude, lateral course, and/or speed



Research Question: Utilizing Cooperative Operating Practices (COPs), what information, capabilities, and procedures are needed for OI Conformance Monitoring?



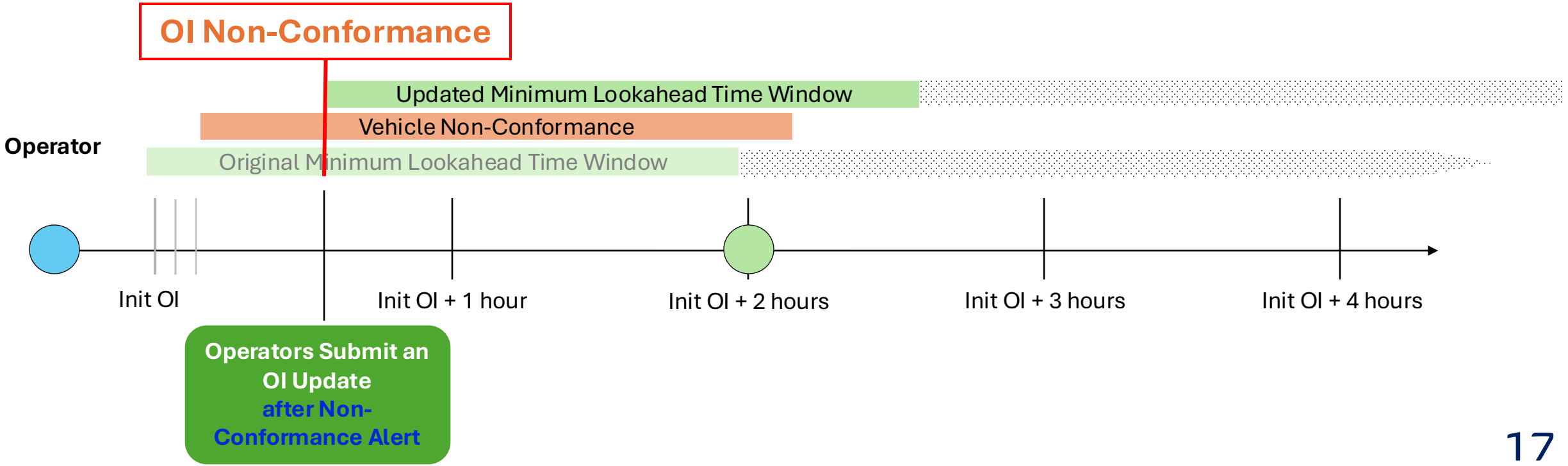
Scenario 3
Conformance to OI

- What is the best way to identify and notify non-conformance to the OI?
- How effective is the *method* for identifying non-conformance?
- What should the procedures be to return the vehicle to conformance?
- Are the OI volumes *properly formulated* for the operations to conform to?

Assessment of the Non-Conformance and Formulation / Execution of a Plan for Returning to Conformance

COP

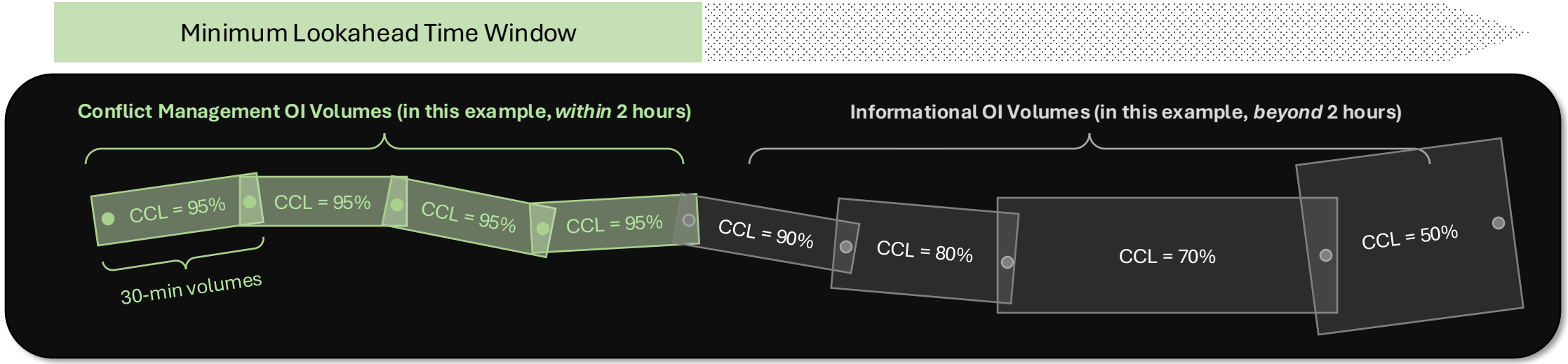
- As soon as possible and within Y minutes of the ESS alert, the **Operator must submit a new Operational Intent** with a new set of OI volumes to the ESS that will put them back in conformance.
- Operators must execute the new Operational Intent and remain within their OI volume to return to conformance.



Initial Findings and Feedback

Results: Conflict Management and Informational OIs

- Use of two types of OIs worked well and were acceptable
  - Conflict Management OIs
    - Within the first 1-2 hours where OI volume size can be small with 95% CCL, using a regular update rate
    - Only region in which the OI intersections / Strategic Conflicts were negotiated and deconflicted
  - Informational OIs
    - OIs for later time window after Conflict Management OIs (e.g. after the first 1-2 hours)
    - Can reduce OI volume size by lowering CCL below 95%
    - OI intersections / Strategic Conflicts for these OI volumes do not have to be negotiated and/or deconflicted
    - Provides general awareness and alerts other impacted vehicles to allow the possibilities of strategic maneuvers if desired



Results: Conflict Management and Informational OIs

Use of Conflict Management and Informational OIs were feasible, acceptable, and easy to build.

Based on your vehicle type, how **feasible** is it to build the **OI volumes**?	Very Feasible (3)	
Do you **agree** with the notion of using **both** "**Conflict Management"** and **"Informational"** OIs?	Yes, Agree (3)	
How **easy/difficult** would it be to develop a **single** submission that encompasses **both** "**Conflict Management"** and "**Informational**" OIs?	Somewhat Easy (1)	Very Easy (2)
Rate how **likely/unlikely** it is that you would be able to create and share **Operational Intent** for:		
Transitioning as part of a Mission	Very Likely (3)	
Loitering as part of a Mission	Very Likely (3)	
The COPs were **feasible** for:		
"Conflict Management" OI Volumes (95% CCL)	Very Feasible (3)	
"Informational" OI Volumes	Very Feasible (3)	
The COPs were **equitable** for:		
"Conflict Management" OI Volumes (95% CCL)	Somewhat Equitable (2)	Very Equitable (1)
"Informational" OI Volumes	Somewhat Equitable (2)	Very Equitable (1)

*Each question used a 5-pt scale, with a "Neutral" middle anchor.

Results: Minimum Lookahead Time Window

- The variation in vehicle performance capabilities impacts how accurately and how far out an operator can predict their OI Volumes.
- The **Minimum Lookahead Time Window** may be a different duration for different vehicle types
  - Vehicles that have more certainty could have a **longer** Minimum Lookahead Time Windows duration than vehicles with less certainty.
- **Conflict Management OIs** may be a different duration for different vehicle types
  - Strategic deconfliction between dissimilar types would be determined by the **shortest** Minimum Lookahead Time Window.
  - For example, because balloons cannot predict their trajectory as accurately as Slow HALEs, balloons may have a shorter Minimum Lookahead Time Window and shorter Conflict Management OI Volumes.

Results: OI Volume – Size, Duration, Update Cycles, and Minimum Lookahead Time Window

- For balloons, OI volume size and the instances of OI intersections could be significantly reduced if the OI volume duration (i.e., start/end times) are reduced (e.g., from 1 hour duration to 10 mins).
- Participant Comments (paraphrased)
  - If we got people to start thinking on shorter time scales for conflict resolution, the uncertainty of "lighter than air" vehicles goes down drastically.

- For balloons, potential deconfliction maneuvers could be much more efficient if the Minimum Lookahead Time Window for the Conflict Management OIs were reduced (e.g., 1 hour instead of 2 hours). Late maneuvers are acceptable when negotiating with other slow moving vehicles due to slow closure rates
- A regular OI update cycle was acceptable, although an alternative method with multiple update cycles based on OI volume location relative to current time was also suggested.
- Participant Comments (paraphrased)
  - If we are comfortable with Minimum Lookahead Time Window to sub one hour and OI volume size and strategic deconfliction down to like 10 minutes, OI update rate will require higher temporal resolution within the first hour.

- Balloons in these descriptions are the larger "controllable" balloons. Smaller "free-flying" balloons that are uncontrolled are not expected to adhere to ETM COPs as constructed.
- Participant Comments (paraphrased)
  - Not all balloons are the same – no altitude information and zero pressure balloons exist, and they go up and down without any input at all.

Results: Strategic Conflict Negotiation and Resolution

- The ad-hoc procedures for detecting strategic conflicts and the negotiation process is generally acceptable if there would be human operators / pilots who are available on-demand to assess the situation and negotiate the solutions in low-density operations
  - Participant Comments (paraphrased)
    - Manual calling and talking in ad-hoc procedures is feasible for low-density operations, but for a higher density, such as 16 vehicles within 40 square miles it is going to get messy in a hurry.
- Scaled operations under m:N conditions, ad-hoc negotiation would need to be replaced by a more structured or automated process.

Results: Strategic Conflict Negotiation and Resolution

- For determining "wait-and-see" vs. resolve right away, an alternative method of agreeing to wait for now, with a discussion on how the operators plan to resolve the conflict at a later time if the situation does not resolve itself was suggested.
  - These two-step procedures were useful when the operators disagreed on whether to resolve the conflict now vs. later, at which time the operator that wanted to wait provided assurance that s/he would be able to move his/her vehicle later if needed.
  - This finding highlighted the importance of coordination between operators and shared situation awareness.
  - Participant Comments (paraphrased)
    - If a plan can be established early between the Operators, maybe just knowing how to resolve a strategic conflict 2 hours in advance and knowing what the resolution options are right is the important thing.
    - A "right of way rules" – e.g. default resolution about 15 minutes out – should be established.
    - For some Operators, there may be some trust issue with the other vehicle – if there is a way to solve the problem by "tightening a turn", one might do that instead.

- A desire to have some sort of conflict likelihood calculator, like the Conflict Probability algorithm that NASA developed, but was not used during CE-1, to aid in the decision to wait-and-see vs. resolve right away
  - Rather than just using the probability threshold, however, a participant suggested that the overall increasing trend of the probability value could also be useful to make this decision.
  - Participant Comments (paraphrased)
    - It would be interesting to calculate the conflict likelihood at the the extremities of OI volumes and see if the likelihood is trending up or down over time. If the trend is going up, the urgency goes up to do something.

Results: COPs Feasibility and Equity

COPs presented in CE-1 were both feasible and equitable.

	COPs Feasibility		COPs Equity	
Minimum Lookahead Window: **Defining Operational Volumes at a 95% Containment Confidence Level (CCL)**	**Very Feasible (all participants)**		**Somewhat Equitable (2 participants)**	**Very Equitable (1)**
Defining **Information Operational Volumes** (beyond the Minimum Lookahead Window)	**Very Feasible (all participants)**		**Somewhat Equitable (2 participants)**	**Very Equitable (1)**
Procedures for **Strategic Conflict <u>Detection</u>** (using an OI intersection to determine if there is a conflict)	**Somewhat Feasible (1)**	**Very Feasible (2 participants)**	**Somewhat Equitable (1)**	**Very Equitable (2 participants)**
Procedures for **Strategic Conflict <u>Resolution</u>** (Wait-and-see, Take action)	**Somewhat Feasible (1)**	**Very Feasible (2 participants)**	**Somewhat Equitable (1)**	**Very Equitable (2 participants)**
Procedures for **Non-Conformance handling** (notification, time)	**Somewhat Feasible (1)**	**Very Feasible (2 participants)**	**Somewhat Equitable (1)**	**Very Equitable (2 participants)**

*Each question used a 5-pt scale, with a "Neutral" middle anchor.

Results: COPs Feasibility and Equity – Additional Feedback

- Feasible with following caveat:
  - Feasible with mature wind modeling
  - Needs common information exchange app to allow everyone to have the same level of information, understanding and interaction
  - Constant OI updating to maintain conformance may conflict with and disrupt other vehicles' flight plans

- Equitable with following caveat:
  - 1-hour OI volume size for Balloon's Conflict Management OIs are not equitable because they take up too much volume. Balloons need higher temporal resolution Conflict OIs.
  - Significant variance in HAPS performance and behaviors makes defining a common standards difficult. COPs may end up favoring certain platforms by default.
  - May need to define Rules of the Road, based on maneuverability of each platform. Less maneuverable vehicles may end up with the right-of-way over more maneuverable vehicles to prevent collision.

Results: Operator Performance and Benefits of ETM

- Capacity
  - The operators were able to increase the number of vehicles that could occupy the target airspace (40x40 miles^2) under ETM than what would be possible under current procedures.
  - Participant Comments (paraphrased)
    - Operating four vehicles, such as in CE-1, is feasible in the target airspace if all four aircraft are cooperative, communicate instantly, and ESS can intervene effectively.
- Safety
  - The vehicles could co-occupy the target airspace safely under both nominal and strategic conflict traffic scenarios
  - Participant Comments (paraphrased)
    - The ability to communicate with others will increase the comfort level and the ability to deconflict vehicles in a straight-forward way.
    - Better intent volumes on shorter time horizons will be needed.
    - Shared information exchange is the key to safe and effective operations. The earlier we know it, better.
- OI Conformance
  - They were comfortable with the requirement to submit OIs that they could conform to within a 95% conformance level.
  - Participant Comments (paraphrased)
    - Confident to stay within 95% conformance level for Operators with good wind predictions and shorter refresh rate.
    - System failures, such as degraded datalink or control surface issues would limit the ability to maintain conformance.

Results: Information Exchange

Coordination between NASA ESS and Operator Clients that submitted the OIs and telemetry information was successful.

During the scenario you just completed, was the process for establishing a connection to the ESS **understandable**?	**Very Understandable (all cases across participants)**	
During the scenario you just completed, rate the **ease/difficulty** of connecting to the ESS.	**Very Easy (all cases across participants)**	
During the scenario you just completed, rate the **ease/difficulty** of the process of **RECEIVING** information from the ESS.	**Somewhat Easy (2 cases)** (Retrieve Ops by GUFI for Balloons)	**Very Easy (22 cases across participants)**
During the scenario you just completed, rate the **timeliness** of **RECEIVING** information from the ESS. For example, did the messages arrive on time or were they delayed?	**Very Acceptable (all cases across participants)**	
During the scenario you just completed, rate the **understandability** of the information you **RECEIVED** from the ESS. For example, did the messages come in a format that was easy to decipher and process?	**Somewhat Understandable (3 cases)** (Retrieve messages and Ops by GUFI for Balloons)	**Very Understandable (21 cases across participants)**
During the scenario you just completed, rate the **ease/difficulty** of the process of **SENDING** information to the ESS.	**Somewhat Easy (5 cases)** (Propose and Update Ops by GUFI; and Submit Messages for Balloons)	**Very Easy (19 cases across participants)**

*Each question used a 5-pt scale, with a "Neutral" middle anchor.

Results: Information Exchange

Sharing of the OIs and telemetry via ESS to all Operators and sharing of the specific OI information with the impacted Operator during OI intersections had mostly adequate information.

During the scenario you just completed, was the **amount and type of information** you received from the ESS **adequate** for this scenario?	**Somewhat Adequate (2 cases)** (Conflict and Non-Conformance Scenarios for Balloons)	**More than Adequate (8 cases across participants)**	
In the scenario you just completed, was the **feedback** you **received** from the ESS **adequate** to gain **situational awareness** about your **own vehicle** and **other vehicles**.	**Somewhat Inadequate (2 cases)** (High Conflict Scenarios for Balloons)	**Somewhat Adequate (6 cases)** (Light Conflict and Non-Conformance Scenarios)	**More than Adequate (15 cases across participants)**
The CE-1 activity demonstrated <u>all information</u> needed during **OI Updates.**	**Somewhat Agree (1 participant)**	**Strongly Agree (2 participants)**	
The CE-1 activity demonstrated <u>all information</u> needed during **OI Intersect Alerts.**	**Somewhat Agree (3 participants)**		
The CE-1 activity demonstrated <u>all information</u> **needed to resolve a conflict.**	**Somewhat Agree (3 participants)**		
Was sharing **Operational Intent (OI) <u>intersection</u> alerts,** via the ESS, **adequate** for coordination?	**Somewhat Inadequate (1 participant)**	**Somewhat Adequate (2 participants)**	

*Each question used a 5-pt scale, with a "Neutral" middle anchor.

Results: Missing Information during Exchange

Additional Information that Should be Exchanged with ESS

- All Scenarios
  - Instant messaging, alerts, acceptance, acknowledgment
- Conflict Scenarios
  - Acknowledgment between the Operators that they have received and and are aware of potential conflicts
    - Acknowledge, acknowledge+deconflict, and acknowledge+negotiate coordination mechanism should be available via ESS.
    - Negotiate option should include a direct chat capability with the conflicting party
    - Ideally, an advisory recommendation on the deconfliction solutions would help reduce the Operator workload.
  - Likelihood and the trend of the likelihood of the Strategic Conflicts
  - Trending and forecasting of tracks and altitudes
  - Downgrading warnings to alerts or cautions to show different conflict status
  - Keep the voice comm between Operators for more manual piloting and as a backup to digital formats once the vehicles become more automated

Results: Desire for Common Operator User Interface

- Recurring theme on the desire for a common UI with a common set of information for all operators
  - Preferred over allowing each operator to build their own UI design for the display based on a common API
  - Interest in having a third-party provide a UI to multiple operators to provide this capability
  - Participant Comments (paraphrased)
    - It would help out if how things are displayed are standardized in some way for the operators
    - I'm surprised that UTM can get by without some amount of standardization
    - Interfacing with ESS might require auto updates, which could create a barrier to entry that could be a sticking point for some people / companies

Summary

- CE-1 Demonstration / Evaluation was successful
  - Thank you to our participating partners for your valuable feedback!

- Operational Intent
  - Having Conflict Management vs. Informational OI types were acceptable and helpful.
  - Strategic conflict negotiation is only mandated within Conflict Management OIs, which may be as short as 1 hour lookahead.
  - OI volume duration should be short (e.g. 10 min) for Conflict Management OIs which reduces the conflict likelihood and the subsequent maneuvers for deconfliction.
- Conflict Detection, Negotiation and Resolution
  - Two step negotiation may be needed to discuss potential resolution solutions early between the Operators but wait to take action as late as safely possible.
  - Conflict likelihood calculator that shows both the likelihood value and the trends of that value would be helpful.
- COPs
  - Proposed COPs were feasible for submitting OIs and negotiating Strategic Deconfliction, with caveats that the Operators had access to accurate wind modelling and had sufficient controllability of their vehicles to stay in conformance, as well as having trust on other Operators to be cooperative and able to conform to their OIs.
  - There may be limits to equitability between dissimilar vehicle types with limited maneuverability.
- There is a desire for the Operator Client to have the common UI and information so that all Operators are seeing and negotiating based on a common picture.

End of Slides

Additional Results Slides Below

Results: Conflict Management and Informational OIs

The COPs were **equitable** for:		
"Conflict Management" OI Volumes (95% CCL)	**Somewhat Equitable (2)**	**Very Equitable (1)**
"Informational" OI Volumes	**Somewhat Equitable (2)**	**Very Equitable (1)**

- Applying the same **OI volume time parameter** for all vehicles may not be equitable, because of varying performance capabilities (speed, maneuverability).

- In one Operator's opinion, because **Balloons** have far more trajectory uncertainty, a 1-hour OI volume takes up "*too much airspace*." Instead, balloons should use a *smaller* OI volume time parameter (e.g., 10 min) for higher "temporal resolution."

- **Overall Takeaway:**
  - Construction of OI volume size, duration, and Minimum Lookahead Time Window need to consider the different vehicle performance capabilities.
  - OI volumes for vehicles with higher uncertainties should reduce OI volume duration within Conflict Management OI (e.g. 10 min).

Results: COPs Feasibility – Additional Feedback

- All Scenarios
  - Feasible with the traffic density and OI volumes shown in CE-1
  - Feasible with proper incentives and reprimand of non-cooperative operators
  - Trust and compliance will be big factors
- Conflict Scenarios
  - Cooperative Areas and COPs for strategic deconfliction may only be appropriate for higher density operations in which "controllability" is required.
  - May need to make sure that Operators can effectively control their vehicles to operate in ETM
  - Procedures and rules needed for non-cooperative aircraft and vehicles that are continually non-conforming or non-compliant
  - COPs should be baselined, but values should not be too restrictive to start and change as the technology advances
- Non-Conformance Scenarios
  - Establishing new OIs to handle non-conformance could be challenging in the presence of a lot of pre-existing OIs unless Minimum Lookahead Time Window is sufficiently small.
  - More vehicle types should be tested for non-conformance to have a better understanding of their control capabilities.

Results: Adequacy of Information Exchange

Additional Feedback on the Information Adequacy in Conflict and Non-Conformance Scenarios

- Conflict Scenarios
  - Sharing the Operator's direct contact info in the messages would be nice.
    - Communication of potential conflict acknowledgment should be shared directly between the Operators of the conflicted vehicles.
  - Focusing on the free text messages instead of waypoints would be helpful.
  - Conflict information should include all vehicle ground tracks and a dead reckoning leader.
  - More collated, specific information, such as a side-by-side comparison of vehicle speed, altitude, and heading would be helpful.
  - Ability to time synchronize and prioritize potential conflicts on a strip chart by conflict probability would be helpful.
  - Prioritization of multiple potential conflicts should be done by conflict probability and probability trending arrow to show increase of decrease over time.
  - Need to add flight direction and high temporal resolution updates on short time horizon (< 1 hr)

- Non-Conformance Scenarios
  - Knowing how much time / distance to vehicle-to-vehicle conflict would be needed.
  - More specific details about the actual non-conformance issue that generated the non-conformance is needed.