Urban Air Mobility:
Verifying Trust

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Making mobility sustainable and trustworthy
• AGENDA

• What is Urban Air Mobility (UAM) ?
• How can we trust UAM ?
• How can one verify that trust ?
• Q & A
What is Urban Air Mobility (UAM)?
What is Urban Air Mobility (UAM)?

The Reality

... it’s like ....
What is Urban Air Mobility (UAM) ?

The Reality

Corridor structure
How can we trust UAM?

- What is trust in this context?
  - “willingness of a party to be vulnerable to the action of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that party. (Mayer et al. 1995)”
  - Competence
  - Dependability
  - Integrity
  - Predictability
  - Timeliness
  - Uncertainty reduction
How can we trust UAM?

Trust means no need to verify.

So, the two cannot exist in parallel but occur in series — trust until there is a reason you do not, then supervise and verify to re-establish trust.

“Levels of Autonomy” is Unsound
Daniel I. Newman
Vertical Flight Society, Feb. 2021
How can one verify that trust?

**VEHICLE**
- LRU(*) monitoring
- Anomaly detection
- Contingency handling

(*) - Line Replaceable Unit

**AIRSPACE**
- Corridor condition
- Micro-weather status
- Contingency re-routing

Making mobility sustainable and trustworthy
### How can one verify that trust?

#### LRU monitoring

<table>
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<tr>
<th>LRU</th>
<th>Sensor</th>
<th>Signal Type</th>
<th>Comm. Protocol</th>
<th>Calibration Constraints</th>
<th>Operational Assumptions</th>
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- **Type**
- **Units**
- **Scaling**
- **Ranges**
- **Process**
- **Sensor State**
- **Signal Integrity**

#### Anomaly detection

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Signal Type</th>
<th>Operational Spectrum</th>
<th>Anomalous Spectra Assumptions</th>
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- **Type**
- **Units**
- **Scaling**
- **Transforms**
- **Scaling**
- **Normal Patterns**
- **Anomaly libraries**
- **Reinforcement learning criteria**
- **Labeling criteria**
### How can one verify that trust?

#### Corridor condition

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<tr>
<th>Corridor</th>
<th>Segment</th>
<th>Crossing Time Interval</th>
<th>Availability</th>
<th>Operational Assumptions</th>
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<tbody>
<tr>
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<td>• At Start</td>
<td>• Weather State</td>
<td>• Segment constraints</td>
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<tr>
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<td>• At End</td>
<td>• Emergencies</td>
<td>• Vehicle obligations</td>
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<td>• Vehicle Status</td>
<td>• ATM requirements</td>
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#### Micro-weather status

<table>
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<th>Corridor</th>
<th>Segment</th>
<th>Crossing Time Interval</th>
<th>Weather Clearance</th>
<th>Operational Assumptions</th>
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<td>• At Start</td>
<td>• Visibility</td>
<td>• Vehicle constraints</td>
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<td>• At End</td>
<td>• Winds</td>
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<td>• Precipitation</td>
<td>• Contents constraints</td>
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Q&A

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