

Project manager: László Windhoffer, FAA  
Georgia Tech (Lead University): Dimitri Mavris (PI), Jimmy Tai (Co-PI)  
Purdue: Daniel DeLaurentis, William Crossley (PIs)  
September 26-27, 2017

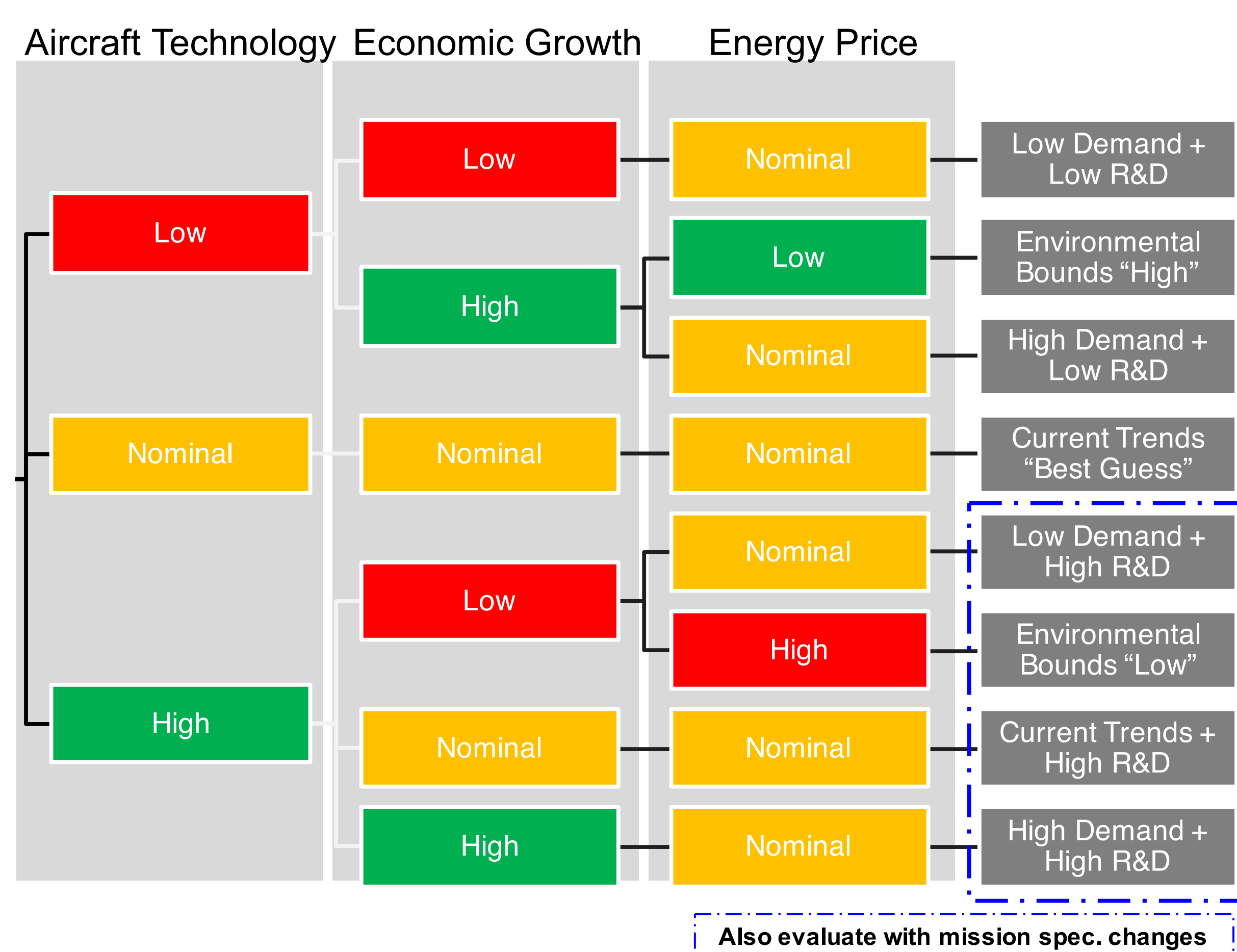
This work was funded by the US Federal Aviation Administration (FAA) Office of Environment and Energy as a part of ASCENT Project 43. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the FAA or other ASCENT Sponsors.

## ASCENT 10 Phase I

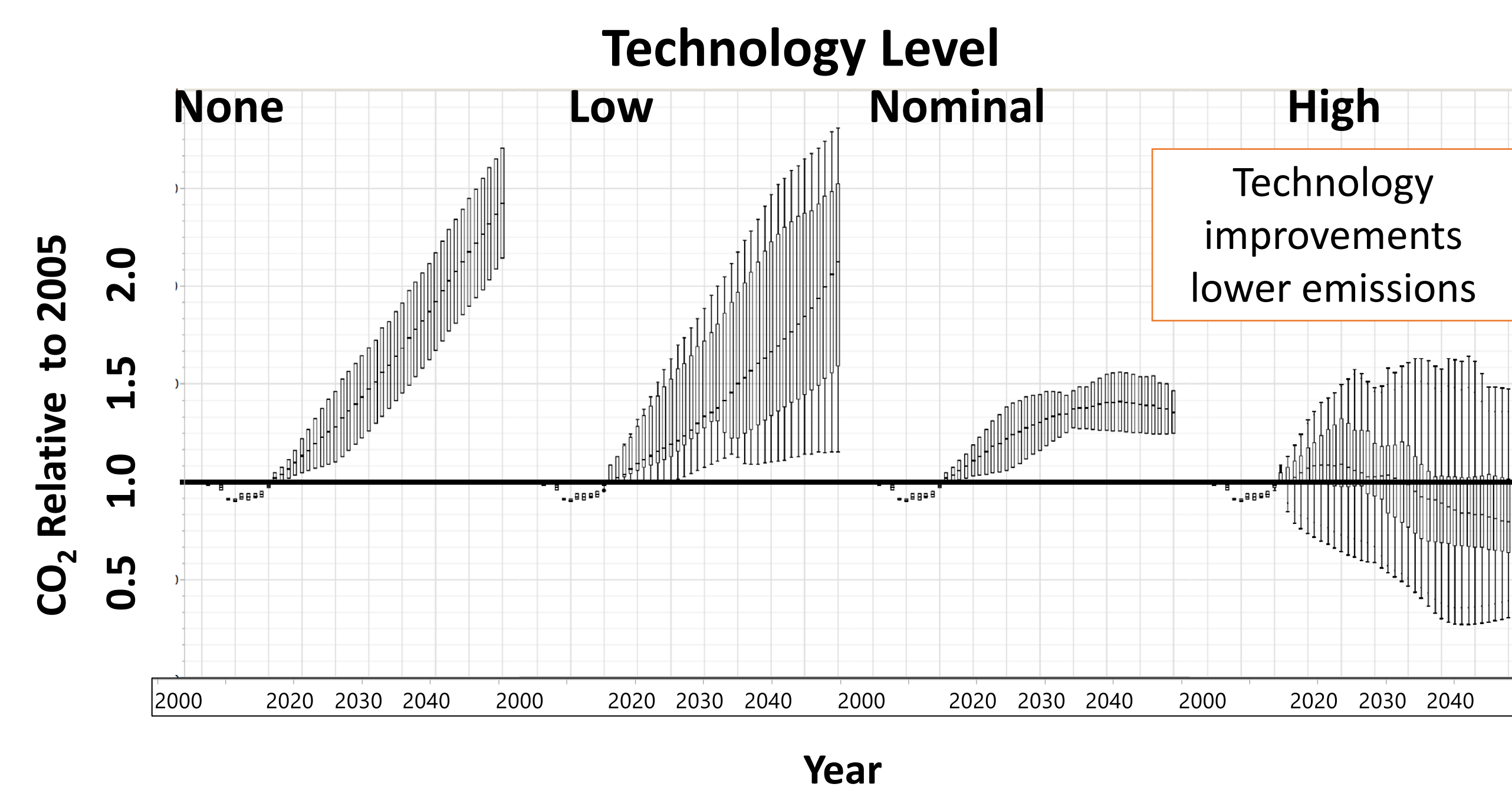
**Objective:** Define range of scenarios that bound the demand for future aviation activity and assess the effects of different fleet composition and aircraft technology on fuel burn, emissions, and noise from aviation

- Evaluated broad set of future scenarios out to 2050, showing potential benefits of technology on fuel burn, emissions, and noise
- Provided modeling and assessment mechanism for aircraft technology
- Supported NextGen analysis/GATBA Study

## Scenarios



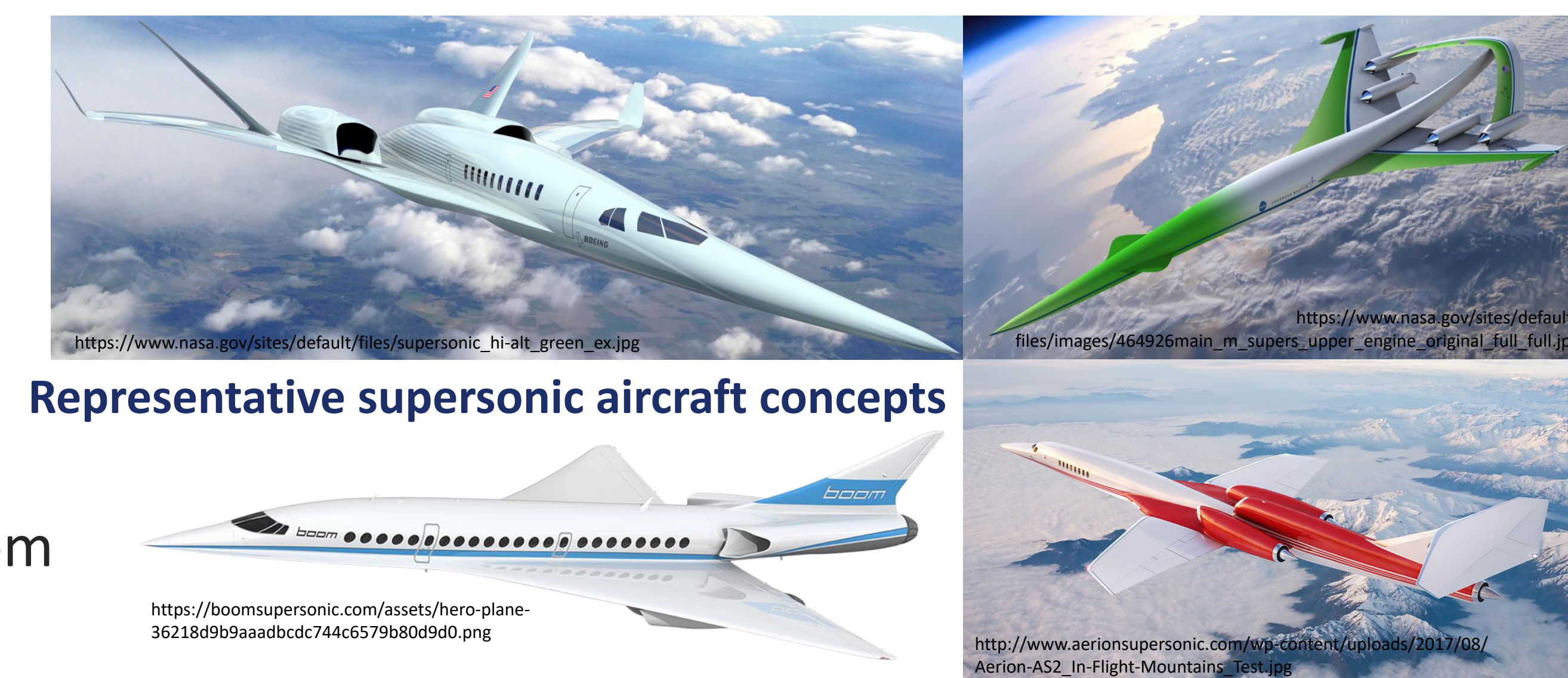
## Aggregate Simulation Results for CO<sub>2</sub>



## ASCENT 10 Phase II: Supersonic Study

### Primary Objectives:

- Assess potential environmental impact of potential future supersonic air travel (domestic & global)
- Develop demand and forecast through 2050
- Analyze existing and future supersonic technologies (e.g. traditional, low sonic boom shape profiles, etc.)
- Provide scenarios with potential changes in fuel burn, CO<sub>2</sub>, H<sub>2</sub>O, NO<sub>x</sub> and noise area exposure



Representative supersonic aircraft concepts

### Task 1 Fleet Assumptions & Demand Assessment

- Determine number of aircraft needed for a different scenarios
- Develop flight schedule

### Task 2 Preliminary Vehicle-level Impact Assessment

- Estimates for performance and key environmental indicators for current and future technology aircraft

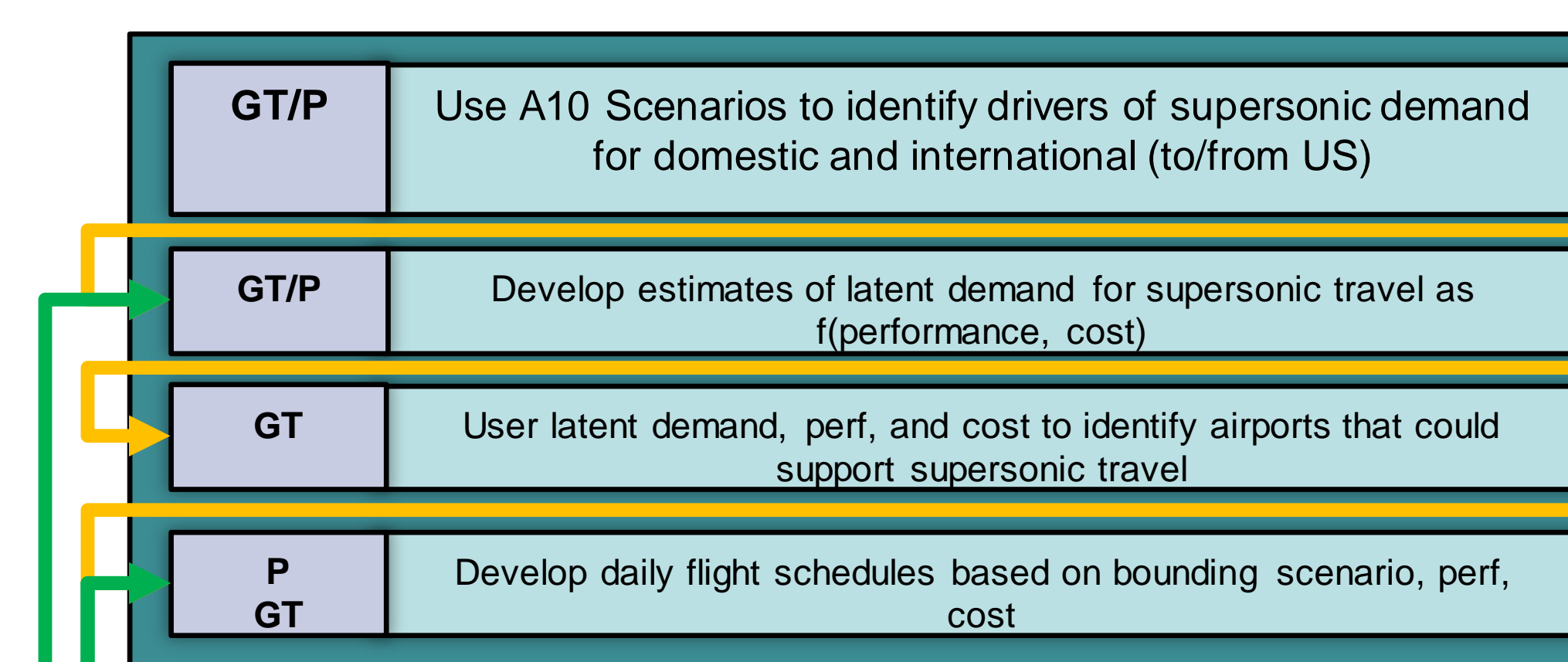
### Task 3 AEDT & EDS Vehicle Definitions

- Perform tests with AEDT vehicle definitions
- Develop recommendations on how to implement supersonic vehicles

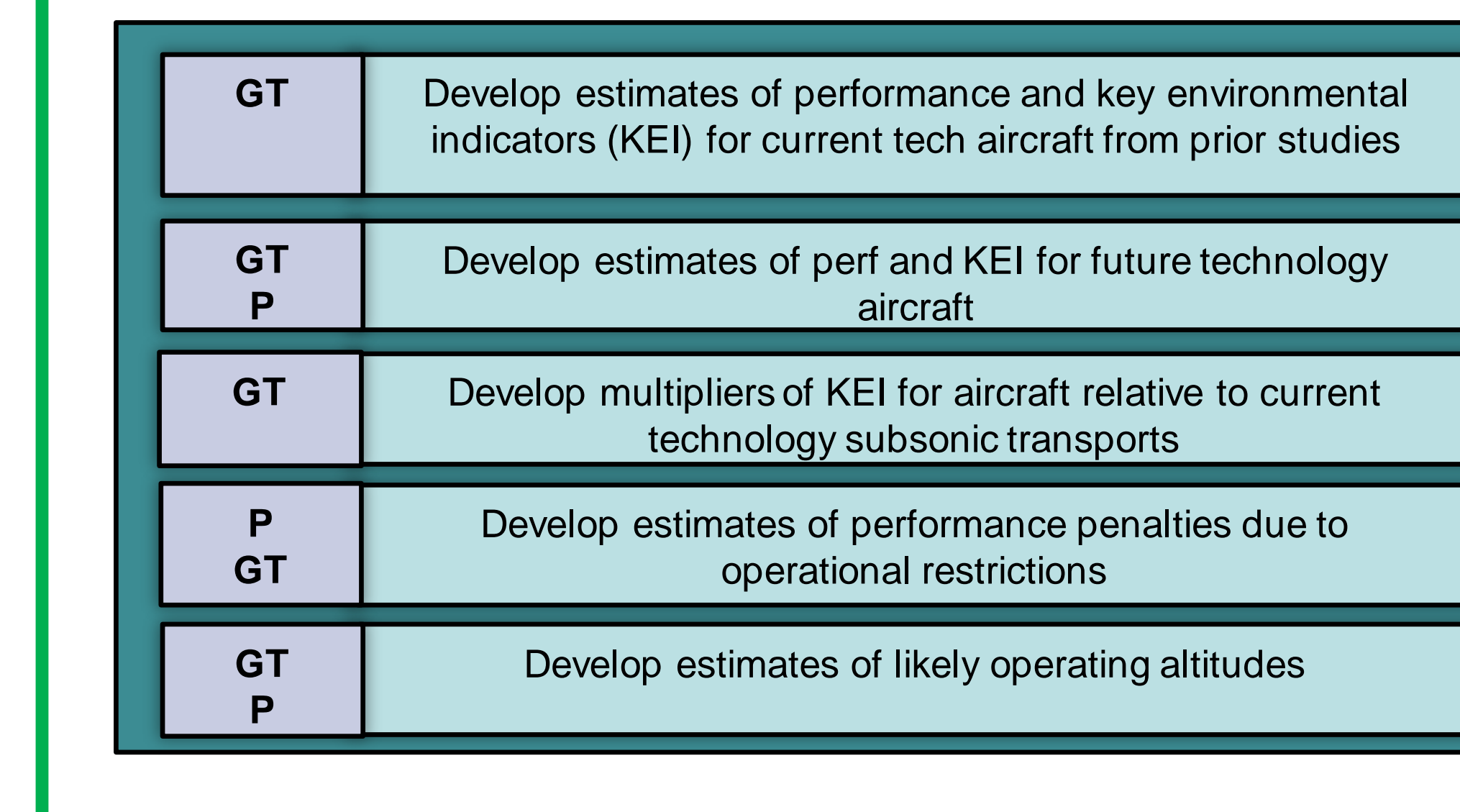
### Task 4 Fleet Level Impact Assessment

- Estimate LTO Emissions and Noise
- Estimate cruise water vapor

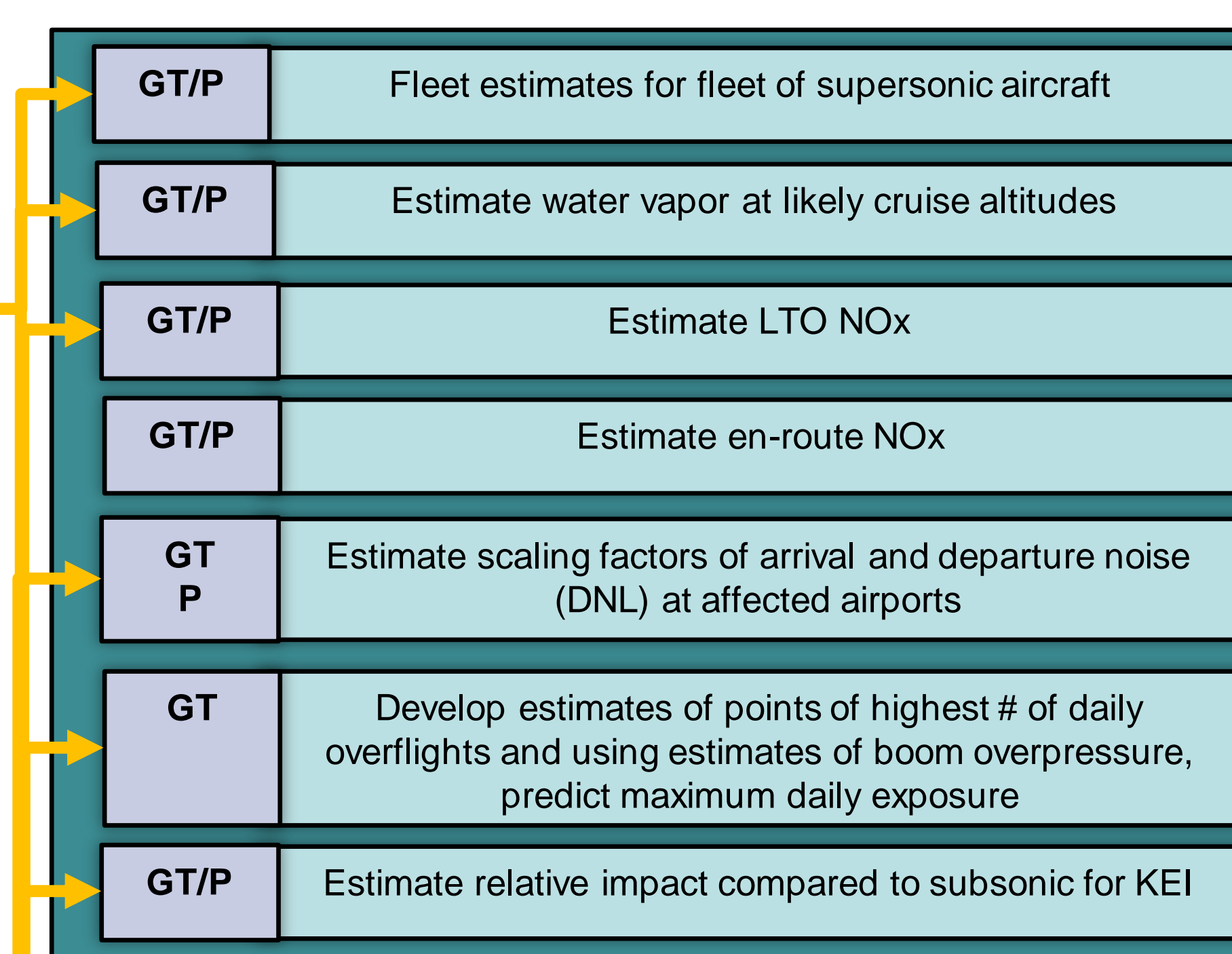
#### Task 1: Fleet Assumptions & Demand Assessment



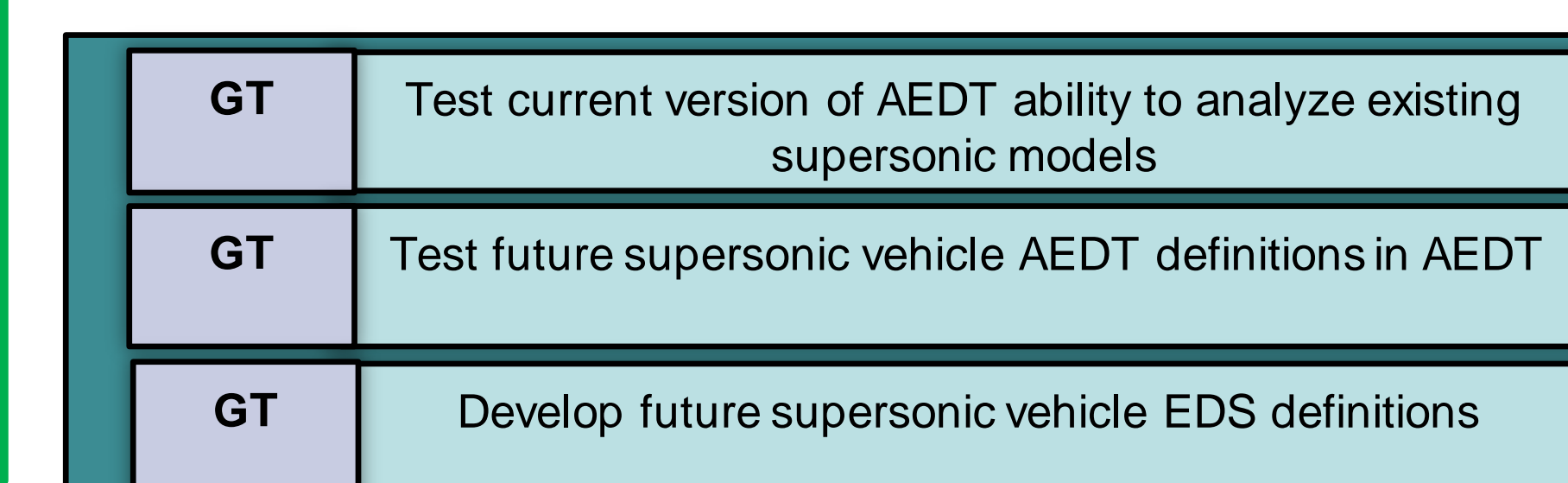
#### Task 2: Preliminary Vehicle-level Impact Assessment



#### Task 4: Fleet-level Impact Assessment



#### Task 3: AEDT & EDS Vehicle Definitions



| LEAD SUPPORT | Task Description |
|--------------|------------------|
|--------------|------------------|

| Task | Subtask   | GT | Purdue | 1Q Y1 | 2Q Y1 | 3Q Y1 | 4Q Y1 |
|------|---|----|--------|-------|-------|-------|-------|
| 1    | Using A10, identify drivers of supersonic demand to/from US                       |    |        |       |       |       |       |
|      | Develop estimates of latent demand for bounding scenarios (U.S.)                  |    |        |       |       |       |       |
|      | Using latent demand, identify airports that can support supersonic flights (U.S.) |    |        |       |       |       |       |
| 2    | Develop daily flight schedules (U.S.)   |    |        |       |       |       |       |
|      | Develop Estimates of KEI for current tech subsonic aircraft                       |    |        |       |       |       |       |
|      | Develop Estimates of KEI for Future tech supersonic aircraft                      |    |        |       |       |       |       |
|      | Develop multipliers of KEI for supersonic relative to subsonic                    |    |        |       |       |       |       |
| 3    | Develop estimates of likely operating altitudes (U.S.)                            |    |        |       |       |       |       |
|      | Test current version of AEDT ability to analyze existing supersonic models        |    |        |       |       |       |       |
| 4    | Test future supersonic vehicle AEDT definitions in AEDT                           |    |        |       |       |       |       |
|      | Estimate fuel burn for supersonic aircraft (U.S.)                                 |    |        |       |       |       |       |
|      | Estimate water vapor at likely cruise altitudes (U.S.)                            |    |        |       |       |       |       |
|      | Estimate LTO NO <sub>x</sub> (U.S.)   |    |        |       |       |       |       |

Year 2:

International scope version of domestic year 1 work

Year 3+:

AEDT and EDS development of future supersonic vehicles  
Detailed fleet-level impacts assessment  
Current Progress:

- Initiated Study of potential demand for supersonic flights based on prior scenarios
- Tested Concorde AEDT model
- Started work on preliminary vehicle-level impacts
- Started modifications of airline network modeling

KEI: Key Environmental Indicators

AEDT: Aviation Environmental Design Tool

EDS: Environmental Design Sapce

LTO: Landing and Take-Off cycle