PARTNER

Partnership for AiR Transportation Noise and Emission Reduction

An FAA/NASA/TC-sponsored Center of Excellence

EDS Support of the CLEEN Program

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Objectives

- Model CLEEN-funded technologies (proprietary) on 5 generic aircraft classes
  - Not intended to replicate proprietary analysis tools and analysis
  - Want flexibility to scale technologies to other aircraft classes
- Assess impact of technology combinations at an aircraft and fleet level
  - Will include models using both proprietary and publicly available data
  - Requires some level of technology integration
  - Results focused on trends and scope of technology interactions
- Allow public releasable results of technology assessments on generic aircraft
  - Proprietary technology models not released
  - Generic aircraft will not be identical to a specific configuration
  - Results provided in context of meeting CLEEN goals (% reduction of noise, emissions, and fuel burn)

EDS Reference Fleet Summary*

Regional Jet (RJ)

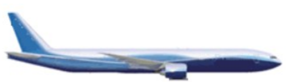
Design Range (nm)	1980	Cruise Mach	0.80
Design TOGW (lb)	73059	Design Fuel Burn (lb)	18230
OEW (lb)	39078	D_p/F_{00} (g/kN)	31.25
Design Payload (lb)	15750	Cumulative Noise (EPNLdB)	262.6
Design #PAX	75	Maximum Payload (lb)	23200
R1 Range (nm)	891	R1 Fuel (lb)	10780

Single-Aisle (SA)

Design Range (nm)	2950	Cruise Mach	0.78
Design TOGW (lb)	177360	Design Fuel Burn (lb)	50681
OEW (lb)	89509	D_p/F_{00} (g/kN)	53.17
Design Payload (lb)	37170	Cumulative Noise (EPNLdB)	273.7
Design #PAX	177	Maximum Payload (lb)	44700
R1 Range (nm)	2416	R1 Fuel (lb)	43150

Small Twin-Aisle (STA)

Design Range (nm)	6000	Cruise Mach	0.8
Design TOGW (lb)	406946	Design Fuel Burn (lb)	167677
OEW (lb)	193704	D_p/F_{00} (g/kN)	49.66
Design Payload (lb)	45570	Cumulative Noise (EPNLdB)	282.3
Design #PAX	217	Maximum Payload (lb)	81785
R1 Range (nm)	4343	R1 Fuel (lb)	131457



Large Twin-Aisle (LTA)

Design Range (nm)	8048	Cruise Mach	0.84
Design TOGW (lb)	640766	Design Fuel Burn (lb)	273594
OEW (lb)	305013	D_p/F_{00} (g/kN)	67.21
Design Payload (lb)	62160	Cumulative Noise (EPNLdB)	284.5
Design #PAX	296	Maximum Payload (lb)	125500
R1 Range (nm)	5669	R1 Fuel (lb)	210253

Very Large Aircraft (VLA)

Design Range (nm)	7090	Cruise Mach	0.85
Design TOGW (lb)	872057	Design Fuel Burn (lb)	381964
OEW (lb)	393564	D_p/F_{00} (g/kN)	43.42
Design Payload (lb)	96529	Cumulative Noise (EPNLdB)	300.7
Design #PAX	416	Maximum Payload (lb)	148500
R1 Range (nm)	7125	R1 Fuel (lb)	383810

*All vehicles are notional

What Is Being Modeled

- GT will model the individual technologies in the context of an engine cycle or airframe in order to assess the overall system impact
- Two requirements
  - Need to model the effect of “widget xyz” in a manner that the technology is portable between vehicle classes
    - For example, a specific engine cooling flow technology may be applied to various engine classes
  - Also need to account for other technologies (non-CLEEN) inherently present in the advanced system
    - Should account for varying engine cycles in future technology systems
- Modeling the advanced platform may increase data requirements from the contractors
- Feeds back into portability of technology models
  - It may be possible to use “widget xyz” on any system, however the configuration of that system may vary widely by vehicle class

EDS Demonstration

Potential Issues

- Applicability of Technology Models to Aircraft Classes
  - Potential issues associated with modeling technology on systems other than the contractor's baseline
  - Availability of data to translate technology benefits between aircraft classes
  - Large uncertainty in translating benefits from one system to another
- Combining Technologies
  - Proprietary sensitivities
  - Systems integration effects
  - Technical issues
- What is being modeled?
  - Impact of technology in isolation
  - Advanced system?
  - Drives data requirements

Potential Modeling Approaches

- Approach A
  - First model contractor's baseline system to validate "technology model", resulting in a proprietary model
  - GT will work with contractor to determine applicability of each technology on the different generic aircraft classes and resolve integration issues
  - Results of modeling the technology on the generic vehicle will be reviewed with the contractor
    - Identify potential error bounds on results
    - Identify key drivers of uncertainty and propagate through to the final analysis
- Approach B
  - Start with unlimited rights models of CLEEN-funded technologies (results may be compared to contractor proprietary baselines)
    - GT will form separate teams for unlimited rights and proprietary models)
  - Integrate open models on generic aircraft classes; each contractor will identify scaling and integration issues among various technologies (still non-proprietary)
  - Replace unlimited rights models with proprietary models

Expected Outcomes

- Proprietary technology models will not be shared (Government-only)
- Models for both proprietary and public releasable data will be used in analysis
- EDS results applied to generic aircraft classes will be publicly releasable
  - Includes both aircraft and fleet-wide assessments of fuel-burn, noise and emissions reductions
  - Shared with each company
  - Technologies will be named but no details provided

Discussion