

National Jet Fuels Combustion Program

Streamline ASTM International jet fuels
approval process

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REDAC E&E Subcommittee

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NIST

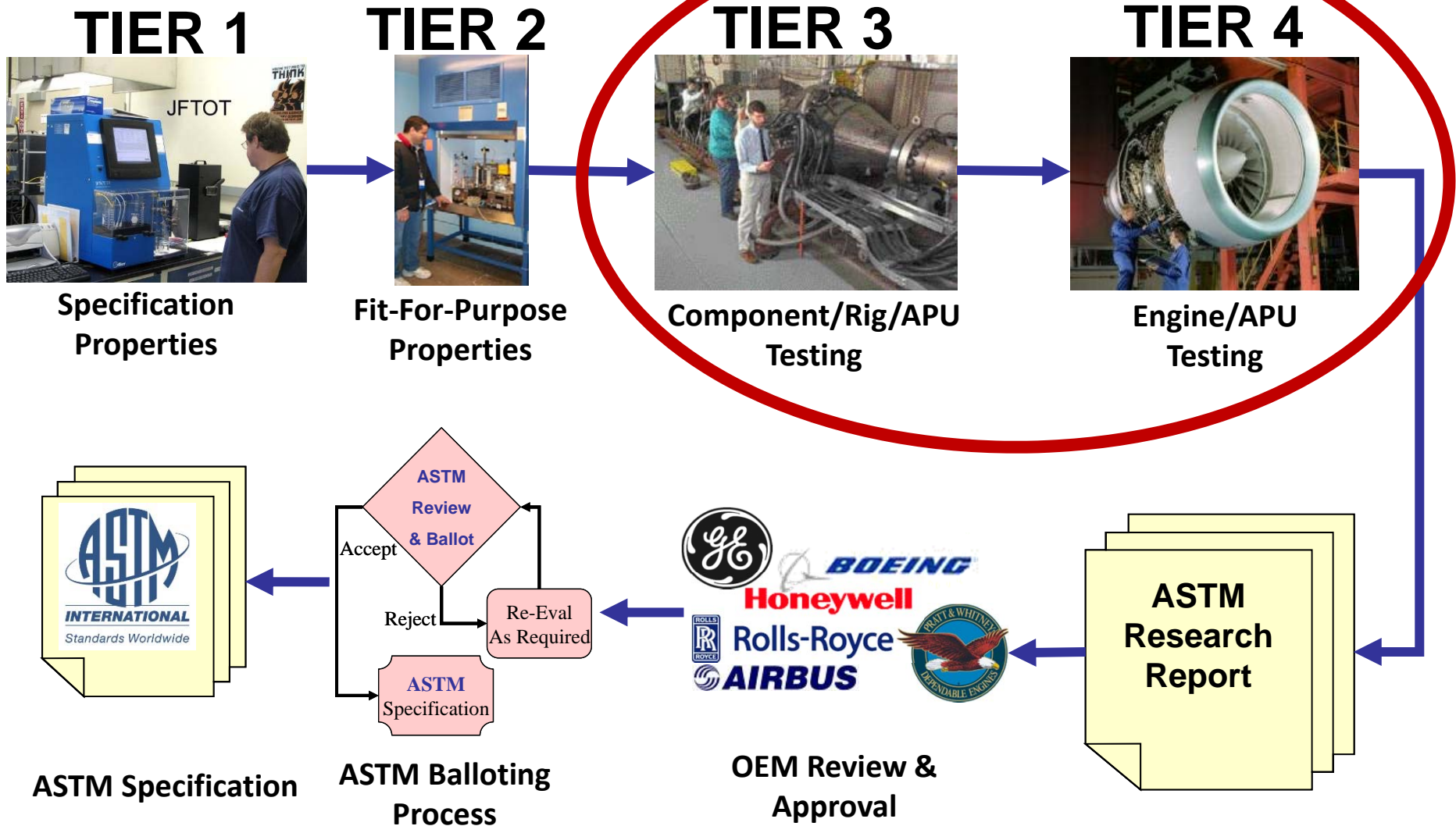


Honeywell

Rolls-Royce

Williams International

ASTM D4054 Qualification Process



Challenges and Proposed Solution

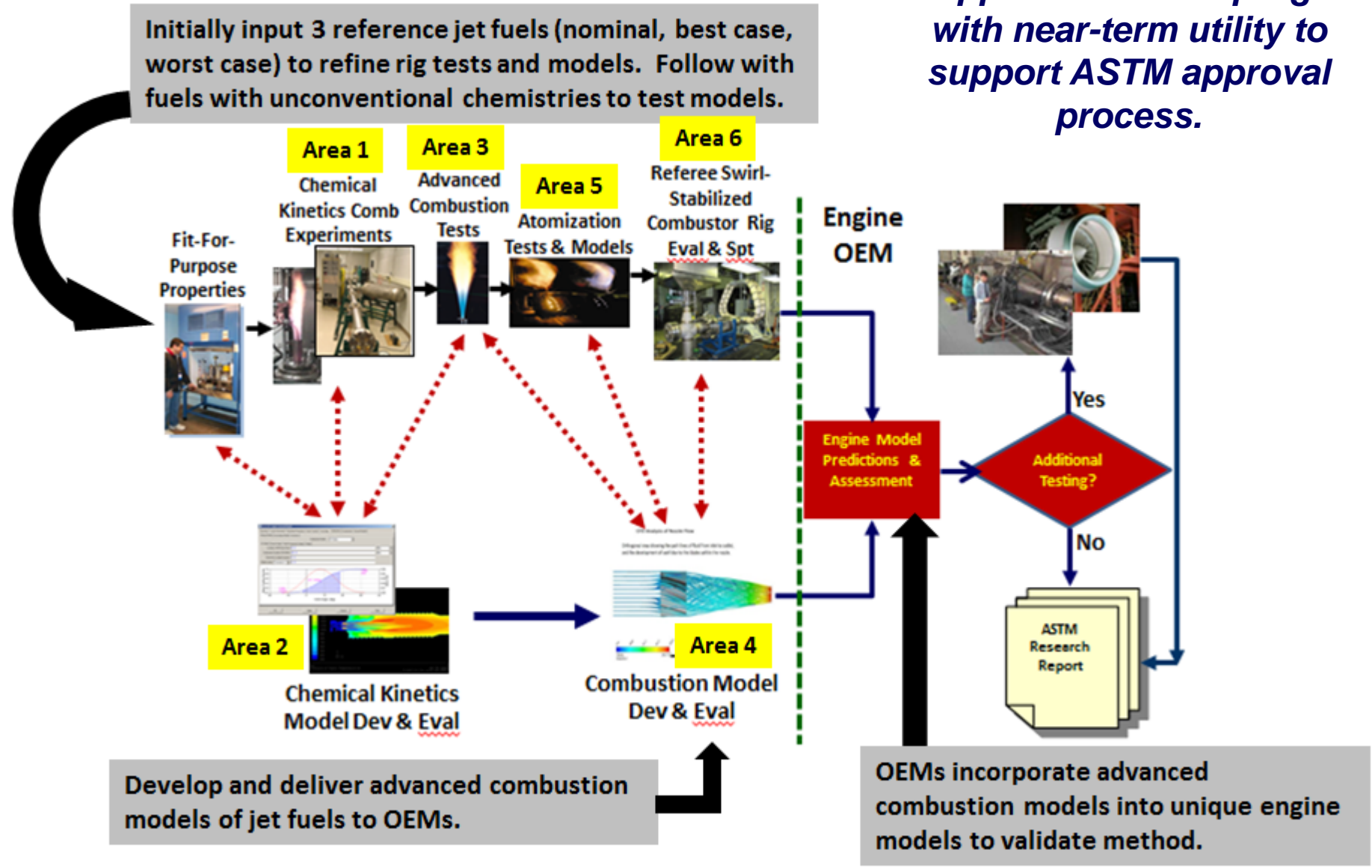
- **Challenges to Alternative Fuel Approval Process**
 - Cost/duration of fuel approval process
 - Fuel quantities for rig/engine tests
 - OEMs uncertainty over effects of novel fuel composition and chemistry on combustor operability
- **Proposed Solution**
 - Develop generic fuel composition/chemistry evaluation methodology
 - Standardized rig/lab tests
 - Chemical kinetic/combustion modeling
 - Collaborative OEM/university/federal effort

Benefits

- **Streamlines current ASTM approval process**
 - Fewer rig/engine tests
 - Eliminates duplicative OEM testing
 - Reduces costs and accelerates schedule
 - Increases throughput of new fuel approvals
- **Reduces fuel quantities required for approval**
 - Replace/reduce combustor/engine tests with rig tests/modeling
- **Reduces engine OEM risk/uncertainty**
 - Provides greater understanding of fuel chemistry effects on combustion
 - Provides greater understanding of the performance of novel fuel chemistry
 - OEM participation in development of tests and models
- **Improved industry modeling and design tools**
 - Supports compositionally-based fuel approvals
 - Supports identification of acceptable fuel composition boundaries for future engine designs

Program Overview

An applied research program with near-term utility to support ASTM approval process.



Figures of Merit and Fuels Properties

Figures of Merit	Fundamental Processes	Fuel Properties
<ul style="list-style-type: none"> • Lean-blowout • Altitude relight • Cold start 	Spray Characteristics	Viscosity, surface tension, density
	Evaporation	Vapor pressure, distillation, heat of vaporization, heat capacity, critical pressure, molecular weight
	Turbulence, Mixing	Mass diffusivity
	Flame Stability, Turbulence-Chemistry Interactions, Combustion Chemistry	Flame speed, heat of combustion, extinction strain rates, flammability limits, molecular weight, fuel density

Sponsors, Contributors and Performers

Federal Sponsors and Contributors

- FAA
- AFRL
- NASA
- NIST
- DLA Energy
- Navy (Tentative)
- DOE (Tentative)

Performers

- ASCENT COE Universities
- AFRL Contractors (including Princeton University)
- Engine OEMs: Pratt & Whitney, Williams, Honeywell, General Electric, LibertyWorks (Rolls-Royce)

Funding Profile

Area (NOI)	Title	Year 1, \$K		Total Years 2 and 3 Projection		
		FAA*	AFRL	FAA	AFRL	Other Agencies
	Steering Committee Support	500	500	1000	1000	Working with other federal partners (including Navy and DOE) to secure more funding
FFP	Fuel procurement, shipping, and properties		200			
1	Chem. Kinetics Comb. Expt.	350		250		
2	Chem. Kin. Model Dev. & Eval.	300		250		
3	Advanced combustion tests	400		725		
4	Combustion Model Dev & Eval.	400		600		
5	Atomization tests & Models	350		350		
6	Referee Swirl-stabilizer Combustion Test/Evaluation/Support	350	1000	900	2000	
7	Program Interface & Integration	100		300		
	Total	2750	1700	4375	3000	

*Includes \$250K from DLA

Leveraging work from other DOD programs (e.g. ARO, AFOSR)



Program Development and Status

- Consulted with engine OEMs on the plan development
 - Conducted three group telecons with OEMs
 - Secured 5 whitepapers from OEMs on program objective and approach
- Conducted a webinar to educate ASCENT COE community on the program objectives and forthcoming solicitation
 - Attended by 64 participants
- Awarded all 5 OEMs contracts through AFRL in the total amount of \$1M (\$500K from AFRL and \$500K from AEE)
- Formed program Steering Committee comprising of Federal and OEM representatives
 - Steering Committee co-chairs: Mel Roquemore and Mohan Gupta
 - Steering committee will also include ASCENT PIs of selected proposals
- Timeline:
 - July 8, 2014: Released 6 Requests for Notice of Intents to ASCENT COE
 - July 28, 2014: Received 20 proposals covering all 6 areas
 - A panel of federal members reviewed all proposals
 - In process to notify the selected teams