The Boeing Company

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New Fuels for Aviation- An Aircraft Manufacturer's Perspective

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New Fuels Quiz

Question?

What is an aircraft manufacturer worried about in regards to approving a new turbine fuel from non-conventional processes and feedstocks?

Is the answer…

A) Interaction with Materials

B) Impact on our fuel system

C) Jet Engines

D) Performance of the aircraft

E) Fuel Handling and Storage

F) Is the specification rigorous enough to insure the production of high quality fuel

And the Answer is…. ***EVERYTHING!***

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Boeing Supports “Drop-In” Fuels

- Meets fuel performance requirements
- Requires NO change to airplanes or engines
- Requires NO change to infrastructure
- Can be mixed or alternated with today’s Jet-A fuel

A new way of making the same fuel

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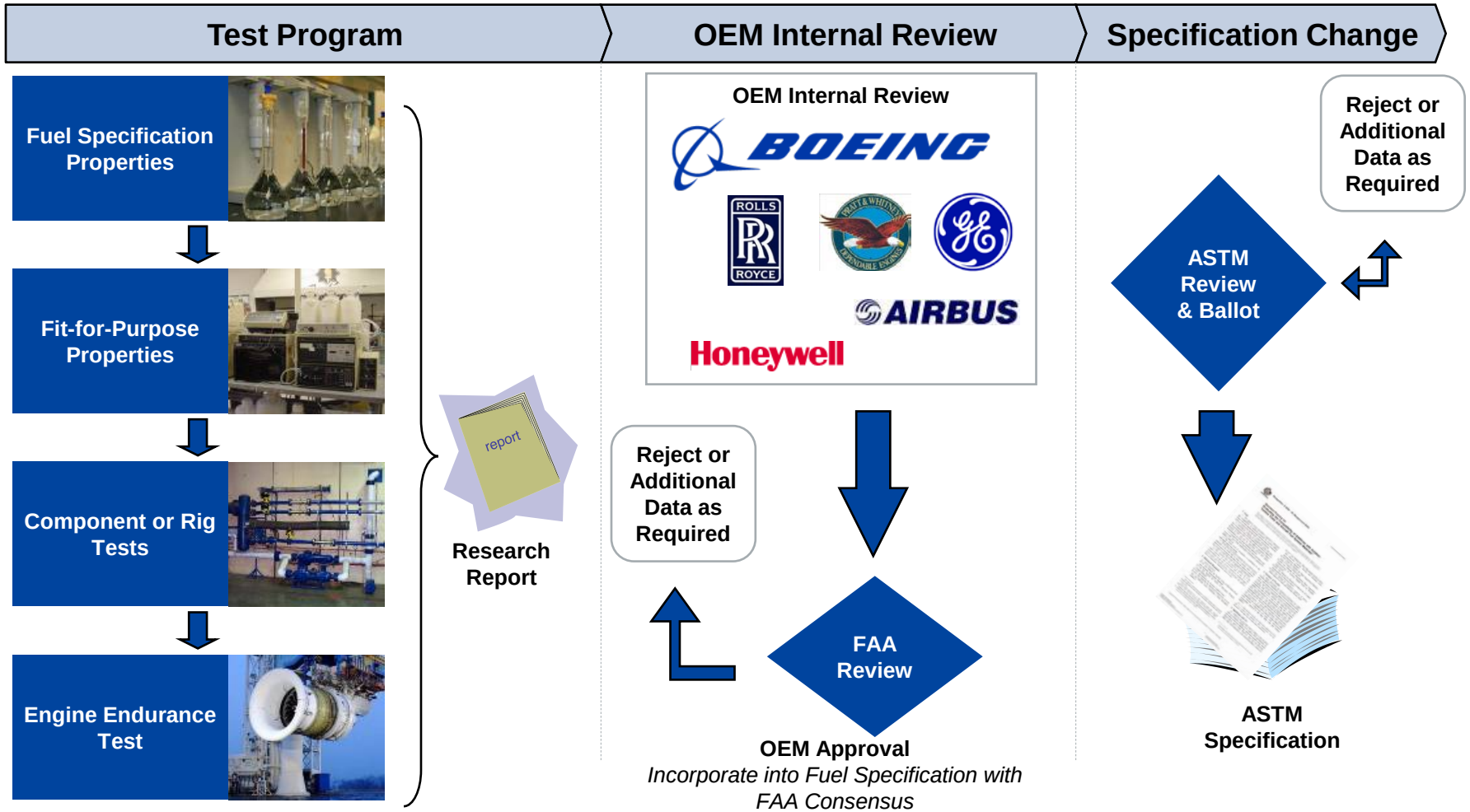
ASTM Fuel Approval Process- ASTM D4054



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Fit for Purpose Tests

		ASTM test method
"Chemistry" :		
Hydrocarbon chemistry		
Hydrocarbon Types		D2425
Aromatics		D1319 or ASTM D6379
Hydrogen		D5291 or D3701
Trace material		
Organics Carbonyls	**UOP, oxygenated species**	E 411
Alcohols		UOP 656 or EPA 8015B
Esters		EPA 8260B
Phenols		EPA 8270C
Inorganics: N		D4629
Trace Elements		
Cu		D6732
Zn, Fe, Va, Ca, Li, Pb, P, Na, Mn, Mg, K, Ni, Si		D7111
"Bulk physical and performance properties" :		
Boiling point distribution		D86
Thermal stability breakpoint		D3241 Appendix X.2
Viscosity vs temperature		D445
Density vs temperature		D4052
Water solubility vs temperature		D6304
Flash Point		D56/3828
Freeze point		D2386 and 5972
"Electrical properties" :		
Dielectric cste vs density		D924
Electrical Conductivity and response to static dissipator		D2624
"Compatibility" :		
With other additives and fuels		D4054 Appendix B
With engines and airframe seals, coatings and metallics		

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Fit for Purpose Tests

"Bulk physical and performance properties" :	
Vapor-Liquid ratio	**D6378**
Lubricity and response to lubricity improver	**D5001**
Specific heat vs temperature	**E1269**
Surface tension vs temperature	**D1331**
Bulk modulus vs temperature	**D6793**
Thermal conductivity vs temperature	**D2717**
Solubility of air (O2/N2)	**1148, 1827,2779, 2780, 3827**
"Electrical properties" :	
Dielectric cste vs density	D924
"Ground handling / safety" :	
Flammability Limits	**E 681**
Autoignition Temperature	**DE 659**
Hot Surface Ignition Temperature	**FTS 791C method 6053 or ISO 20823**

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Fit for Purpose Tests

"Ground handling / safety" :	
Effect on Clay Filtration	**D3948**
Filtration- coalescers filters and monitors (water fuses)	**API 1581 (/// SAE J 1488)**
Storage Stability:	
- Peroxides	**D3703**
- Potential gums	**D5304**
Toxicity	**DoD handbook Aerospace Fuels Certification, Appendix G**

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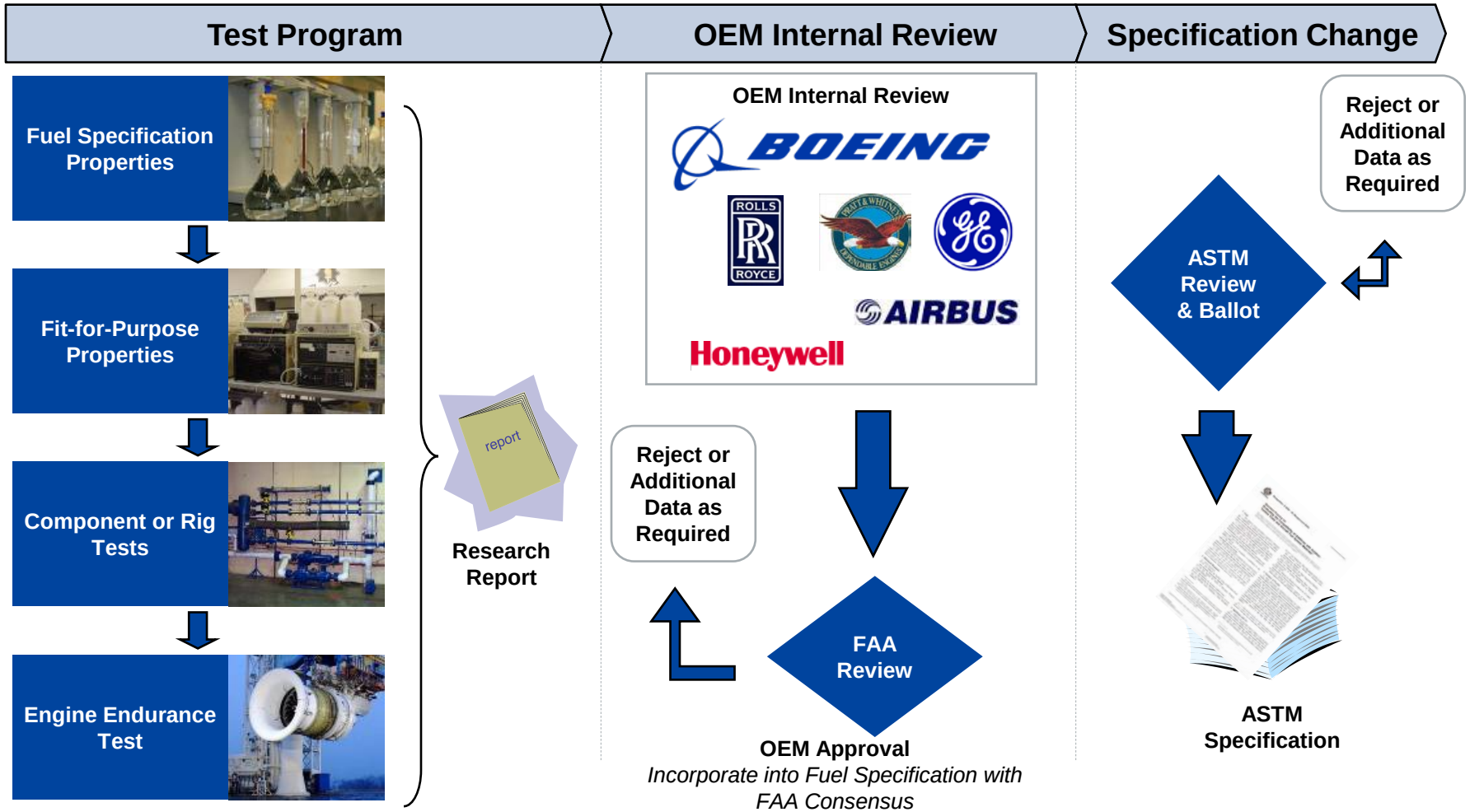

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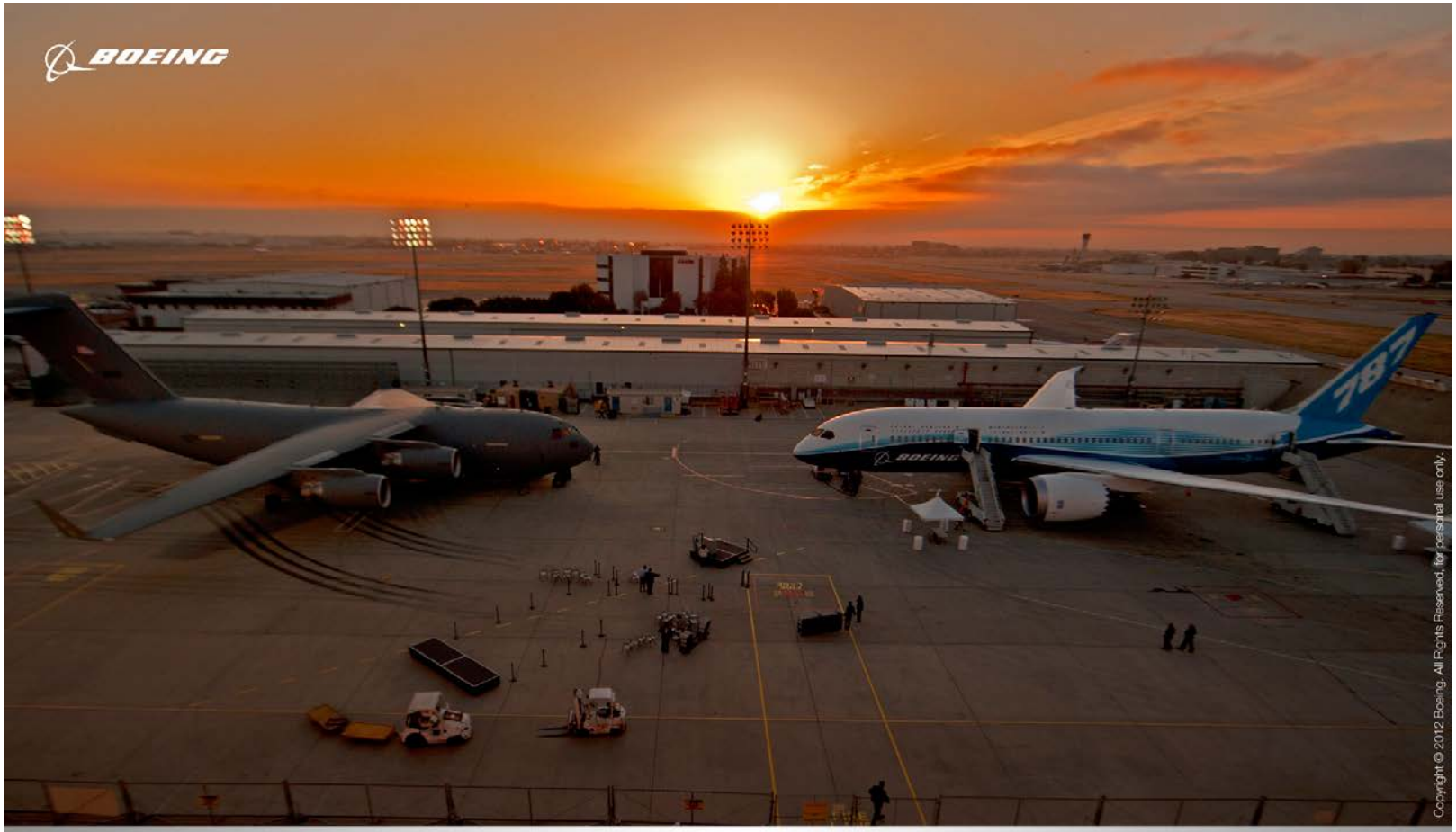
WHAT'S ON THE HORIZON?



C-17 Collier Trophy 1994

787 Collier Trophy 2011

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Feedstocks for Bio-Derived Fuel for Aviation

Feedstocks

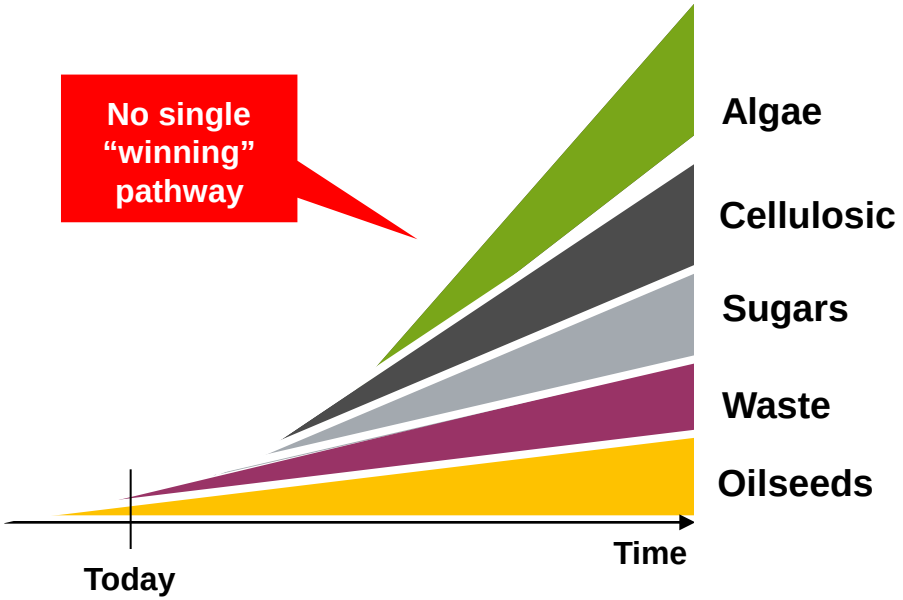
Algae

Cellulosic

Sugars

Waste

Oilseeds



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Sugar to Jet production Routes

Sugar

Alcohol **Yeast** **Bacteria** **Hydroreforming** **Algae**

JET FUEL

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Boeing’s Role in Making Biofuel a Reality

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Boeing Global Biofuel Engagements

Recent and Active Biofuel Projects

Outcomes

- ASTM & DEF STAN approval
- SAFUG[1] established
- Commercial flights from June, 2011
- Focused regional research projects
- Biofuel roadmaps published

1. Sustainable Aviation Fuel Users Group

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Moving From Dreams to Reality

Aviation Biofuel Progress

- ASTM approval for commercial use
- Approval for military use
- Regional assessments
- Favorable policy developments
- Commercial flights continue

Next Steps

- Continued emphasis on sustainability
- ASTM approval of new fuels
- Research - expanded feedstocks/pathways
- Commercial production scale-up

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Questions?

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Forever New Frontiers

http://www.newairplane.com/environment/