



**ICAO AVIATION AND SUSTAINABLE  
ALTERNATIVE FUELS  
WORKSHOP**

ICAO Headquarters, Montréal, Canada

18 to 20 October 2011

# Qualification of Alternative Aviation Fuel

Mark Rumizen

CAA/FAI Certification Qualification

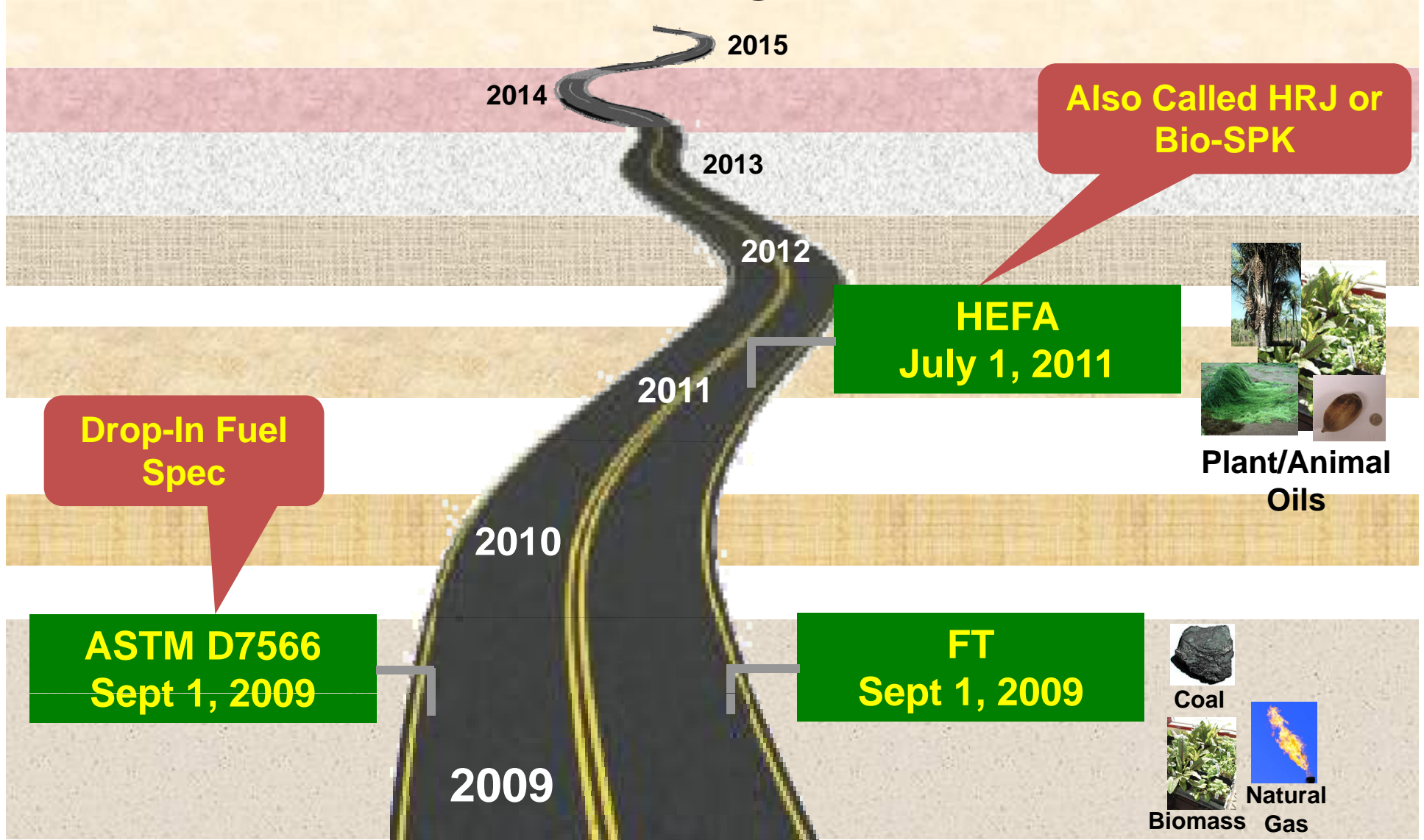
FAA Aviation Fuel Specialist



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# Qualification: Continuing Our Progress



# Fuel Specifications for Aviation



Petroleum Industry



Civil Aviation



Fuel Specs

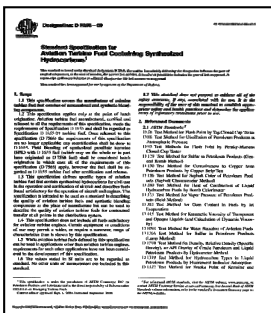


High Volume Commodity

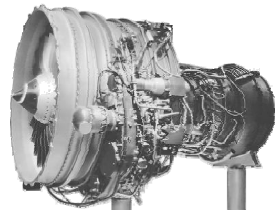
Exacting Standards



**Regulatory Authorities Do Not Certify Fuel, They Certify Airplanes and Engines to Operate on Specified Fuel**



**Industry/Military Fuel Specification**



- Engine Operating Limitations
  - Fuel Specification



- Aircraft Operating Limitations
  - Engine limitations Used for Aircraft



- Aircraft Operator (Airlines) Operating Rules
  - Must Adhere to Aircraft and Engine Limitations

# Certification of Alternative Fuels



## Industry Qualification



Revised Spec Drop-In Fuel

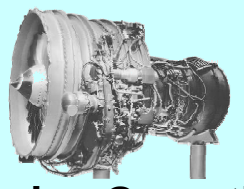


New Spec Non-Drop-In Fuel

Unchanged Operating Limitation

New Oper Limitation

## Airworthiness Certification



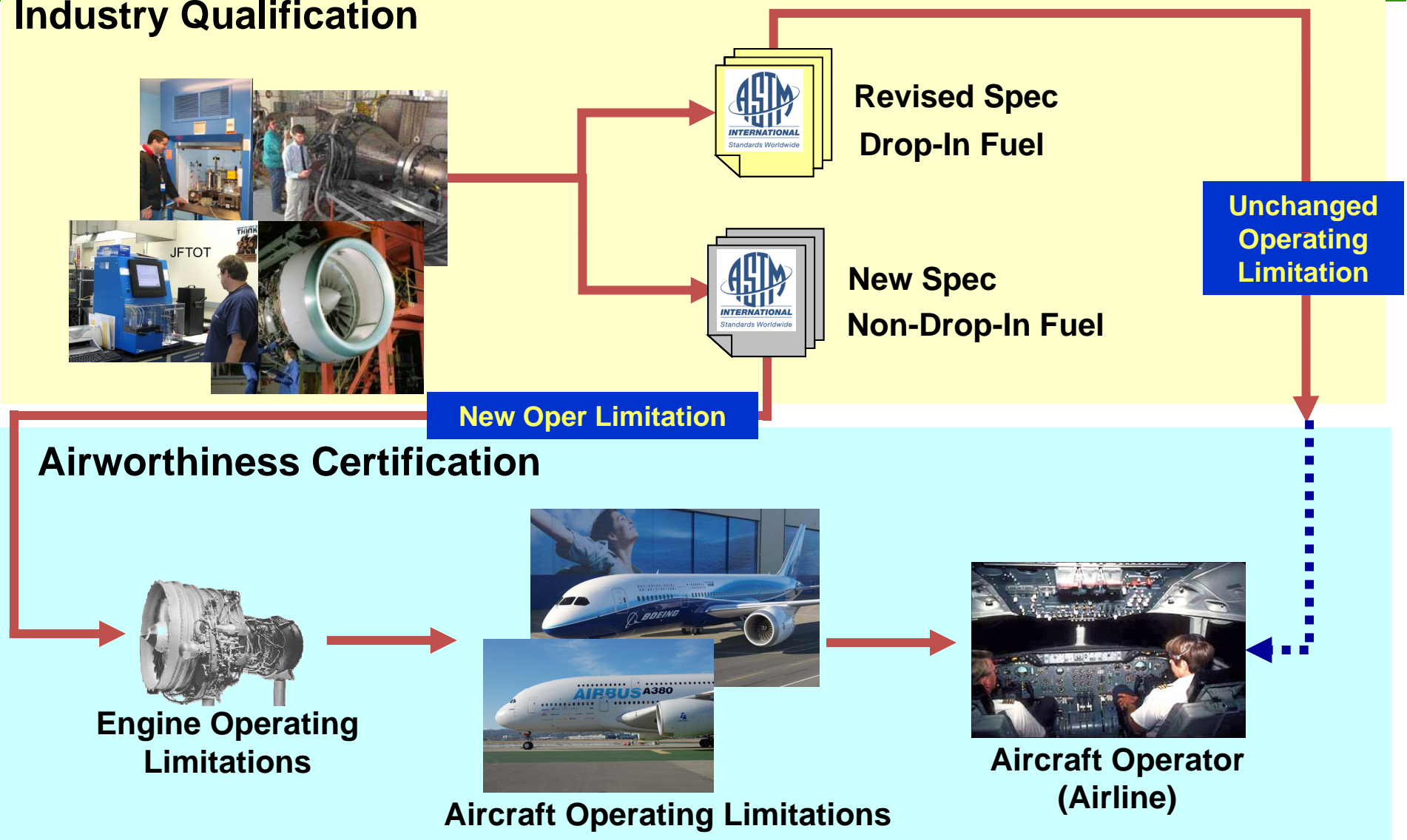
Engine Operating Limitations



Aircraft Operating Limitations



Aircraft Operator (Airline)



# Industry Qualification (ASTM D4054 Process)



Specification  
Properties



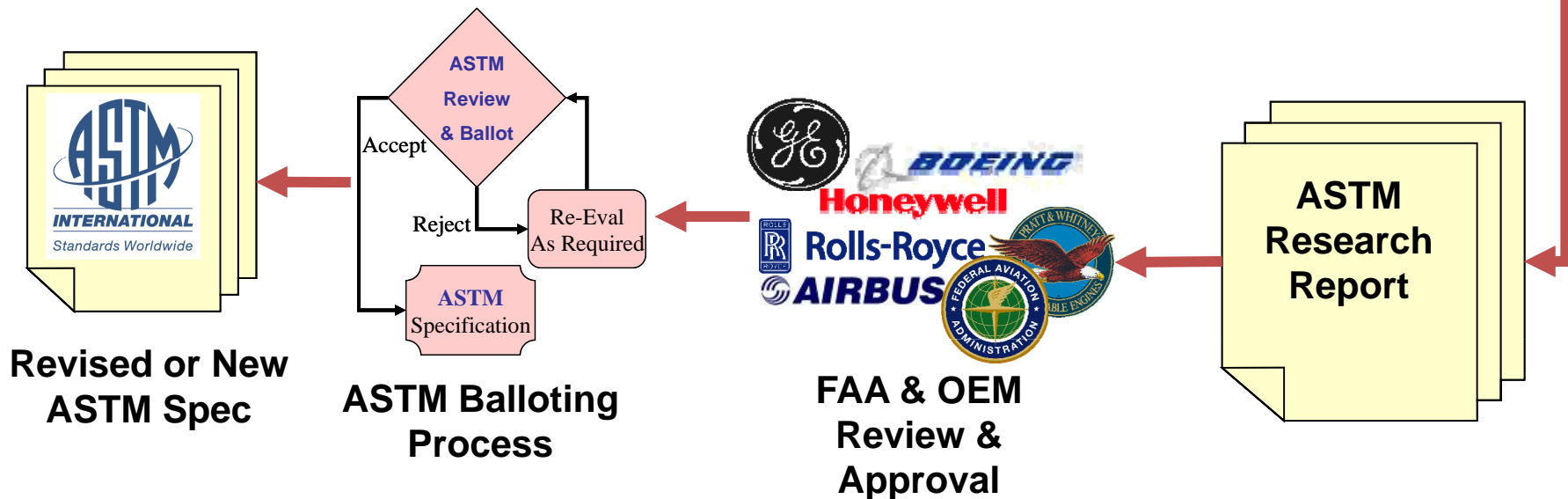
Fit-For-Purpose  
Properties



Component/Rig  
Testing



Engine/APU  
Testing





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# D7566 Enables Drop-In Fuel



## Production



**Semi-Synthetic Fuel**

**Tighter Control of Fuel Properties**

## Distribution



**Conventional Jet Fuel**

**Separate Tracking NOT Required**

## Operations



**Conventional Jet Fuel**

**Re-Certification NOT Required**

**Re-Identified**

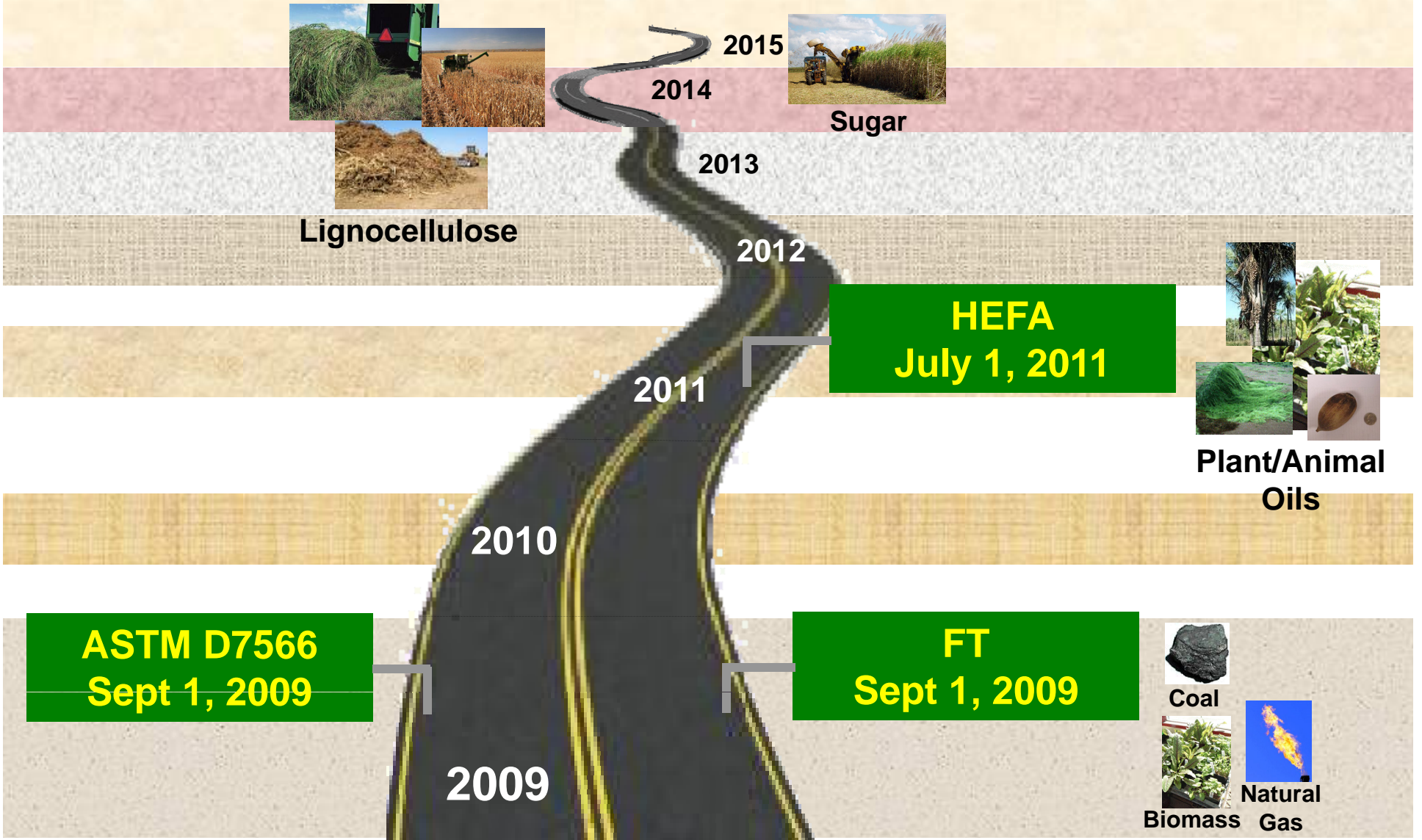




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# Future Pathways







### Fermented Sugar to HCs



Genetically Engineered Microbes

Fermentation

### Alcohol to Jet (ATJ)



Fermentation

Dehydration

Olefins

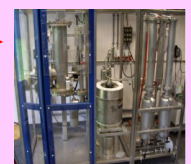
### Catalyzed Sugar to HCs



Catalysis

Synthetic-Crude

### Pyrolysis



Pyrolysis

Bio-Crude

# Future Pathways



sugarcane  
Sugar



switchgrass



corn stover

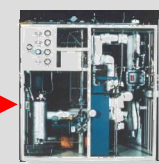


forest waste  
Lignocellulose

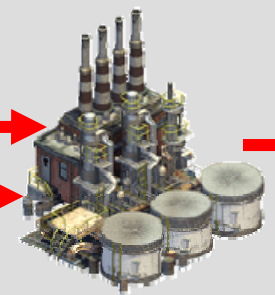


Jet Fuel Product

### Conventional Refinery Processes



Oligomerization



Hydroprocessing



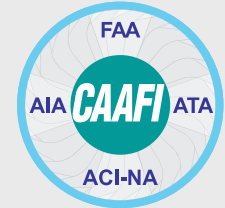
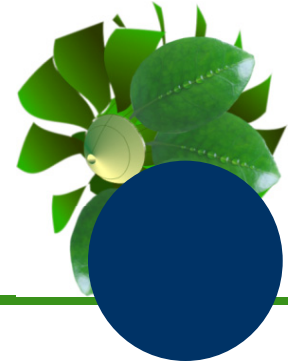
Jet Fuel



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# Thank You



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