

## ASCENT Project 31



# Alternative Jet Fuel Test and Evaluation

## University of Dayton Research Institute

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Cost Share Partner: Global Bioenergies, Boeing, Shell, IHI, Neste, GE Aviation, NRC Canada, LanzaTech, and University of Dayton

### Research Approach:

Fuel property and composition testing

Support for rig/engine evaluations

Coordination of OEM approval process

Goal is new D7566 approved annex for each candidate fuel

### Objective:

**Coordinated performance testing** to support the **evaluation of novel alternative jet fuels** toward ASTM approval.

### Project Benefits:

- ASTM research reports for OEM approval and **creation of D7566 annexes**
- **Management of D4054 qualification** process
- **Coordination of fuel qualification** to enable increased supply of secure, safe, low life cycle carbon, sustainable aviation fuels (SAF)

### Major Accomplishments (to date):

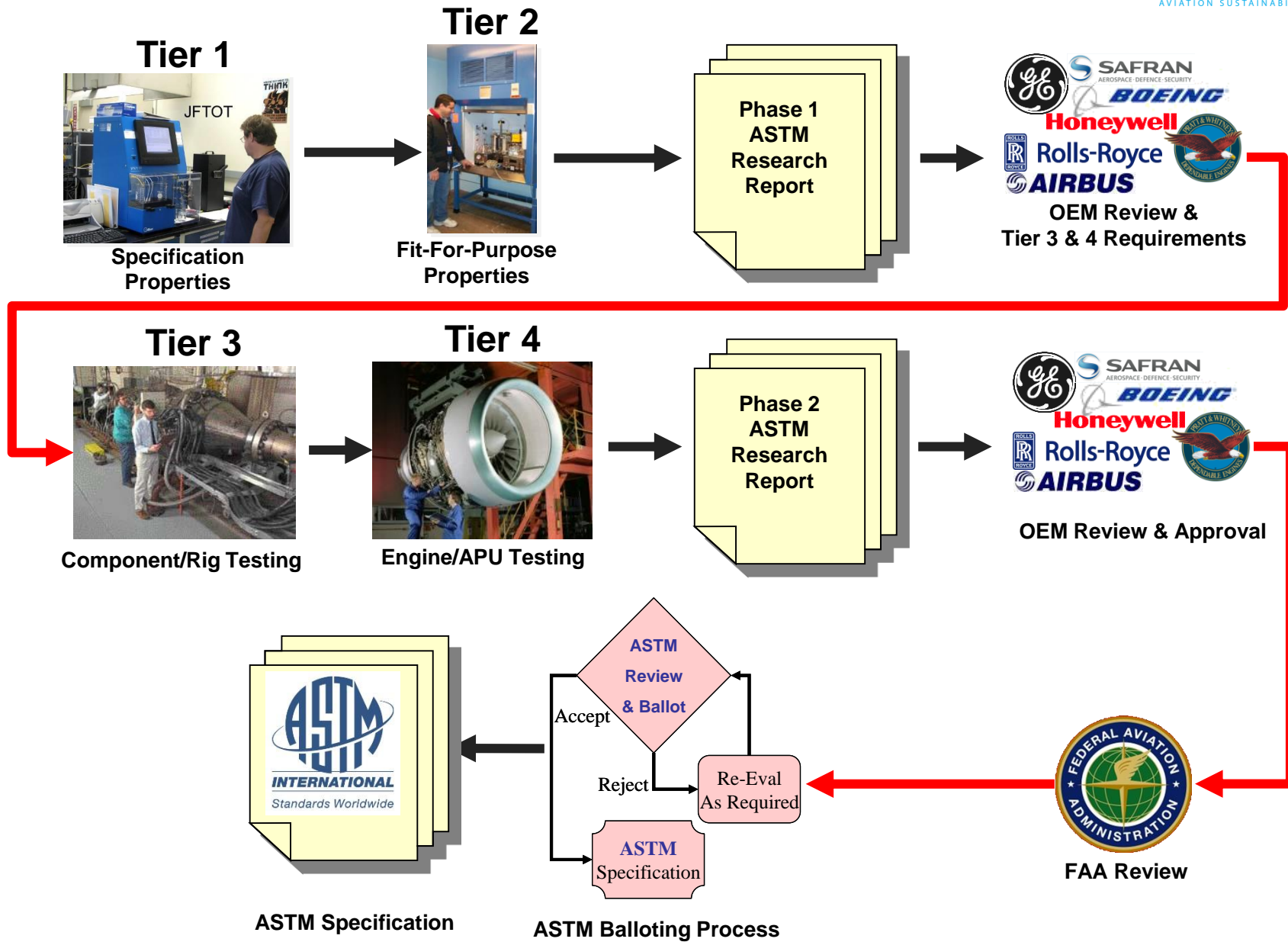
- ASTM D7566 Annexes – ATJ & HC-HEFA
- D4054 Fast Track Process
- Two GCxGC analysis methods documented
- Co-processing pathways in ASTM D1655
- Testing of Shell IH2, HC-HEFA, Global Bioenergies, CSIR-IIP, Revo, and Swedish Biofuels fuels
- Cost-share with Global Bioenergies

### Future Work / Schedule:

- Continue guiding fuel producers through approval
- Continue fuel testing & evaluation
- Continue OEM committee and report reviews toward ASTM approvals

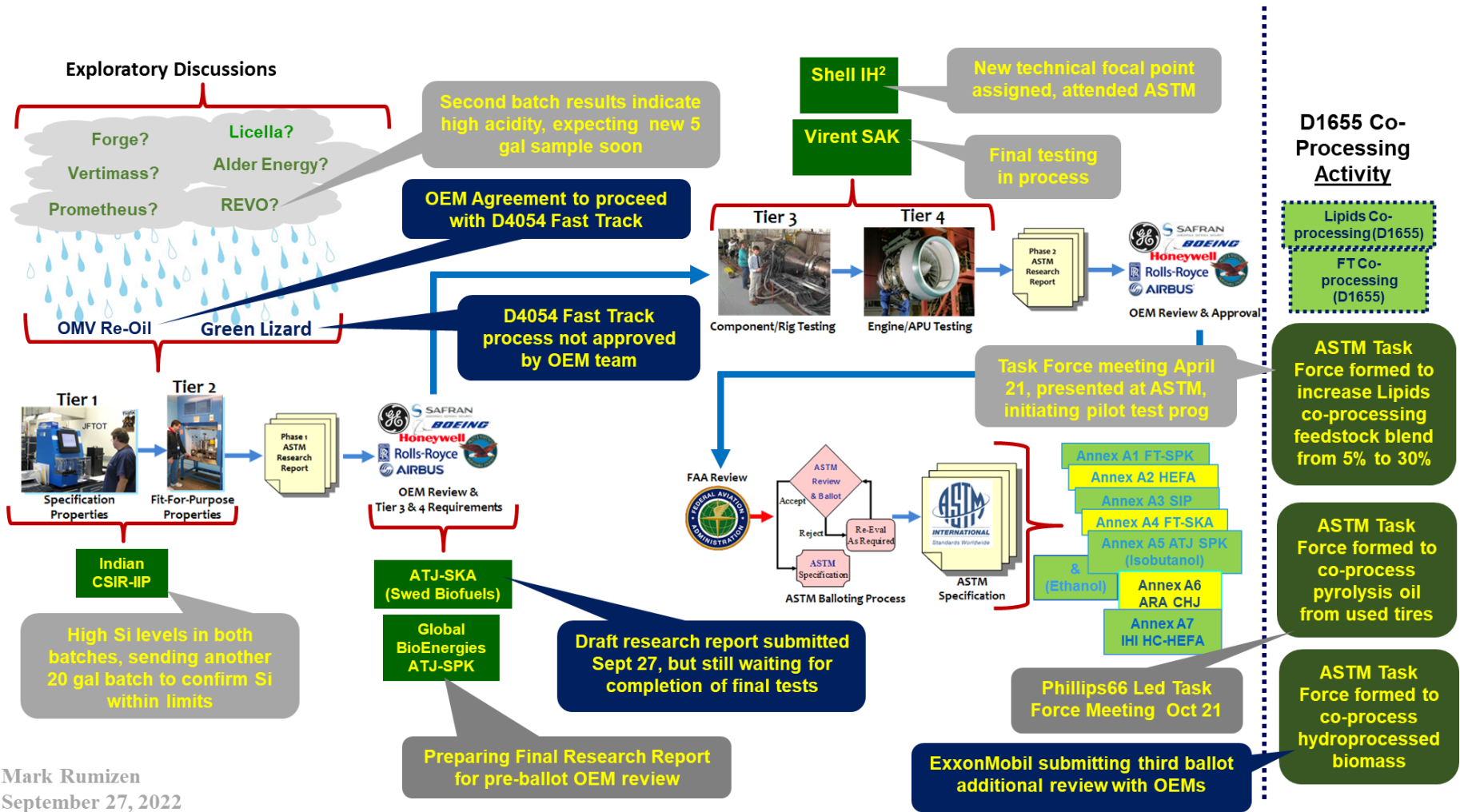


# D4054 Certification Process





# ASTM D4054 Qualification Status





# Current Candidates

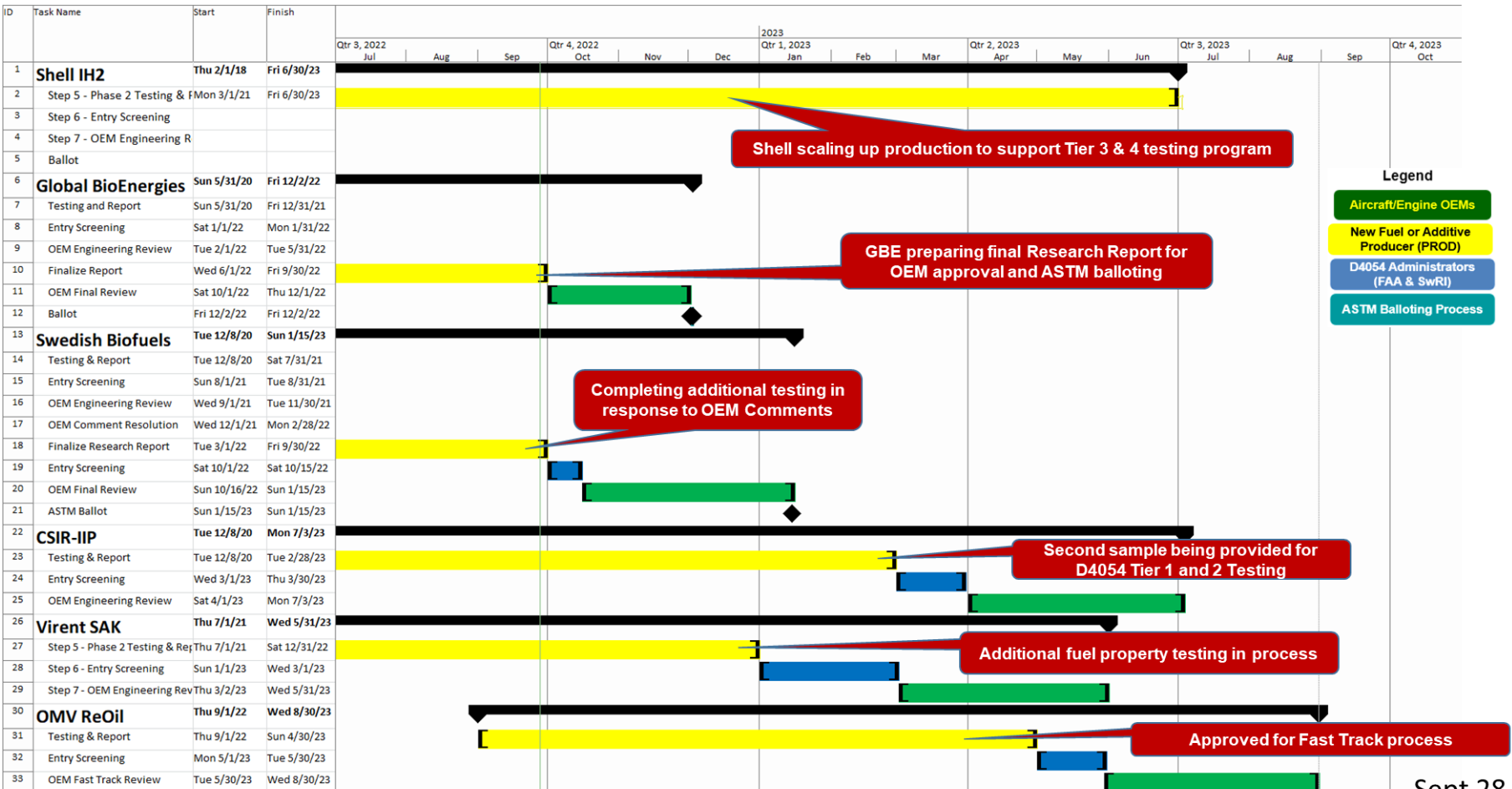


- Shell IH<sup>2</sup> – wood pyrolysis – Phase 1 completed
  - Planning for Tier 3 testing – APU & combustor rig (also CLEEN III)
  - Waiting on larger fuel volumes
- Global Bioenergies (Rewofuel) – France – wood residue to isobutylene
  - Phase 1 research report response complete
  - GBE/EU funds for support – received €250K as cost share + in-kind
- Swedish Biofuels – ATJ with variety of alcohols
  - Completed additional testing in response to Phase 1 review
- CSIR-IIP – India – single step HEFA w/ aromatics
  - completed Tier 1/2 testing – waiting on additional sample
- Virent SAK – aromatics only blendstock – additional testing to start
- Revo – Japan – HEFA with higher cycloparaffins – 45% cycloparaffin limit – waiting on additional sample
- OMV ReOil – approved for Fast Track process – awaiting samples



# Gantt Chart Schedule

## D4054 Clearinghouse Forecasted Fuel Evaluation Schedule



Sept 28, 2022



# New Fuel Candidates

- Forge Hydrocarbons – Canada
  - Lipids to hydrocarbons – with aromatics & cycloparaffins
- Prometheus Fuels – USA
  - CO<sub>2</sub> from air electrochemical conversion to alcohols using renewable energy
- Alder Energy – USA
  - NREL technology for pyrolysis oil – interested in Fast Track
- Green Lizard – UK
  - Pyrolysis oil from wood and waste products
  - Rejected for Fast Track
- Vertimass – US
  - DOE BETO, Optimization of Bio-Derived Jet Fuel Blends Funds – renewable cycloalkanes from ethanol
- ExxonMobil – US – methanol to jet
- Initial Discussions – Greenfield Global, NGT-Synthesis, Fraunhofer ISE, BioWright, Varo Energy, Uzbekistan GTL
- Co-processing of hydroprocessed biomass – e.g., green diesel, HEFA



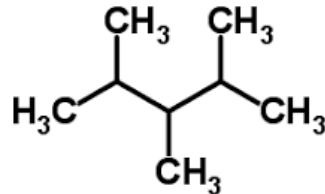






# Renewable Iso-octane for Avgas

- Iso-octane has octane no. = 100



- Isobutene oligomerization --> Iso-octane
  - Gevo ATJ – fermentation produces isobutanol --> isobutene
  - Global Bioenergies – wood residues/sugars to isobutene
- Measure composition and properties - mixture of isomerized octanes
  - Determine composition & purity (~85 - 91%)
  - Measure important properties
  - Perform materials compatibility?
- Develop proposed specification table
- Determine additional testing requirements



- Chinese gov't has approached FAA/OEM committee for approval of their SDA and CI/LI additives
- T1502 is similar to Stadis 450 – polysulfone, polyamine, a sulfonic acid, in a HC solvent @ 5 mg/L
- T1602 is similar to DCI-4a and other approved CI/LI additives – mixture of naphthenic acids @ 20 mg/L (rather than di- and tri- linoleic acids)
- Use levels are also similar to ASTM D1655 approved additives
- Testing program status
  - T1502 completed/additional testing identified
  - T1502 in progress – waiting on materials compatibility data