Boeing's Approach to Biofuels

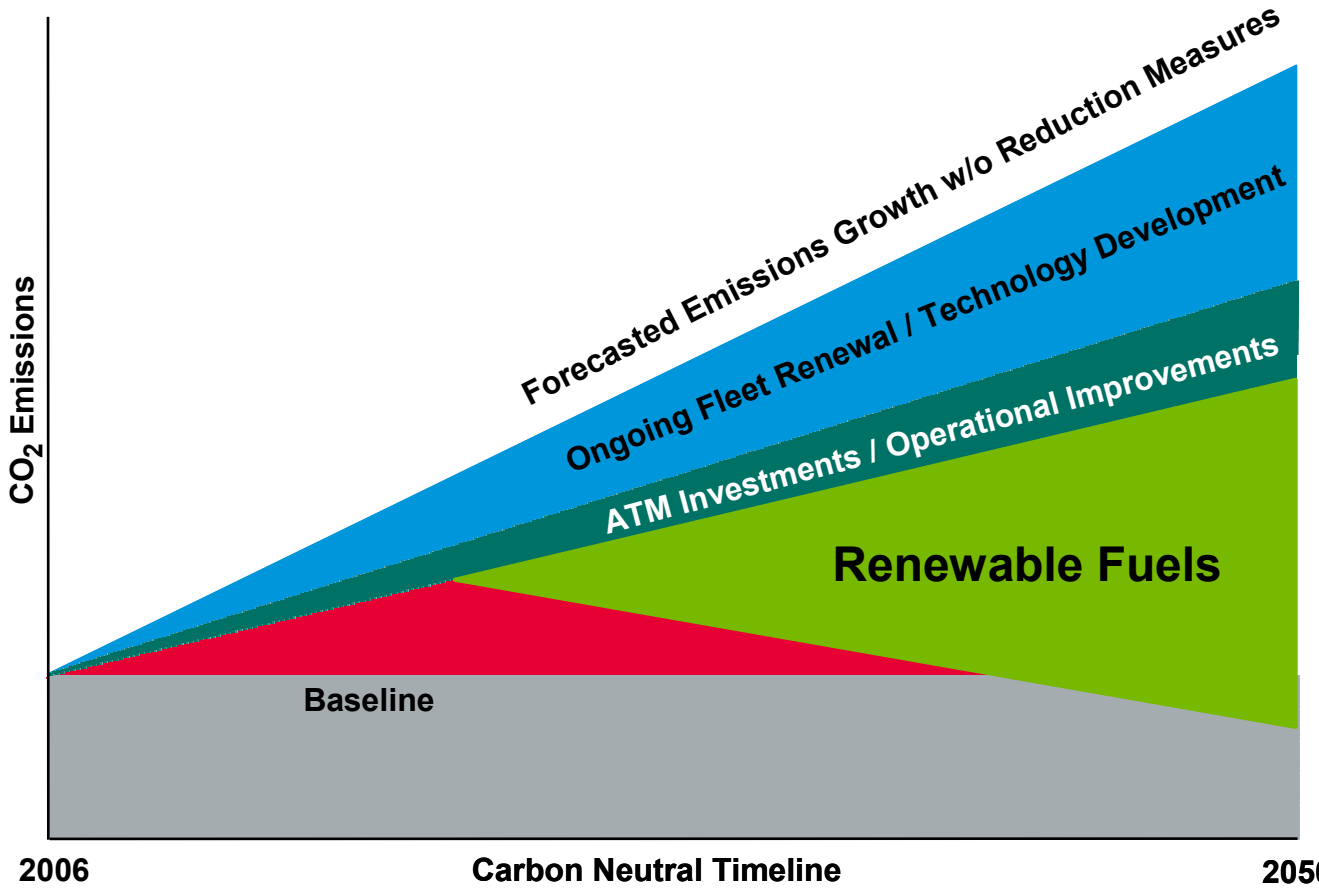
2010 Navy Energy Forum

12 October, 2010

Tim Vinopal
Chief Engineer – Environment,
Boeing Defense, Space & Security

The Commercial Aviation Challenge

Carbon-Neutral Growth



Use less fuel

- Efficient airplanes
- Operational efficiency

Change the fuel

- Lower lifecycle CO_2
- No infrastructure modifications
- "Sustainable Biofuels"

Presented to ICAO GIACC/3 February 2009 by Paul Steele on behalf of ACI, CANSO, IATA and ICCAIA

Sustainable Biofuels Enable Continued Growth

Boeing pursuing sustainable biofuel strategy

Enable the industry to achieve market viability – by 2015

Success Criteria ➡

- 600+ million gallons/yr of bio content
- 5-10 feedstock/fuel production projects

Five Focus Areas

Fuels Approval

Specification approach enables viable new fuel types and is not process-specific

Feedstock Viability

Feedstock providers able to support 600M gallons/yr

Airport Infrastructure

Infrastructure to deliver increasing quantities of sustainable biofuels

Commercial Production

Commercial production capacity & business models

Aviation-Prioritized Sustainable Biofuels

Support & advocacy for aviation-prioritized, sustainable biofuels

Technical focus

Strategic & commercial focus

Boeing Acting as a Catalyst to Accelerate Commercialization

Boeing Leading ASTM Fuels Subcommittee –
Certifying aviation synthetic and biofuel

Test Program

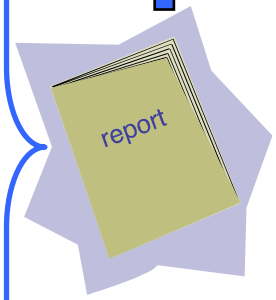
Fuel Specification Properties

Fit-for-Purpose Properties

Component or Rig Tests

Engine Endurance Test

Now ASTM D7566 as well



Research Report (Boeing lead author)

OEM Internal Review

OEM Internal Review

Honeywell BOEING GE AIRBUS Rolls-Royce

Reject or Additional Data as Required

FAA Review

OEM Approval

Incorporate into Fuel Specification with FAA Consensus

Specification Change

ASTM Review & Ballot

Reject or Additional Data as Required

ASTM Specification

Candidate sustainable biofuel feedstocks

Current technology – hydroprocessing triglycerides (fats & oils)

Camelina

Ready Now

Challenges

- Limited total yield
- Tied to grain markets

Jatropha

Ready in 2 to 4 years

Challenges

- Warm climates only
- Still manual harvest

Halophytes

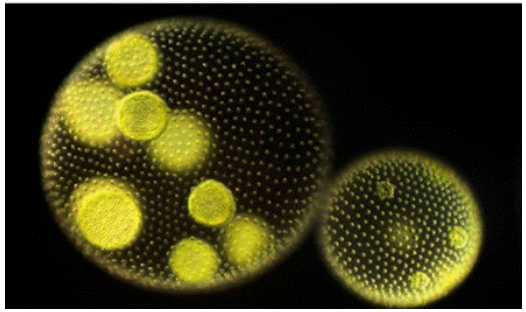
Ready in 2 to 4 years

Challenges

- Prove at scale
- Optimize agronomy

Algae

Ready in 8 to 10 years



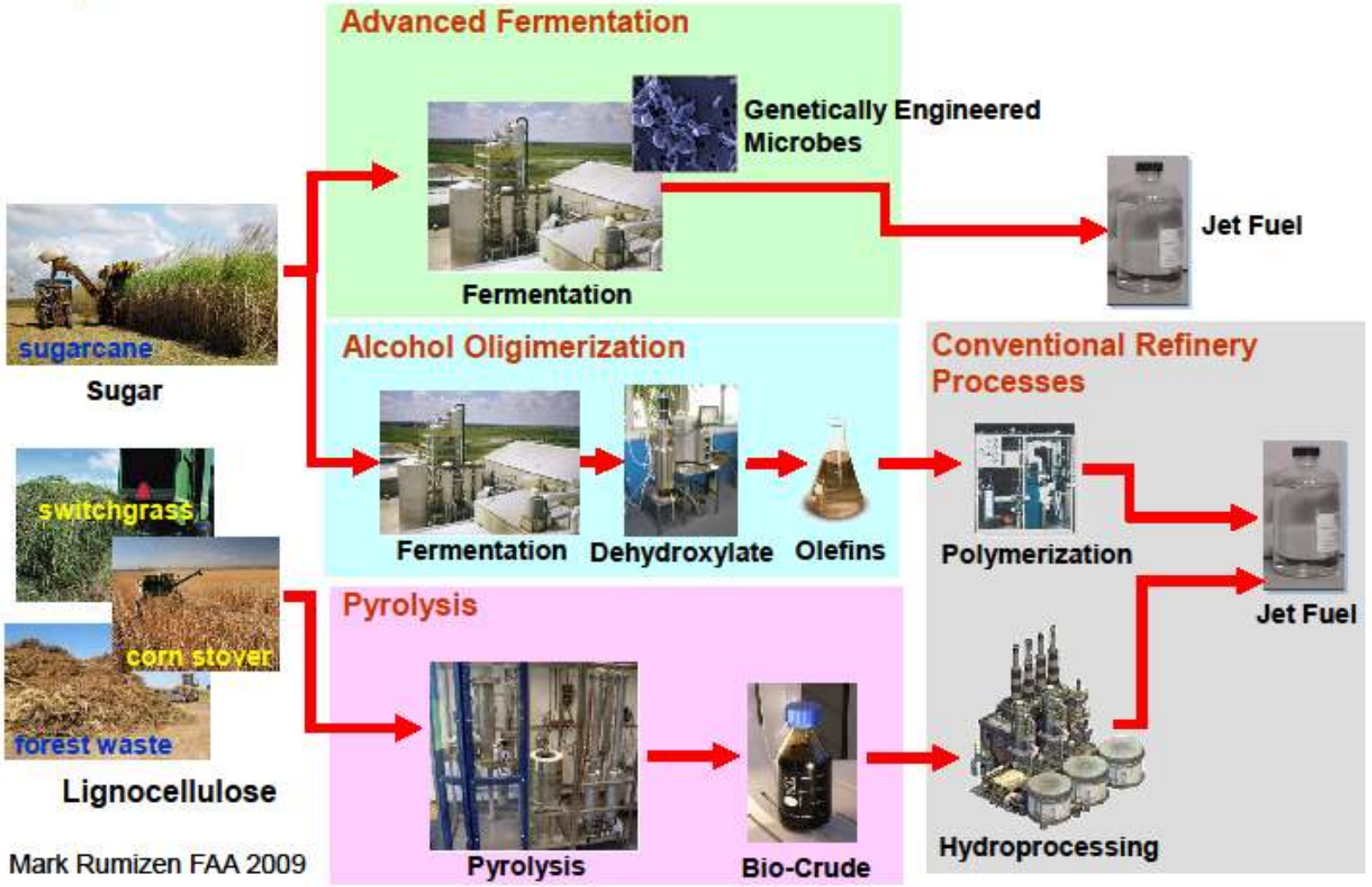
Challenges

- Bio-optimization
- Competing approaches
- Processing costs

Viability Based on Timing, Technology, and Local Resources

Other sustainable pathways still needed

Much more biomass available to other pathways



Technology and sustainability issues to be addressed

Sustainable Aviation Biofuel Projects
by Region

Sustainable Biofuels – Progress Report




Progress

- Low lifecycle CO_2 sustainable bio-based fuels
- Flight tests – met / exceeded expectations
- Excellent fuel – ASTM approval expected 1Q11
- Comprehensive regional assessments underway
- Stretch goal: market quantities by 2015

Action Required

- Continued emphasis on sustainability
- Research in expanded feedstock and processing pathways
- Long term contract authority
- Continued engagement with USDA

Clean Energy AND Energy Security