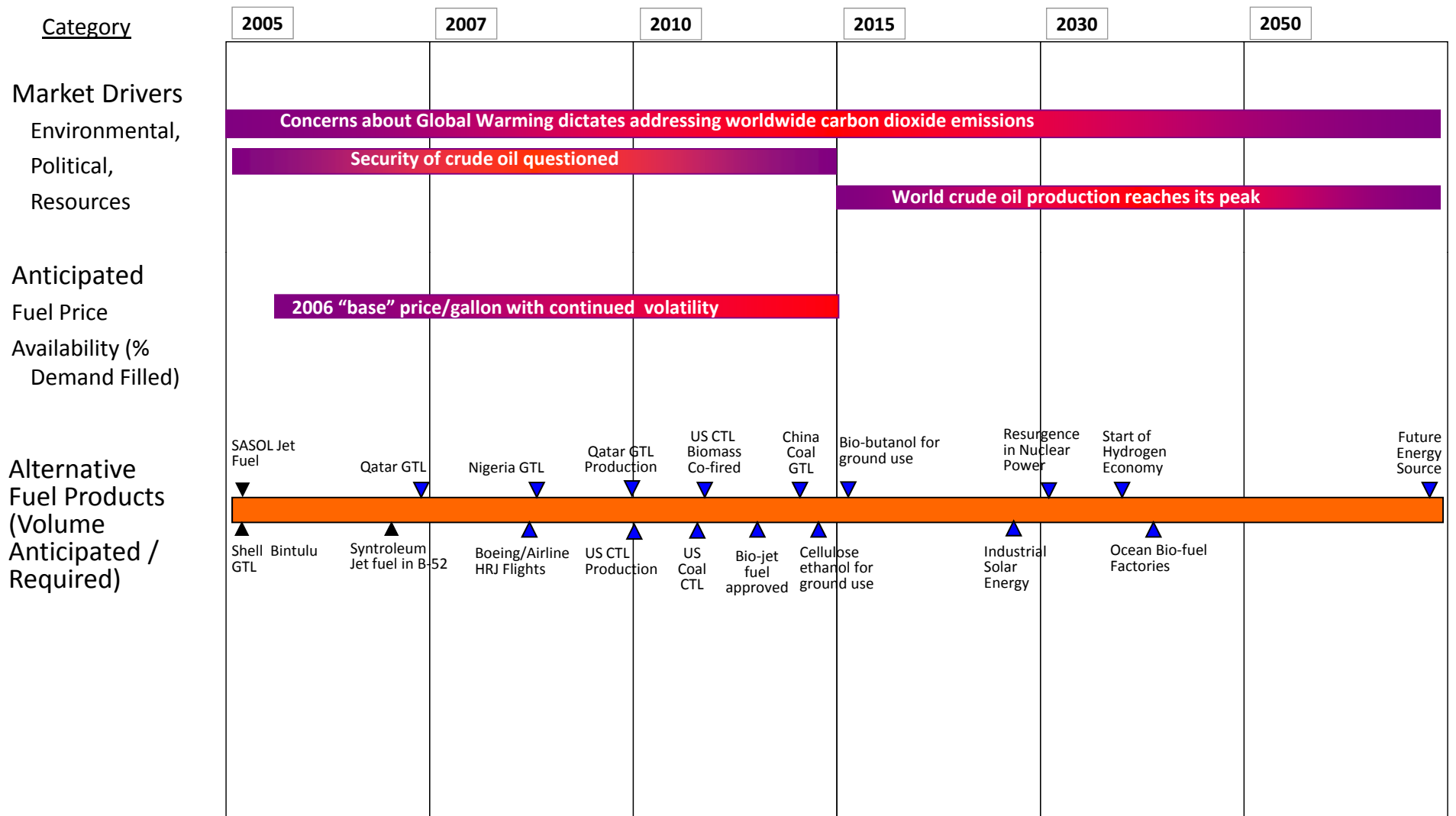


Aviation Alternate Fuels Roadmap

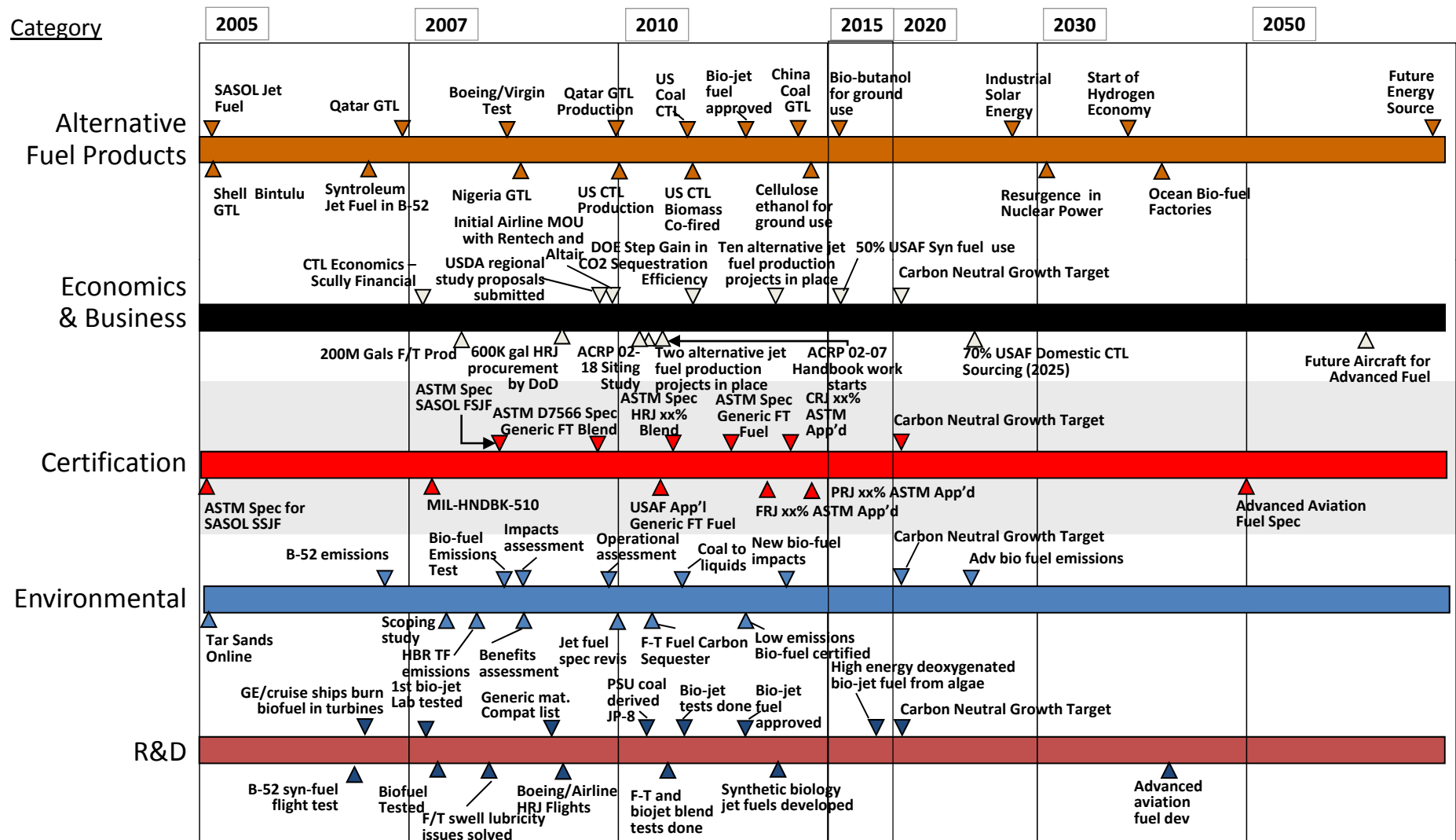
Level 1 / Scenario 1



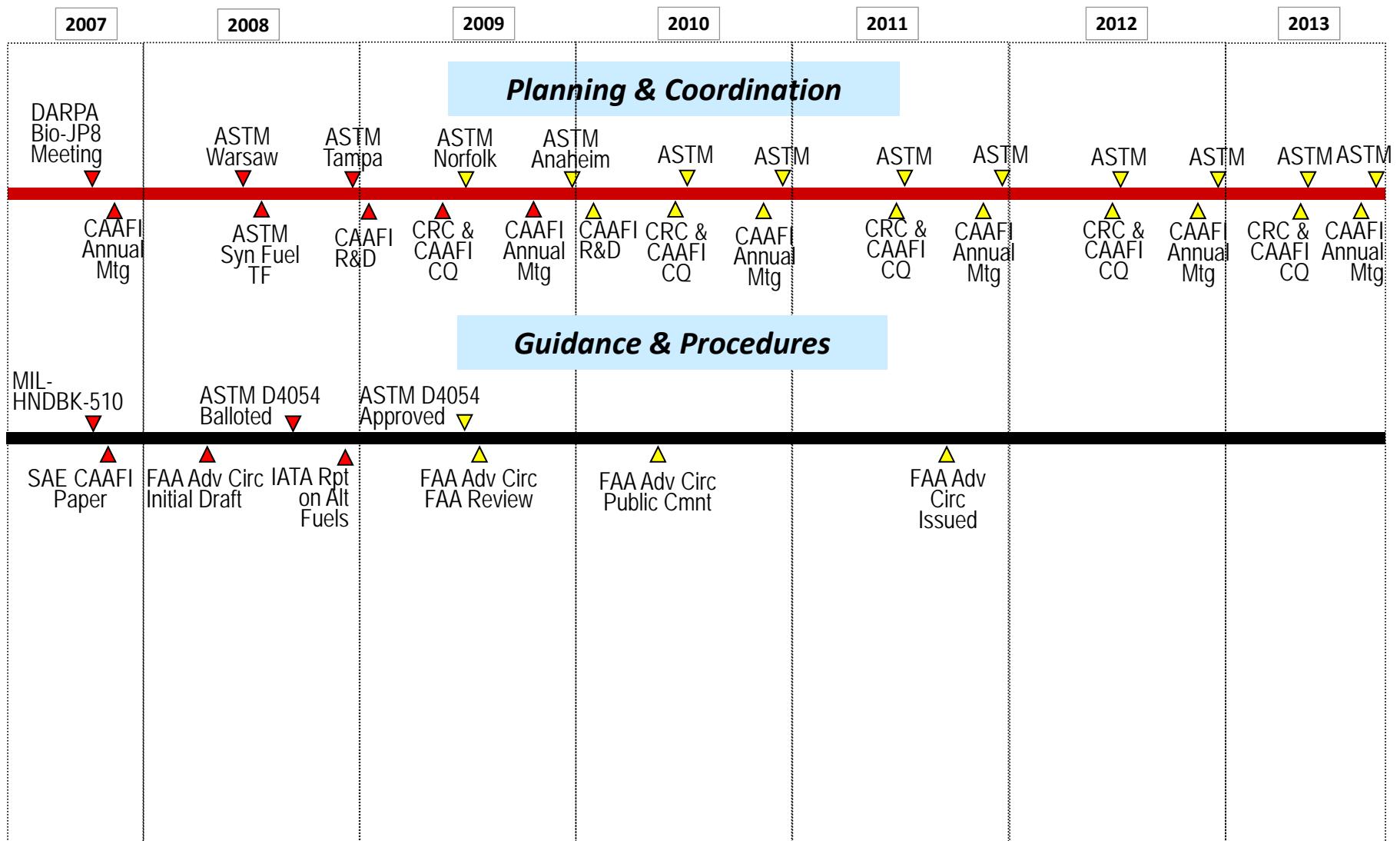
* Fuels produced from seeds and other organic sources such as Soybean Methyl Ester

Aviation Alternate Fuels Roadmap

Level 2 / Scenario 1 - Long Term

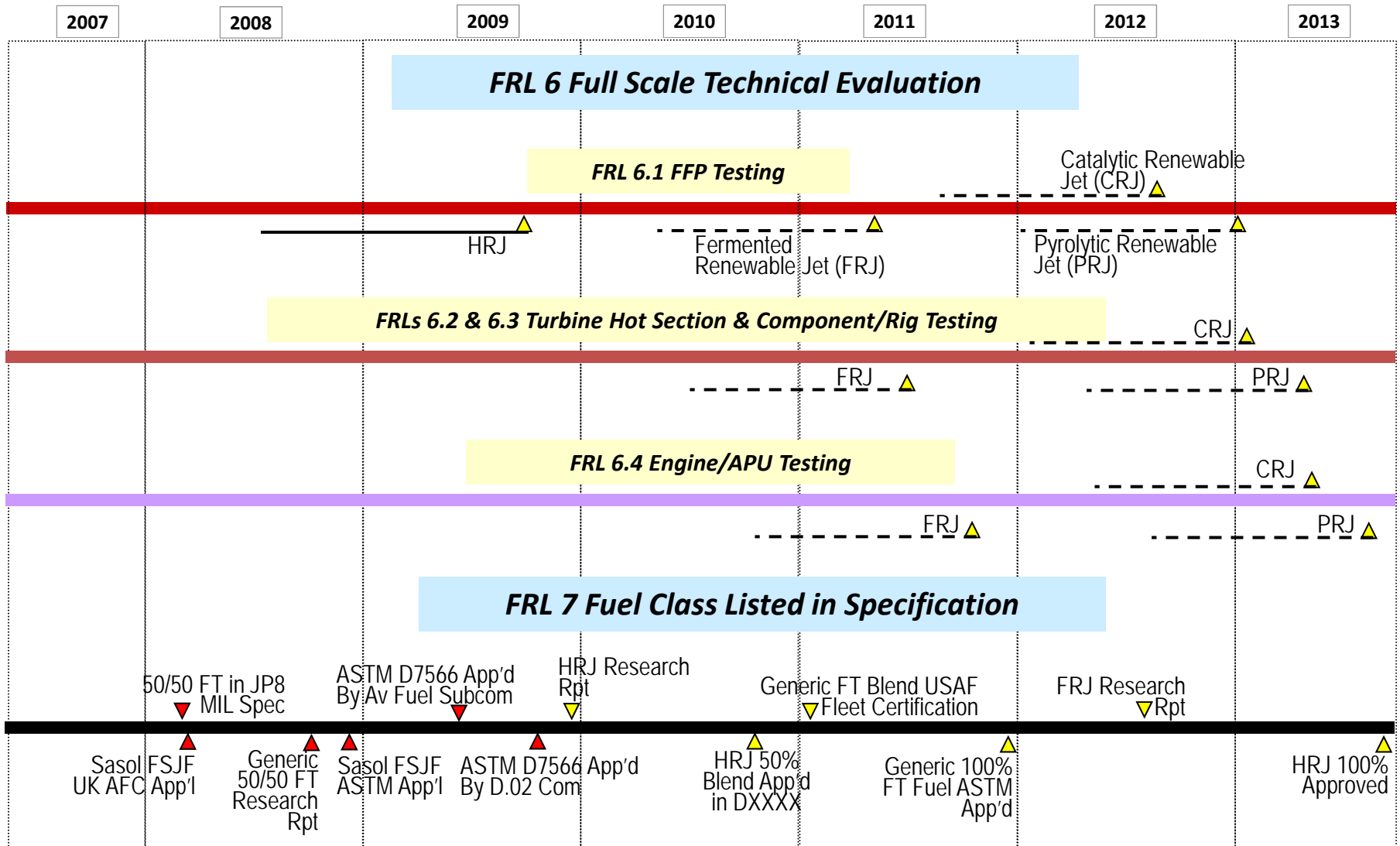


Level 3 Certification and Qualification



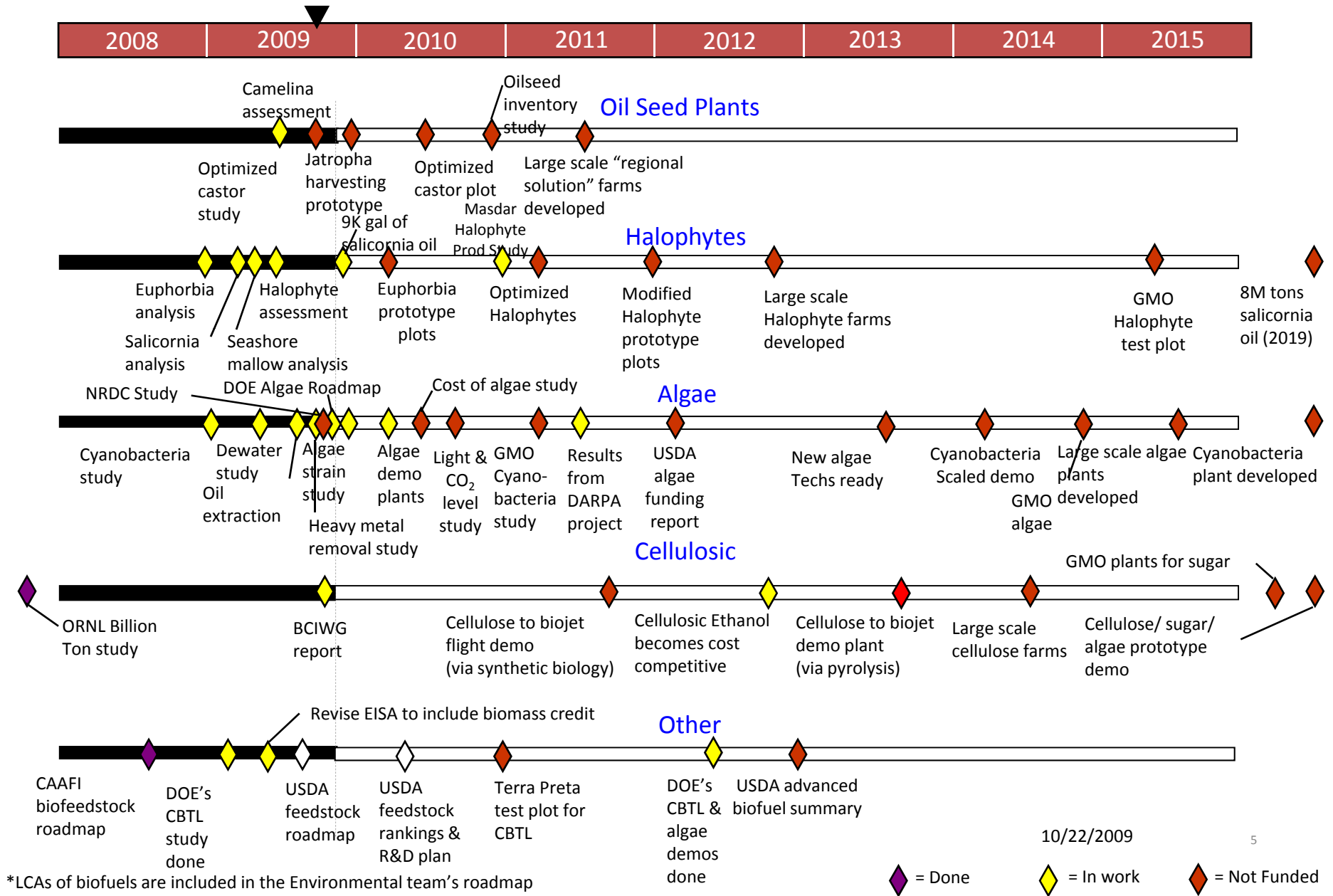
Level 3 Certification and Qualification

DRAFT



Level 3 Research and Development (1 of 6)

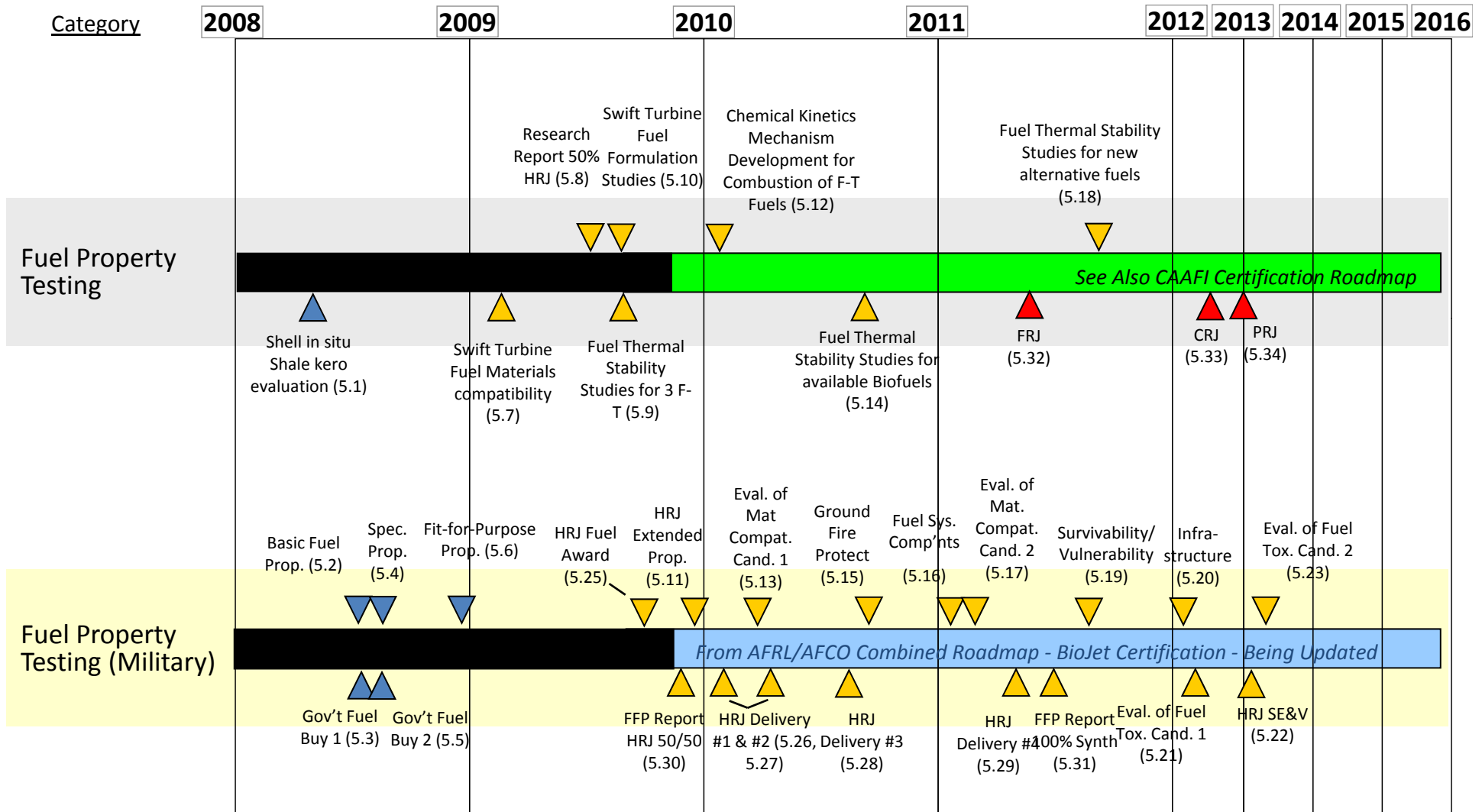
Feedstock



*LCAs of biofuels are included in the Environmental team's roadmap

Level 3 Research and Development (3 of 6)

Fuel Property Testing

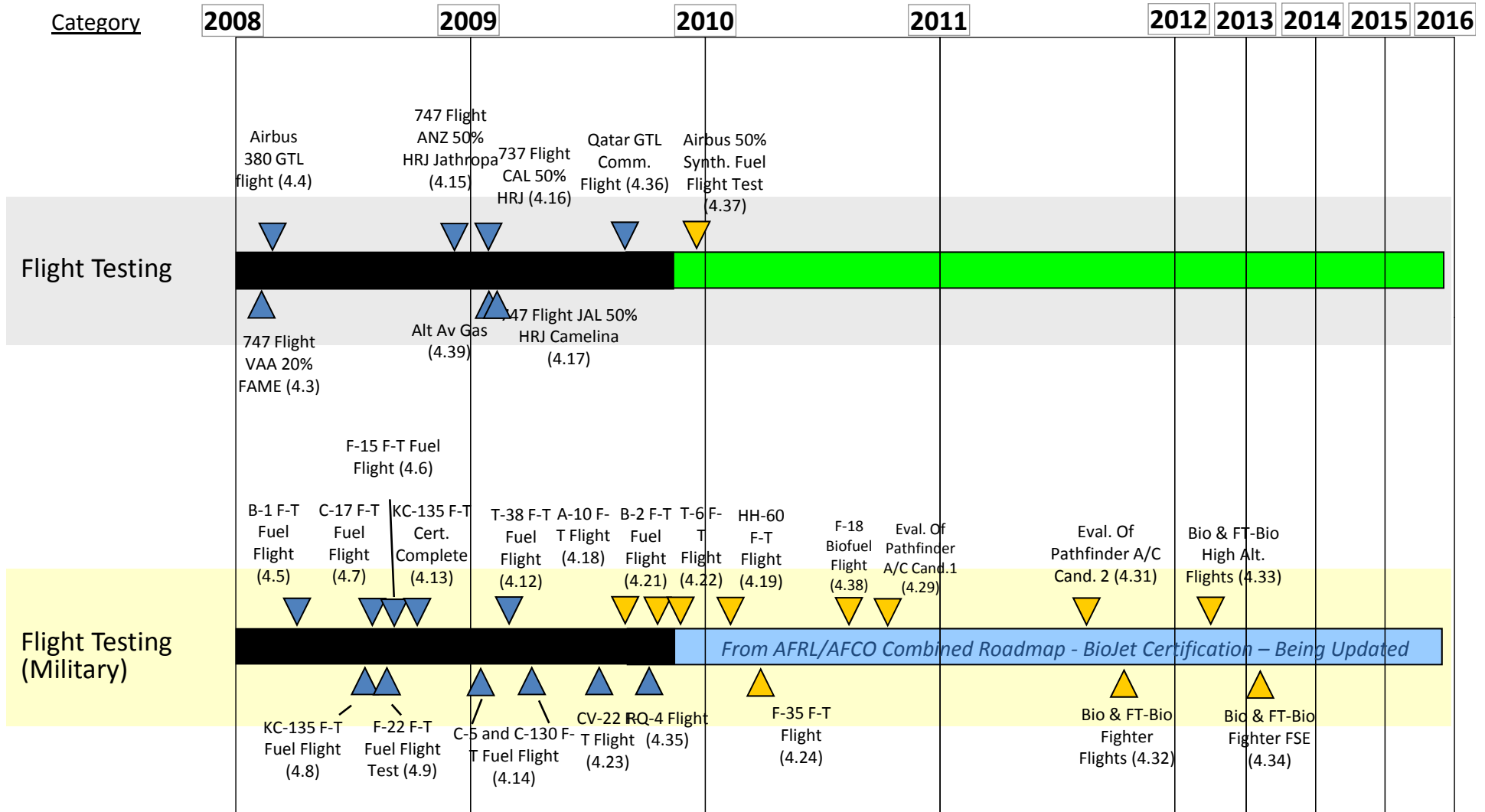


 Completed Result
  Target
  Vision
  Unfunded Needs

10/22/2009

Level 3 Research and Development (5 of 6)

Flight Testing

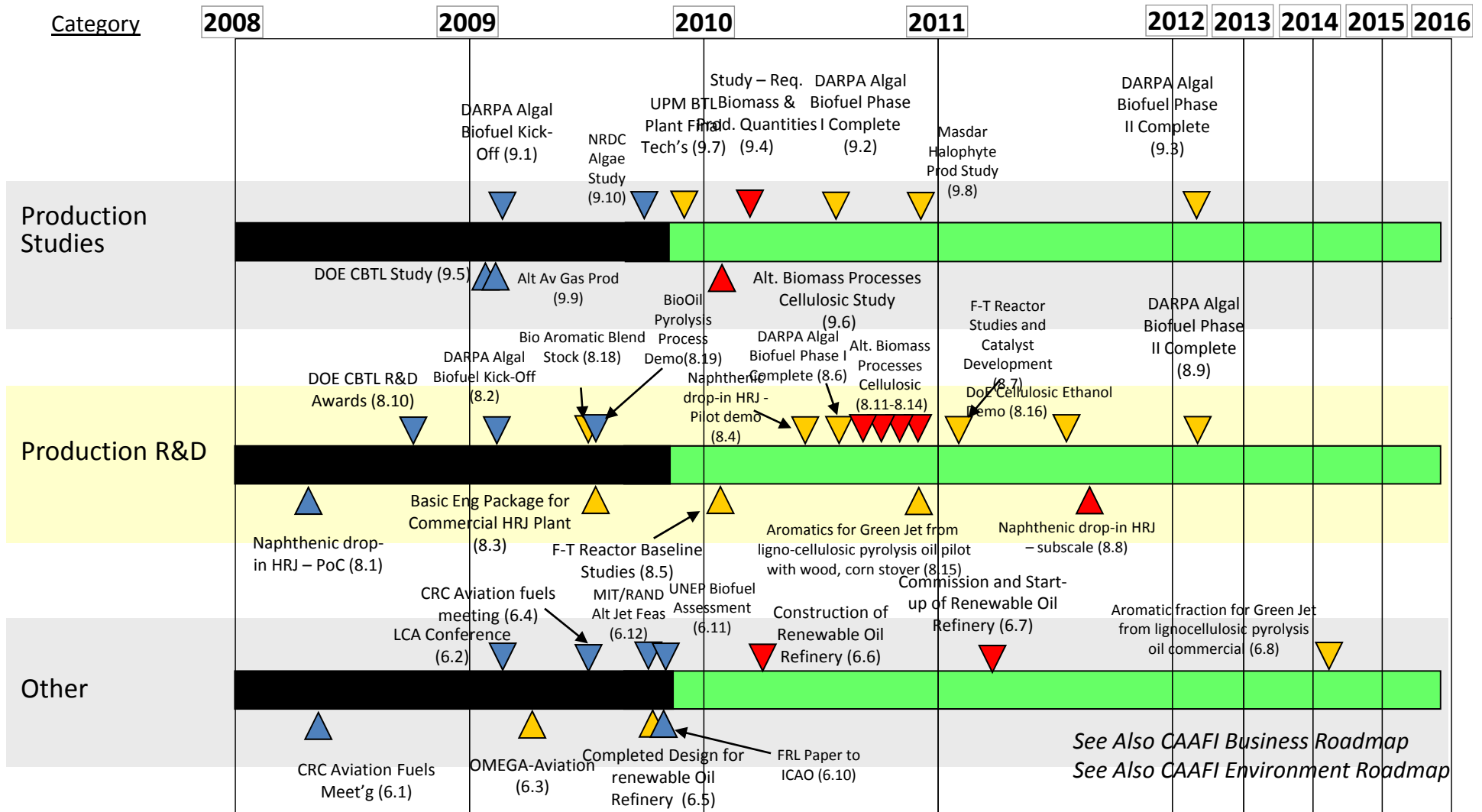


 Completed Result
 Target
 Funded Plans (Public/Private) Vision
 Unfunded Needs Vision

10/22/2009

Level 3 Research and Development (6 of 6)

Production Studies and R&D



01/10/10

Level 3 Environment(1 of 2)

▲ Planned

△ Desired

Category	2005	2007	2009	2011	2013	2015	
Quantify LTO emissions		Industry SASOL Rig Test	NASA/ Industry FT Blend Rig Tests	NASA- Industry Biojet Rig Test	Comm. Engine Fuel 2 Test	Comm. Engine Fuel 3 Test	Comm. Engine Fuel 4 Test
		▼	▼	▼	▼	▼	▼
Quantify Altitude emissions	▲ C130 Test	▲ B-52 Test Flight	▲ AF Engine Test 2	△ FT Comm. Engine			
		FAA Parametric Studies	Altitude Test - if warranted				
Quantify infrastructure impacts		▲ Characterize military FT fuels	△ Assessment of benefits of single fuel	△ Comm. Equip test Fuel 2	△ Comm. Equip test Fuel 3	△ Comm. Equip test Fuel 4	
			▼				

Fuels 2, 3, 4 etc. could be CTL, GTL, BTL via FT, other bio, etc. as defined by what fuel producers are likely to drive to

Level 3 Environment(2 of 2)

▲ Planned
 ▲ Desired

Category	2005	2007	2009	2011	2013	2015
Toxicology impacts		If warranted heavy metal impact assessment ▼	Test Fuel 2 ▼	Test Fuel 3 ▼	Test Fuel 4 ▼	
		▲ AF Tests				
Net environ. impacts		Heavy metal content assessment ▼	In-depth assessment ▼	In-depth assessment Fuel 2 ▼	In-depth assessment Fuel 3 ▼	In-depth assessment Fuel 4 ▼
		▲ FAA Scoping Study	▲ Chinese Operational plant data	▲ US Operational plant data		
Compare GHG prdxn	▲ SASOL Operational plant data	▲ Review Other US and international data	▲ Air Canada H2 fuel cell			
		▲ FAA Scoping Study	▲ Operational Assessment	▲ Operational Assessment Fuel 2	▲ Operational Assessment Fuel 3	▲ Operational Assessment Fuel 4

Fuels 2, 3, 4 etc. could be CTL, GTL, BTL via FT, other bio, etc. as defined by what fuel producers are likely to drive to