U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

OCT 1 2 2007

The Honorable Edward J. Markey
Chairman, Select Committee on Energy
Independence and Global Warming
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Thank you for your letter of August 14 to former Administrator Blakey about how the Next Generation Air Transportation System (NextGen) effort is dealing with aviation emissions and climate change. I apologize for the delay, but we wanted to await the outcome of the International Civil Aviation Organization (ICAO) Assembly before responding in writing.

The U.S. commercial aviation sector is contributing less, not more, to growth in greenhouse gas emissions in recent years. U.S. airlines consumed 5 percent less fuel through 2006 compared to 2000. This translates into producing over 10 million tons less of carbon dioxide emissions even as they moved 12 percent more passengers and 22 percent more freight. This compares very favorably with the overall performance of the U.S. economy with respect to such emissions. Nevertheless, as demand for passenger and cargo aviation continues to rise, I believe we have a responsibility to reduce the impact of aviation's carbon footprint.

As well as answering your specific questions in Enclosure 1, I have enclosed some information that outlines how the NextGen effort is dealing with aviation greenhouse gas emissions and climate change. As you will see in information provided in Enclosure 2, tackling environmental issues is at the heart of the NextGen plan.

To achieve environmental protection that allows sustained aviation growth, NextGen is developing a systematic and comprehensive approach to mitigating the impacts of aviation on the environment, including those from greenhouse gas emissions. The NextGen strategy includes support of research to better understand the issues and development and fielding of new technologies, operational enhancements, and policies to achieve near-term and long-term solutions. We have already launched a number of initiatives to improve scientific understanding, enhance air traffic operations, and explore use of alternative fuels to reduce aviation's environmental footprint.

Concerning the European Union (EU) emissions trading proposal you mentioned, there are serious flaws in the EU's approach and proposed legislation. Under the EU proposal, international airlines would be forced into the EU trading scheme without consent of their governments. This means a U.S. airline flight from Los Angeles to Paris would need permits for aircraft emissions in its transit of domestic U.S. airspace as well as over the high seas. This approach clearly violates international aviation law and is an infringement on U.S. sovereignty. Not surprisingly, we are not alone in this judgment as countries from around the world have joined us in their objection to the proposed EU scheme.

Addressing aviation's greenhouse gas emissions, including the use of emissions trading, was a central discussion item at the ICAO Assembly this past September. All States agreed to set-up a special high level group through ICAO to develop a framework of action that countries could use to address aviation greenhouse gas emissions. A report with recommendations is due prior to the next ICAO Assembly in 2010. Further, with the sole exception of European countries, all States agreed to endorse emissions trading for international aviation on the basis of mutual consent between States.

In closing, I would ask your support of the FAA's NextGen Financing Reform Act of 2007. The legislation contains a number of important environmental provisions that foster improved scientific understanding of aviation environmental impacts, and technology and operations research and development, demonstration projects, and site-specific studies that will bring new technologies, operational innovations, and other capabilities to help NextGen reduce aviation environmental impacts, including greenhouse gases.

If I can be of further help, please contact me or Ms. Megan Rosia, Assistant Administrator for Government and Industrial Affairs, at (202) 267-3277.

Sincerely,

Robert A. Sturgell
Acting Administrator

3 Enclosures

Questions and Answers
Concept of Operations For The
  Next Generation Air Transportation System (NextGen)
  Chapter 7- Environmental Management Framework
CAAFI Roadmap

Enclosure 1

1) What is NextGen's position on the current and anticipated impact of aviation on global warming?

A key objective of the NextGen environmental strategy is to limit or reduce the impact of aviation greenhouse gas emissions on global climate. NextGen is also seeking to enhance the scientific understanding of aviation climate impacts to levels that enable appropriate action.[1] The NextGen effort recognizes that the effects of aircraft emissions on the current and projected climate of our planet may be a serious long-term environmental issue facing the aviation industry. Our position is informed by scientific consensus. The last major international coordinated effort focused solely on assessing the contribution of aviation to greenhouse gases was published by the Intergovernmental Panel on Climate Change (IPCC) in 1999.[2] Aircraft were estimated to contribute about 3.5 percent of the total radiative forcing (a measure of change in climate) by all human activities and this percentage, which excludes the effects of possible changes in cirrus clouds, was projected to grow. The recently released Fourth Assessment Report by the IPCC notes that aviation carbon dioxide emissions account for about 2 percent of global totals. Due to new scientific knowledge and more recent data, estimates of the climate effects of contrails have been lowered and aircraft in 2005 are now estimated to contribute about 3 percent of the total of the anthropogenic radiaive forcing by all human activities, again excluding the possible effects of cirrus clouds.

The IPCC Fourth Assessment Report noted mitigation of carbon dioxide emissions from the aviation sector can come from improved fuel efficiency, which can be achieved through technology, operations, and air traffic management. However, such improvements are expected to only partially offset the growth of aviation emissions. Total mitigation potential in the sector would also need to account for non-carbon dioxide climate impacts of aviation emissions. In 1999, the IPCC projected that aviation may eventually (approximately 2050) account for 5 percent of greenhouse gases, and this projection likely remains reasonably accurate.

Today scientists have a good understanding of the effect of aircraft-generated carbon dioxide on climate. However, there are large uncertainties in our present understanding of the magnitude of climate impacts due to other aviation emissions. Scientists still do not know the relative effect on climate of aviation oxides of nitrogen emissions and contrails. Scientists also do not know the impact of particulates and their role in enhancing cirrus cloudiness. Metrics to assess the impact of these emissions and to determine their relative impact compared to carbon dioxide are still being developed. The NextGen plan needs enhanced scientific knowledge because there are often trade-offs amongst emissions. For example, a more efficient engine that produces less carbon dioxide tends to produce more oxides of nitrogen. Further, aviation will still need to address effectively other environmental constraints, such as noise and local air quality emissions.

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[1] For additional information on how environmental issues are being deal with in the NextGen plan, please see Concept of Operations, Chapter 7. Further information is contained in the Integrated Work Plan (IWP) document that is currently under review and will be available later this year.

[2] Intergovernmental Panel on Climate Change Special Report, "Aviation and the Global Atmosphere," 1999

2) How many tons of carbon dioxide emissions are emitted on a yearly basis in the U.S. from aviation? Please differentiate between emissions in-air and on-ground within an airport.

The Environmental Protection Agency (EPA) estimates that commercial aircraft carbon dioxide emissions were 158.10 teragrams (Tg) in 2005.[3] The EPA inventory estimate for aviation does not include non-aircraft aviation-related sources associated with airport operations, such as auxiliary power units, ground support equipment, surface transportation, stationary sources including power stations, fire fighting exercises, construction, and training aircraft. The EPA estimate does not differentiate between emissions in-air and on-ground within an airport environment.

The FAA has developed a modeling capability to estimate inventories of fuel burn and emissions from commercial aircraft and is in the process of coordinating with the EPA to enhance their reporting of greenhouse gas emissions inventories. The FAA maintains a modeling capability to assess the air quality impacts of airport emissions sources, particularly those aviation sources mentioned above. Although we do not maintain a national emissions inventory for airport sources, from our knowledge of relative contribution we estimate that about 88 percent of the carbon dioxide emissions (or about 143.46 Tg) associated with an airport's operations, including land-side and air-side, are emitted outside of the terminal area (roughly 3,000 feet above ground level). The remaining approximately 12 percent (or about 19.08 Tg) is estimated to be emitted within the airport terminal area. We estimate that about 83 percent (approximately 15.95 Tg) of the airport terminal area carbon dioxide emissions are attributable to on-ground operations, including aircraft.

There is currently a project under the Transportation Research Board's Airports Cooperative Research Program that aims to develop a guidebook by the end of 2008 that can be used to prepare airport source-specific inventories of greenhouse gas emissions. Details on the tasks involved in this effort are available on line at http://www.trb.org/TRBNet/ProjectDisplay.asp?ProjectID=1584.

[3] The U.S. Environmental Protection Agency's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005

3) What strategies is NextGen considering to address emissions both in-air and on-ground within an airport?

To achieve environmental protection that allows sustained aviation growth, NextGen endorses a systematic and comprehensive approach to mitigating the impacts of aviation on the environment. The NextGen strategy includes support of research to better understand the issues and development and fielding of new technologies, operational enhancements, and policies to achieve near-term and long-term solutions. Success will result in preventing or reducing significant environmental impacts from aviation emissions, both locally and globally, as well as impacts affecting community noise footprints and water quality.

NextGen activities focused on addressing climate impacts include:

- Better Scientific Knowledge. Understand and quantify the potential impacts of aviation emissions to help policymakers address climate and other potential environmental impacts associated with aviation. This will ensure that we identify the right issues, know how to measure their impact, and design appropriate measures to mitigate their effects. To inform NextGen, a workshop last year brought together approximately 30 selected international science experts to assess and document the present state of knowledge of climatic impacts of aviation and the underlying uncertainties.[4] Additionally, an Aviation-Climate Change Research Initiative (ACCRI) was initiated to coordinate FAA and National Aeronautics and Space Administration (NASA) research efforts with the goal of reducing key scientific uncertainties in quantifying aviation-related climate impacts and providing timely scientific input to inform policy-making decisions for NextGen.

- More Efficient Air Traffic Management. Implementing operational changes and improvements to air traffic management to reduce fuel burn (hence emissions) of the aviation sector is crucial. NextGen is developing procedures and decision support tools for reducing the environmental impact of air traffic operations and conducting simulations and field demonstrations to validate benefits and explore implementation issues. NextGen is working to expand Area Navigation routes to all major airports and implement Required Navigation Performance routes, increasing access to runways during instrument meteorological conditions, reducing noise and emissions impacts, and improving traffic flows. International efforts also are being pursued, such as the Atlantic Interoperability Initiative to Reduce Emissions, a scientific and research venture between the FAA, the European Commission, and industry partners that will focus on upgrading air traffic control standards and procedures for trans-Atlantic flights (see Enclosure 2). A similar initiative is being developed for the Asia Pacific Region.

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[4] For full information on the NextGen Climate Workshop, please see: Workshop on the Impacts of Aviation on Climate Change: A report on findings and recommendations, June 7-9, 2006, Cambridge, MA. Donald Wuebbles, et al. August, 2006. (Report No. PARTNER-COE-2006-04)

- Accelerate Environmental Technology Development. The development and integration of promising improvements in engine and airframe technologies into the civil aviation fleets to quicken improvements in energy performance of the aviation sector is crucial to the NextGen concept of operations. NextGen is currently undertaking "gap" analysis to identify the advancements in engine and airframe technology to address multiple environmental impacts. Further, efforts are underway (see question 4) to assess the potential for alternative fuels for commercial aviation to enable reductions in aircraft emissions. FAA, working with commercial aviation sponsors and stakeholders, launched the Commercial Alternative Aviation Fuel Initiative (CAAFI) last year to explore the development of alternative fuels for use in commercial aviation.

Critical to the success of NextGen's environmental endeavors are the environmental provisions in the NextGen Financing Reform Act of 2007. Based on work by the NextGen participants, FAA offered a set of provisions that include research, development, and maturation of needed environmental technologies and operational procedures; demonstration projects to accelerate deployment of new technologies and procedures to reduce aviation's environmental footprint; and site-specific studies that will bring new technologies, operational innovations, and other capabilities on line to address and reduce aviation environmental impacts. These include: Airport Cooperative Research Program (ACRP) (Sec. 601/102), Environmental Mitigation Demonstration Pilot Program (Sec. 604), Grant Eligibility for Assessment of Flight Procedures (Sec. 605), Airport Funding of Special Studies or Reviews (Sec. 603), and the Research Consortium for Lower Energy, Emissions and Noise Technology Partnership "CLEEN" (Sec. 606), for development, maturation, and certification of lower energy, emissions and noise engine and airframe technology over 10 years.

4) What is the status of NextGen's studies to develop a national roadmap on the viability of alternative fuels for aviation?

NextGen recognizes the importance of securing a stable fuel supply and pursuing alternative aviation fuels; activities in this area are being executed through CAAFI. CAAFI was founded by the FAA and the commercial aviation industry in 2006 to coordinate the development and commercialization of "drop-in" alternate fuels (i.e., fuel that can directly supplement or replace crude oil derived jet fuels), as well as explore the long-term potential of other fuel options. The goal is to ensure an affordable and stable supply of environmentally progressive aviation fuels that enable continued growth of commercial aviation.

CAAFI's sponsors include the Aerospace Industries Association, Airports Council International - North America, Air Transport Association, and FAA. Non-sponsor stakeholders make up 75 percent of CAAFI's membership. CAAFI's government partners include NASA and the Departments of Defense, Commerce, and Energy. Energy entities representing oil, coal, and biofuel companies, international stakeholders (Canada, United Kingdom, Germany, France, Brazil, South Africa, and Columbia), academia, non-governmental organizations, and consultants are also engaged in CAAFI.

An Executive Director, Mr. Richard Altman, paid for by FAA leads this effort. Four panels manage the many study areas within CAAFI. Sponsor members lead and participate in the panels. Other stakeholder members participate in at least one of the four panels. Specific panel objectives are:

- Research and Development – identify all efforts being executed by sponsors and stakeholders and clarify technology status effort at low maturity levels;
- Certification and Qualification – monitor and participate in the activities of aviation fuel industry oversight organizations to ensure maximum synergy and commonality of qualification and certification criteria to the greatest extent possible;
- Environmental – seeks to improve understanding of the potential environmental benefits and impacts of the use of alternative aviation fuels; and
- Business and Economics – seeks to identify economic factors and business rational that align sponsor and stakeholder requirements.

A roadmap for the CAAFI effort as well as additional information is provided in Enclosure 3. Further information is available from Mr. Altman, 860-721-8634 or altrich@cox.net. Finally, the annual CAAFI meeting will be held November 8-9, 2007 in Washington, DC, and we would be happy to extend an invitation to you and your staff.

Enclosure 2

Concept of Operations For The
Next Generation Air Transportation System (NextGen)
Chapter 7- Environmental Management Framework

7 Environmental Management Framework

7.1 INTRODUCTION

Anticipated increases in air transportation demand will place significant environmental pressures on various segments of the NAS. Current operational trends show that environmental impacts such as noise, air emissions, water pollution, land use, climate change, and fuel consumption will be the primary constraints on the capacity and flexibility of NextGen unless these impacts are managed and mitigated. It should be noted that discussion of fuel consumption is not an environmental impact but is discussed as a surrogate for emissions impacts, such as carbon dioxide (CO2).

Environmental issues have resulted in the delay and/or downscaling of certain airport capacity projects over the past decade. Airports will need to escalate their efforts to address the environmental concerns of neighboring communities. Noise has been and will continue to be a primary area of concern. However, air quality, water quality, and other environmental demands are a growing challenge to significant capacity expansion without a detrimental impact to the environment. These challenges are not only of concern to commercial aviation; military readiness is also constrained by training and operations restrictions due to environmental issues. Therefore, the NextGen environmental challenge is to manage aviation's environmental impacts in a manner that limits or reduces their "footprint" and enables the U.S. air transportation system to meet the nation's future transportation needs.

NextGen manages mission-critical environmental resources/impacts through an Environmental Management Framework that is fully integrated into all NextGen operations. This framework ensures *environmental protection that allows sustained aviation growth*. The framework's success is dependent on the prevention or reduction of significant environmental impacts, especially as aircraft noise and local air quality emission concerns remain strong constraints on system capacity, while proactively addressing other important environmental issues (e.g., water quality, energy use, global climate change, and noise sensitive areas). The NextGen Environmental Management Framework must account for interdependencies among many environmental issues so that in addressing some, others are not exacerbated. To achieve this, the NextGen Environmental Management Framework consists of a self-correcting feedback cycle that systematically identifies, manages, monitors, and adapts to the environmental demands associated with the high-volume and dynamic nature of the NextGen air transportation system.

Objectives of the NextGen Environmental Framework: Environmental Protection that Allows Sustained Aviation Growth (*NGATS Integrated Plan, 2004*) include—

- Reduce significant community noise and local air quality emissions in absolute terms
- Proactively address emerging environmental issues (e.g., water quality, energy intensity, global climate change).

This chapter describes the operational concept of the NextGen Environmental Management Framework, including the key transformed environmental operations (Section 7.3) that will be enabled in the NextGen, and services and capabilities (Section7.4) that need to be implemented to enable these transformations. As some enabling services are not yet clearly understood, policy and research areas are identified in each applicable section.

7.2 KEY TRANSFORMATIONS

As shown in Table 7-1, the key environmental transformations are expected in the areas of aviation environmental management systems (EMS), airspace operations, airport planning and operations, and transformed aircraft design and technology. These transformations enable the fundamental operations of NextGen and transform the national airspace operation.

Table 7-1. Significant Environmental Transformations

Significant Transformation	2006 Current Capability	2025 NextGen Capability
Transformed Aviation System EMSs	• Some airports, air carriers, and agencies have EMSs. • Organizations focus on individual objectives that are not necessarily dealt with on an integrated basis or focused on future capacity concerns. • Limited infrastructure exists for tracking performance of airports/agencies/aircraft operators in managing environmental impacts. • Limited infrastructure exists for collecting and sharing environmental information across airports, air carriers, and agencies. • Challenges exist for evaluating cumulative effects of multiple airports and nearby projects.	• All airports, air carriers, and agencies have integrated EMS principles to support NextGen continual environmental improvements. • Incentive programs exist for the establishment and integration of EMS requirements/objectives that focus on improvements to remove/reduce environmental constraints on capacity. • Metrics are established for key components of the air transportation system that support decisionmaking and policy development to sustain capacity while limiting the system's environmental effects. • Information management systems are established to enable real-time reporting of environmental conditions and performance metrics at airports, carriers, and other key components of the air transportation system. These systems transfer best practices, communicate incentives, gauge progress toward NextGen goals, and transfer other information.
Airspace Environmental Operations	• Fuel-efficient routes are sought but limited by dependence on ground-based NAVAIDS. • Environmental impacts are primarily evaluated by FAA for major airspace decisions.	• An agile air traffic system has flexibility to achieve improved fuel efficiency and emissions reductions during flight through the use of environmentally friendly procedures, such as CDA.

Table 7-2. Significant Environmental Transformations (continued)

Significant Transformation	2006 Current Capability	2025 NextGen Capability
	• Noise abatement arrival and departure procedures consider efficiency to some extent, but generally not emissions or fuel burn. • There are open questions about the contribution of the en route system to regional emissions, climate change, and noise over special quiet locations, e.g., national parks. • Management of en route congestion and delay in terminal airspace is not traditionally perceived as an environmental problem. However, many large commuter airports are in air quality non-attainment areas and there is growing concern regarding green house gas (GHG) emissions.	• In a dynamic airspace not limited to ground-based NAVAIDs, environmental impact management is embedded into en route flight planning on an ongoing and real-time basis. • Integrated noise/emissions/fuel burn/ costs/efficiency information feeds into and is optimized in selection of routes and procedures. • Better scientific information guides appropriate actions/procedures to responsively address noise, air quality, climate change, and fuel burn.
Airport Planning and Operations	• Generally, environmental planning and mitigation focuses on regulatory compliance or the next development project. • Procedures to minimize environmental impacts of operations focus on individual impacts, e.g., noise or emissions. • Almost 500,000 people continue to be exposed to significant levels of aircraft noise around airports, and local air quality issues are increasingly pressing. • Airport and community planning are often done in isolation from each other and are adversarial, especially with respect to land-use planning to manage noise. • Some airports are moving to low-emissions ground equipment in response to local air quality concerns. • Water quality impacts occur due to stormwater runoff and deicing operations. [R-130] • Management of congestion and delay at airports and terminal airspace is not traditionally perceived as an environmental problem, although there is growing awareness and concern.	• Environmental issues are fully integrated into a smart planning and management cycle. This focuses on enabling the long-term viability/sustainability of the airport. • A wide range of environmental procedures exist for managing operations, which are assessed and implemented in an integrated fashion that optimizes the environmental benefits. • Significant aircraft noise is contained within the airport boundary and/or neighboring compatible land uses. • Significant health and welfare impacts of local air quality emissions will be reduced in absolute terms. • Airport facilities, vehicles, and Ground Support Equipment (GSE) produce low or no emissions. • Airport and community planning processes acknowledge and complement each other. Communities value airports as regional economic engines and gateways to the national and international air transportation system. • More effective airplane and runway de/anti-icing agents reduce impact to water quality.

Table 7-3. Significant Environmental Transformations (continued)

Significant Transformation	2006 Current Capability	2025 NextGen Capability
		• Improvements that optimize performance and reduce congestion and delay promote energy conservation and lower emissions through reduced fuel burn. Airport terminals will incorporate energy-efficient green design technologies.
Transformed Aircraft Design and Technology	• Considerable research has been incorporated into aircraft and engines to improve environmental performance. • Significantly lower funding is going into federal research and development to improve aviation noise and emissions technology. • Environmental performance is an increasingly important component of aircraft design. • National and international regulatory frameworks are based mostly on multiple, uncoordinated approaches to noise and emissions. • Improvements in avionics provide significant opportunities for improvement in environmental operational performance.	• There is a well-established R&D and implementation process for technology that improves aviation's environmental performance. • Technological breakthroughs enabled by robust R&D programs allow dramatic reductions of noise and emissions impacts from airframes and engines. • Integrated models allow selection of the optimum environmental performance characteristics, including informed decisions on any necessary tradeoffs. • Alternative fuels are available and in service. • A significant portion of U.S. aircraft fleets contain environmental technology matured between 2007 and 2012. • Advanced aircraft avionics support the conduct of operations that reduce environmental impacts. • The optimization of environmental performance continues to be a critical factor in aircraft design.

7.3 TRANSFORMED ENVIRONMENTAL OPERATIONS

The NextGen Environmental Management Framework consists of enterprise-level operational transformations and describes the overarching environmental architecture (including systems, business processes, and infrastructure) to support NextGen. These transformations are driven by increased traffic volume and compounded by greater stakeholder and community awareness of environmental issues and increasing community expectations for environmental impact reductions. Transformations are facilitated by activating the services and capabilities described in Section 7.4. The major transformed environmental operations are described in sections 7.3.1 through 7.3.4.

7.3.1 Transformed Aviation System EMSs

The NextGen Environmental Management Framework does not treat the aviation system as a single unit, but as a community of organizations with a diverse range of requirements and drivers. The program establishes systematic but flexible approaches that enable individual EMS programs to respond to the aviation system's dynamic capacity demands by working within the

Environmental Management Framework. These approaches are supported by enhanced information flow and better connections between individual component organizations.

What are Environmental Management Systems?

EMS is an organizational business process that consists of four phases. In the "planning" phase of the NextGen EMS, the organization identifies environmental issues with the potential to constrain future capacity. These are the focus of tactical, measurable objectives for which improvement initiatives can be undertaken during the "implementation" phase. During the "assessment" phase, the effectiveness of these initiatives is monitored and key performance metrics are tracked. Monitoring data is then used to support planning at the organization itself in the "review and adaptation" phase. In the NextGen EMS, monitoring data is also reported at an enterprise level to support NextGen-wide planning.

The NextGen Environmental Management Framework aims to provide individual air transportation component organizations (e.g., airports, agencies, air carriers, manufacturers) with greater flexibility to identify and manage the environmental resources that are necessary to meet their individual long-term capacity demands. This includes integrating sound EMS principles into all aviation system component organizations (e.g., airports, air carriers, ANSPs, FAA) and ensuring that these EMS approaches, or models, focus specifically on capacity-related environmental issues. NextGen EMS models establish standardized, systematic approaches for managing the environmental aspects of operations in support of the organization's overarching mission. The use of NextGen-focused EMS models ensures that all aviation system component organizations contain processes that help them align with critical NextGen goals.

Implementing NextGen-focused EMS models will provide mechanisms for identifying and managing issues critical to sustainable growth, transferring information, standardizing operations based on best practices, and encouraging environmental stewardship. The implementation also provides a vehicle for NextGen-level objectives to be incorporated by individual organizations as part of their EMSs, thereby aligning them with NextGen goals. Individual organizations (e.g., airports, air carriers, FAA) connect through an information management system. As discussed in Section 7.4, this system enables environmental information management enterprise-wide, including tracking environmental metrics, storing best practices (e.g., on construction, maintenance, and operational procedures), and communicating NextGen environmental objectives, policies, incentives, and regulations.

7.3.2 Transformed Airspace Environmental Operations

The NextGen plan seeks to create a dynamic and flexible airspace capable of supporting a tripling in demand by 2025 in an environmentally sustainable manner. An agile air traffic system based on advanced cockpit avionics, satellite navigation, and dynamic airspace has enhanced ability and flexibility to maximize routings for fuel efficiency and emissions. NextGen has the ability to address relevant environmental impacts dynamically on a continuing real-time basis, augmenting the current, more rigid structure of federal review linked to federal actions with respect to the airspace. Environmental performance is embedded in the overall performance of the air traffic system and supported by EMS goals, including the availability of up-to-date critical system information.

Consistent with EMS principles, a holistic but flexible approach is used to manage key environmental issues as they pertain to specific geographic regions and to the system as a whole. This approach accounts for variations at an individual component level (e.g., airports or air carriers); adaptive EMS models implemented by individual components account for specific needs while also contributing to system-level requirements.

Environmental impacts and potential constraints of terminal airspace are currently better understood than those associated with en route airspace, but there is significant uncertainty associated with 2025 projections for both. Therefore, the primary capability of the Environmental Management Framework is its ability to adapt to the complex nature of the air traffic system. This framework is facilitated by a dynamic airspace structure and includes environmental management embedded into en route flight planning on an ongoing and real-time basis. For example, new technology, in concert with airspace redesign, enables optimized route selection during landing and takeoff procedures that are based on minimizing the impact of noise and air emissions, minimizing costs and fuel burn, and maximizing route efficiency and safety. The establishment of environmentally friendly operational procedures (e.g., CDA) for all traffic conditions is one example. [R-131]

In terminal airspace, single-purpose noise abatement procedures are replaced by more sophisticated environmental procedures that maximize benefits based on integrated assessment and management of multiple factors, including noise, emissions, fuel burn, land use, operational efficiency, and cost. Procedures are dynamic and adapt to changing needs rather than remaining static and institutionalized. There are additional procedures available using advanced technologies from which to select the best operational and environmental benefits.

In the case of the en route environmental impacts, ongoing discussions and analyses have resolved major questions, and outcomes are integrated into the Environmental Management Framework. Specific focus is placed on understanding and identifying the direct attributable role of aircraft emissions in climate change through targeted research with national and international partners. [R-132]

7.3.3 Transformed Airport Planning and Operations

The greatest interaction between the national aviation system, communities, and environmental resources occurs at airports. By 2025, significant aircraft noise will be confined within the airport boundary and over small areas of adjacent compatible land. Airports are emissions-friendly with ongoing transition to low- or no-emissions stationary facilities and GSE. Airport and community planning complement and support each other, and airports are valued community assets as air transportation gateways and economic engines. Through the integration of EMS, environmental planning and mitigation is continuous and includes activities to meet long-term goals for sustainable growth in airport capacity. These activities are supported by improved information management that, for example, transfers and stores information on environmentally preferable airport practices. In addition, an advanced capability to integrate and balance noise, emissions, fuel burn, land use, efficiency, and the costs and effects of alternative measures allows the selection of optimum operational modes, mitigation strategies, and surface planning procedures. [R-133], [R-134], [R-135]

The implementation of a NextGen-focused EMS model provides a flexible systematic approach to identify and manage environmental aspects of operations so as to meet capacity needs and environmental goals. The EMS approach is adaptable to the airport's characteristics, such as its size (large or small), its ownership (public or private), and its geography. Such a model allows airports to assess and improve environmental performance on an ongoing basis, rather than on a cyclic basis, linked to airport development, and it facilitates both capacity growth and environmental protection. The noise, air quality, and water quality concerns identified by airports and communities as critical to sustainable growth are fully integrated into "smart growth" management plans that have the ability for mid-course adjustment based on feedback and forecasts. Therefore, airports are able to assess their specific environmental requirements for sustainable growth and develop or select approaches (based on industry best practices) to address specific operational, geographic, and local community impacts that fit within that national framework. [R-136]

Local environmental monitoring allows the effects of management strategies to be assessed and best practices or lessons learned to be available system-wide. Monitoring enables regional and national trend analysis and supports decisionmaking and planning. Improved environmental information availability and subsequent information sharing ensures that proven practices are widely used and successes quickly proliferated.

7.3.4 Transformed Aircraft Design and Technology

Environmental considerations are a critical component of aircraft design and operations. These design and operational improvements also aim to reduce costs to aircraft operators, airports, and the ANSP. As regulation and environmental impact increasingly constrain capacity, public/private sector partnerships deliver more robust R&D that enables technological breakthroughs to dramatically reduce significant impacts. Scalable models and analytical capabilities that integrate noise, emissions, fuel burn, costs, and other factors enable development of the optimized aircraft performance characteristics, based on informed decisions of any necessary tradeoffs (e.g., between noise and emissions). [R-137]

The development of alternative fuels for aircraft is driven by costs, energy supply, security concerns, and environmental factors. Alternative fuels will be available and in service by 2025.

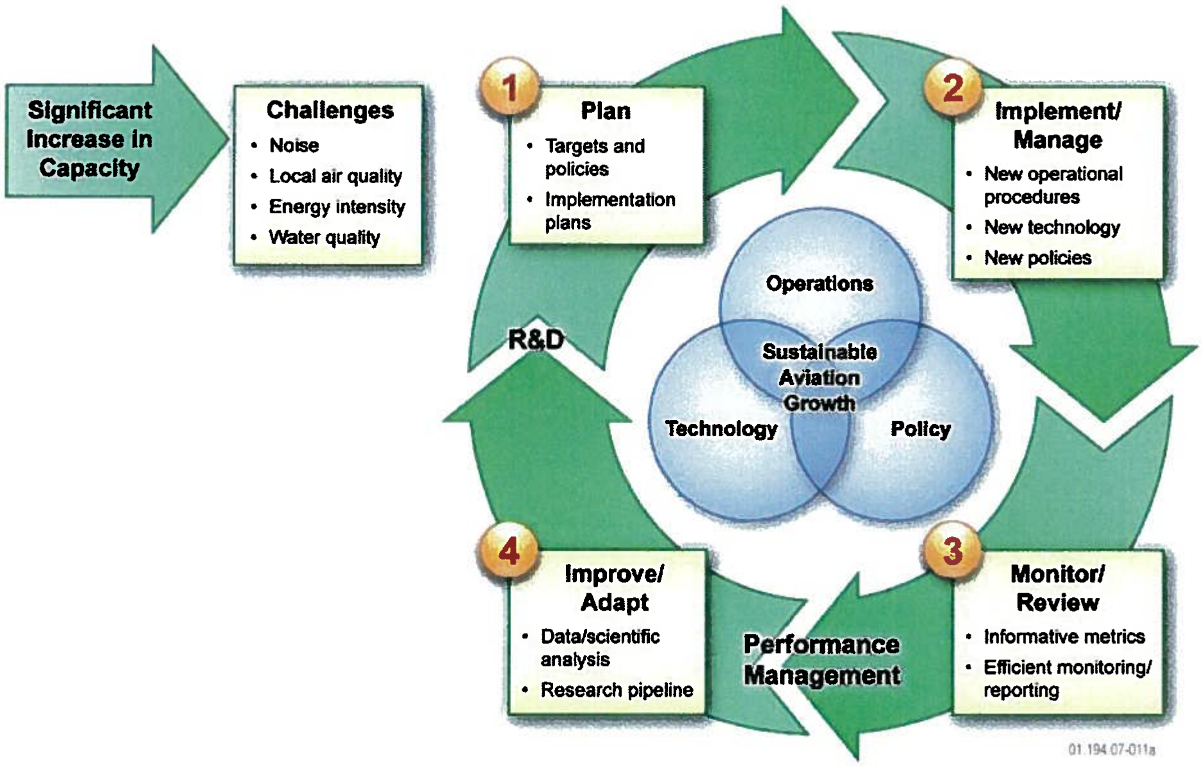
Use of environmentally sensitive technology is facilitated by a prompt and efficient development process where innovation, such as environmentally friendly airframe and engine design, is encouraged. [R-138] Design, product development, testing, and certification steps are well established, with changes in policy enabling a more direct flow from concept through implementation. This, combined with increased demand from aircraft operators, provides for a strong market for environmentally sensitive aviation technology. [R-139]

7.4 ENVIRONMENTAL MANAGEMENT FRAMEWORK POLICIES AND CAPABILITIES

The NextGen Environmental Management Framework is a single, fully integrated, cohesive system. NextGen uses this framework to manage and mitigate environmental constraints to capacity and impacts due to aircraft operations. An integrated NextGen Environmental Management Framework, consistent with this ConOps, is based on researching, designing, and implementing a broad set of enabling services and capabilities (i.e., systems and infrastructure). These services and capabilities are described in subsections 7.4.1 through 7.4.5. Each plays an important role in supporting the transformed operations of NextGen. [R-140], [P-65]

Figure 7-1 depicts the Environmental Management Framework Process.

Figure 7-1. Environmental Management Framework



7.4.1 Policy

NextGen Environmental Policy. Although many air transportation system component organizations have robust environmental programs, the focus of these multiple programs varies. Development of a unified NextGen environmental policy supported by a wide array of air transportation system stakeholders (e.g., airports, aircraft operators, agencies, communities) will assist component organizations with aligning their environmental systems with NextGen goals and objectives. The establishment of long-term measurable targets that address environmental issues critical to NextGen (e.g., noise, air emissions, fuel, climate effects, and water quality) is central to this policy. While this policy provides an overarching framework for NextGen, it also allows sufficient flexibility to ensure that organizations can design their programs to meet their unique challenges. Performance metrics provide a yardstick for monitoring and assessing progress towards meeting environmental targets. Metrics will be appropriate for use by the various air transportation system component organizations. These are reported via a net-centric environmental information management system for the purposes of analysis, continuous improvement, and public dissemination. [R-141]

Standardized EMS Model. There are a wide variety of approaches and methodologies for the application of EMSs. This flexibility is critical for EMSs to be applied to a diverse range of organization types. However, to meet future capacity challenges, NextGen EMSs will contain some necessary standard elements. Examples of these elements are mechanisms for incorporating enterprise-wide environmental objectives (e.g., reduction of significant community noise), reporting with standardized metrics, and linking to a NextGen environmental information management system. Therefore, a NextGen EMS model will be developed based on existing best practices. This model may be based on the globally recognized International Organization for Standardization (ISO) 14001 standard and will be sufficiently flexible to support the diverse needs of aviation system component organizations. It will also include those standard elements necessary to support an enterprise-wide approach to environmental management.

Incentives System. Although the NextGen Environmental Management Framework is expected to deliver net monetary savings to the system as a whole, incentives will likely be necessary to increase implementation and encourage environmental improvements at a more rapid pace than the market would normally provide. The consideration of incentives would be tied to specific NextGen environmental program initiatives or goals. [R-142]

Information Management System. A robust information management system is critical for transfering environmental information throughout NextGen. This system, for example, couples shared available information to provide real-time information to aircraft operators and the ANSP on dynamically forecasted areas of noise sensitivity, areas susceptible to dispersion of pollution, and volumes of airspace that are sensitive to emissions, so that these factors can be included in planning routes, approaches, and departures. This enables communication between different NextGen organizations; airports can share best practices or receive updates on new policy, regulation, or other initiatives with the NextGen system. Organizations are also able to directly input environmental metrics data, such as air emissions and noise monitoring data, from monitoring equipment into the system. Subsequent data analyses enable better decisionmaking and policy development, allowing for the adjustment of environmental objectives. They also facilitate the development of effective incentives and communication of all of these actions seamlessly across the NextGen in an efficient manner. Therefore, this single enterprise-wide system supports all the environmental information management needs of the NextGen. [R-143]

7.4.2 Operations Initiative

Integrated Environmental Planning. More flexible "smart plans" enable airports to make midcourse corrections to planned initiatives, thus shortening the planning horizon. Planning includes greater involvement of stakeholder groups and local communities. As part of the EMS, airports conduct standardized environmental evaluations to identify environmental resources that are adversely impacted and/or have the potential to constrain future airport capacity. This information supports long-term planning efforts and helps direct airport improvement initiatives to mitigate potential future resource constraints. Standardized environmental evaluations are reported via the enterprise-wide information management system so that it is possible to identify the specific, local environmental issues that must be addressed for NextGen to be enabled. This allows organizations to review regional and national trends and support planning and decisionmaking within NextGen.

Airport Approaches. A range of environmentally sensitive operational procedures are developed to assist airports and aircraft operators with minimizing environmental impacts. Currently, most aircraft use the standard approach route at an airport, though large numbers of noise abatement procedures are used. However, aircraft that use quiet technology will no longer produce significant noise impacts and therefore will be able to use a wide range of approaches. These procedures, developed based on improved tools and information (e.g., real-time weather information), increase airport efficiency and ensure the maximum number of aircraft operations can be accommodated within environmental limits (e.g., state implementation plan air quality requirements, land use compatibility guidance with aircraft noise exposure, or water quality regulations), without impacting capacity. [R-144], [R-145], [R-146], [R-147]

Environmental Routes Consideration. This initiative introduces environmental considerations into the route planning decisionmaking process, including identifying and considering cumulative effects in routing decisions and providing preference to quieter and less-polluting aircraft. In addition, advanced navigation systems enable greater routing flexibility without impacting capacity, while also enabling en route adjustments according to on-the-ground conditions (e.g., designated quiet times or air quality emergency days). For example, aircraft that have low noise and emissions have access to a wider selection of routes than those that do not have comparable technology. Enhanced real-time weather information allows better prediction of noise and emissions impacts. [R-148], [R-149]

Ground Procedures. The implementation of EMSs encourages the use of a range of environmentally sensitive and cost-effective standardized procedures for ground activities. These include converting airport GSE to alternative and low-emission fuels (e.g., use of fixed underground services), reducing the time spent on the ground by aircraft, reducing the use of auxiliary power units (APU), using environmentally sensitive deicing chemicals, and employing a wide range of other procedures. These standardized airport ground procedures are focused on enhancing surface operations, reducing delays, and minimizing environmental impacts. In particular, through the implementation of EMS, organizations use these activities in a focused manner specifically targeting pre-identified environmental impacts. An action taken to reduce emissions may increase aircraft noise, and vice versa.

7.4.3 Analytical Tools

Understanding the relationship and interdependencies between various environmental impacts is critical to minimizing environmental degradation. For example, if an action is taken to reduce air emissions, will this affect another impact category, such as noise? A suite of transparent, integrated aviation noise and emissions models is developed to help planners understand the environmental impacts of their actions holistically. The suite of models includes—

- The Environmental Design Space (EDS), a capability to provide integrated analysis of noise and emissions at the aircraft level
- The Aviation Environmental Design Tool (AEDT), which provides integrated capability to generate interrelationships between noise and emissions and among emissions at the local and global levels

- The Aviation Environmental Portfolio Management Tool (APMT), which provides the common, transparent cost/benefit methodology needed to optimize choice among standards, market-based options, policies, and operational procedures to gain the largest environmental benefit while understanding cost.

This suite of models allows government agencies and airport operators to understand how proposed actions and policy decisions affect noise and emissions. The models help industry understand how operational decisions influence proposed projects related to aviation noise and emissions. They also help the public understand how actions by Government and industry impact aviation noise and emissions. [P-66]

The tools allow optimized environmental benefits of proposed actions and investments, improved data and analyses on airport/airspace capacity projects, and increased capability to address noise and emissions interdependencies in the resolution of community concerns, health and welfare impacts, and better targeting of solutions to problems. Ultimately they will facilitate more effective portfolio management and support the EMS process. [P-66]

7.4.4 Technology

Clean and Quiet Technologies. In the near-term, new technologies to improve ATM enable new, quieter, and cleaner operations. In the mid-term, technologies from NASA's Quiet Aircraft Technology (QAT) and Ultra-Efficient Engine Technology (UEET) programs will be matured for private-sector implementation. In addition, the Research Consortium for Lower Energy, Emissions, and Noise Technology (CLEEN) is a partnership developed to make the aviation technology advances needed for quieter, cleaner, and more energy efficient NextGen. In the long-term, new engines and aircraft will feature enhanced engine cycles, components to enable quieter operations, more efficient aircraft aerodynamics, and reduced weight. These technology advancements enable significant reductions in noise and emissions.

Technology Development Processes. Aircraft design, navigational capabilities, and technology play a central role in NextGen's ability to increase capacity sustainably. The development of environmentally sensitive technology is encouraged by an efficient, expeditious R&D pipeline. A critical aspect will be the development of an innovative and sustainable source of funding and the formation of public/private partnerships to facilitate the movement of technology from the conceptual phase through to its operational use in NextGen. CLEEN is an example of the type of partnership needed to advance technology.

7.4.5 Science/Metrics

Enterprise Environmental Metrics. Environmental performance indicators (e.g., noise, emissions at the airport, emissions in the airspace), combined with other system information (e.g., forecasted traffic flows, market data, fleet size, technology implementation, operational procedures), provide the needed information to quantify the individual environmental impacts (noise impacts, local air quality, and global climate change). Based on information from the results of such scientific assessments, environmental metrics are defined to put all environmental impacts on a common scale and assign relative priority to reach a quantified goal. The metrics are used to derive analytical tools to study interdependencies and perform cost/benefit analyses.

These tools in turn drive policy, regulations, incentive programs, national objectives, operational procedures, and technology design goals. The development of new metrics to assess the impact of aviation activities on environmental and health welfare enables a robust NextGen EMS framework. Next generation metrics, based on improved scientific knowledge and computations of interdependent relationships and related benefit/costs, provide an enhanced platform for environmental decisions and mitigation. Metrics include new operating paradigms, such as very light jets and supersonic aircraft. [R-150]

7.5 ENVIRONMENTAL MANAGEMENT FRAMEWORK SUPPORT

The environmental framework focuses on improving linkages between various components of the air transportation system (e.g., airports, aircraft operators, federal agencies, manufacturers) and establishing a systematic but flexible framework to meet NextGen environmental protection needs for sustainable growth. Where possible, this aims to enable decisionmaking and planning at the implementation level with support from several mission support functions. These functions (e.g., environmental, market, social trends, best practices, lessons learned, feedback, incentives, monitoring) are accessible to provide more robust information to all components of NextGen through an information management and communication system. In addition, cross-functional groups that include representatives from all stakeholder entities are assembled to review trends, policy, monitoring, and goals at a national level. These groups provide a forum for discussing research, funding, policy, regulation, tools, and other issues linking the aviation system as a whole.

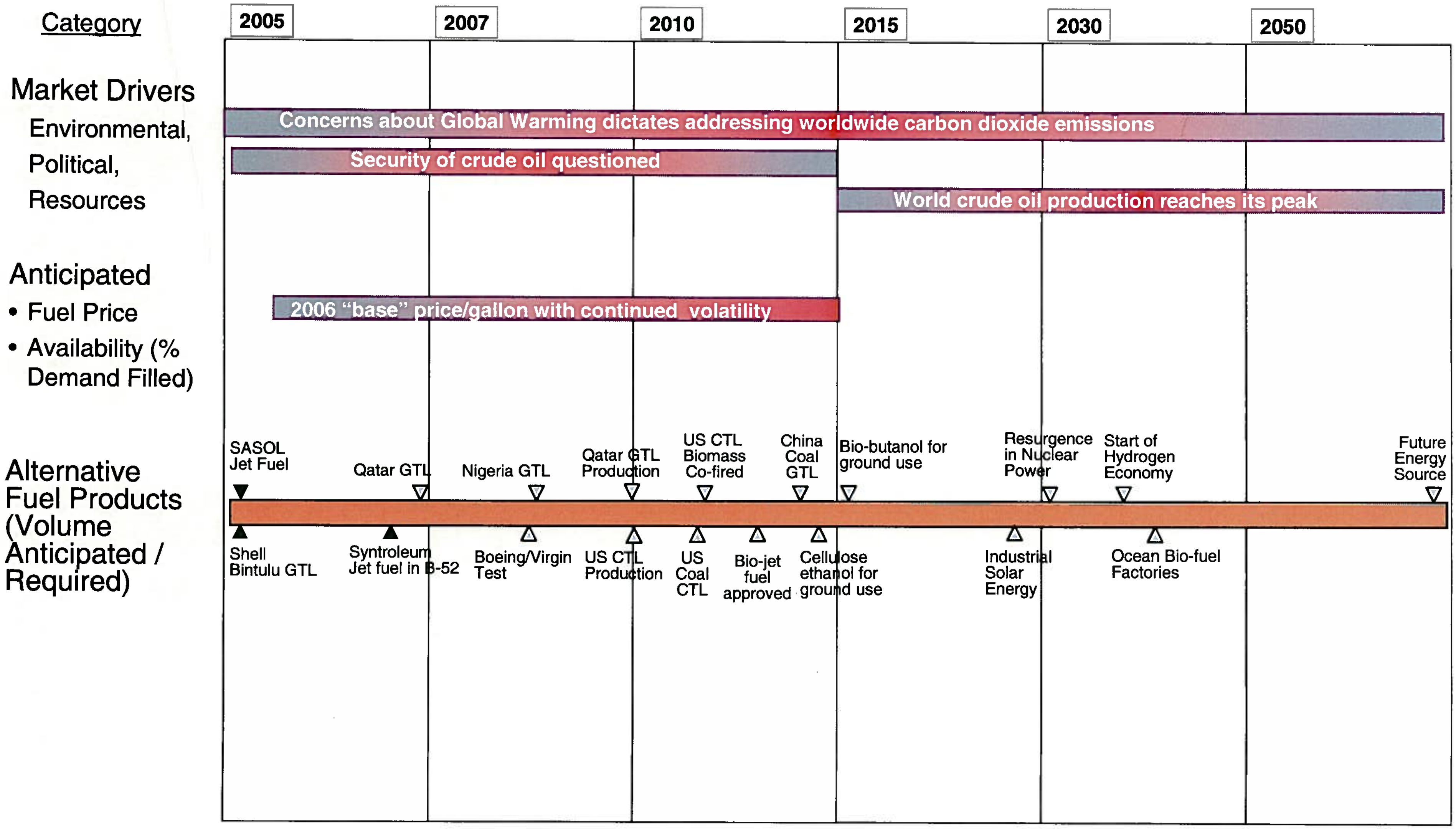
Enclosure 3

CAAFI Roadmap

Aviation Alternate Fuels Roadmap

8-22-07

(Level 1 / Scenario 1)



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

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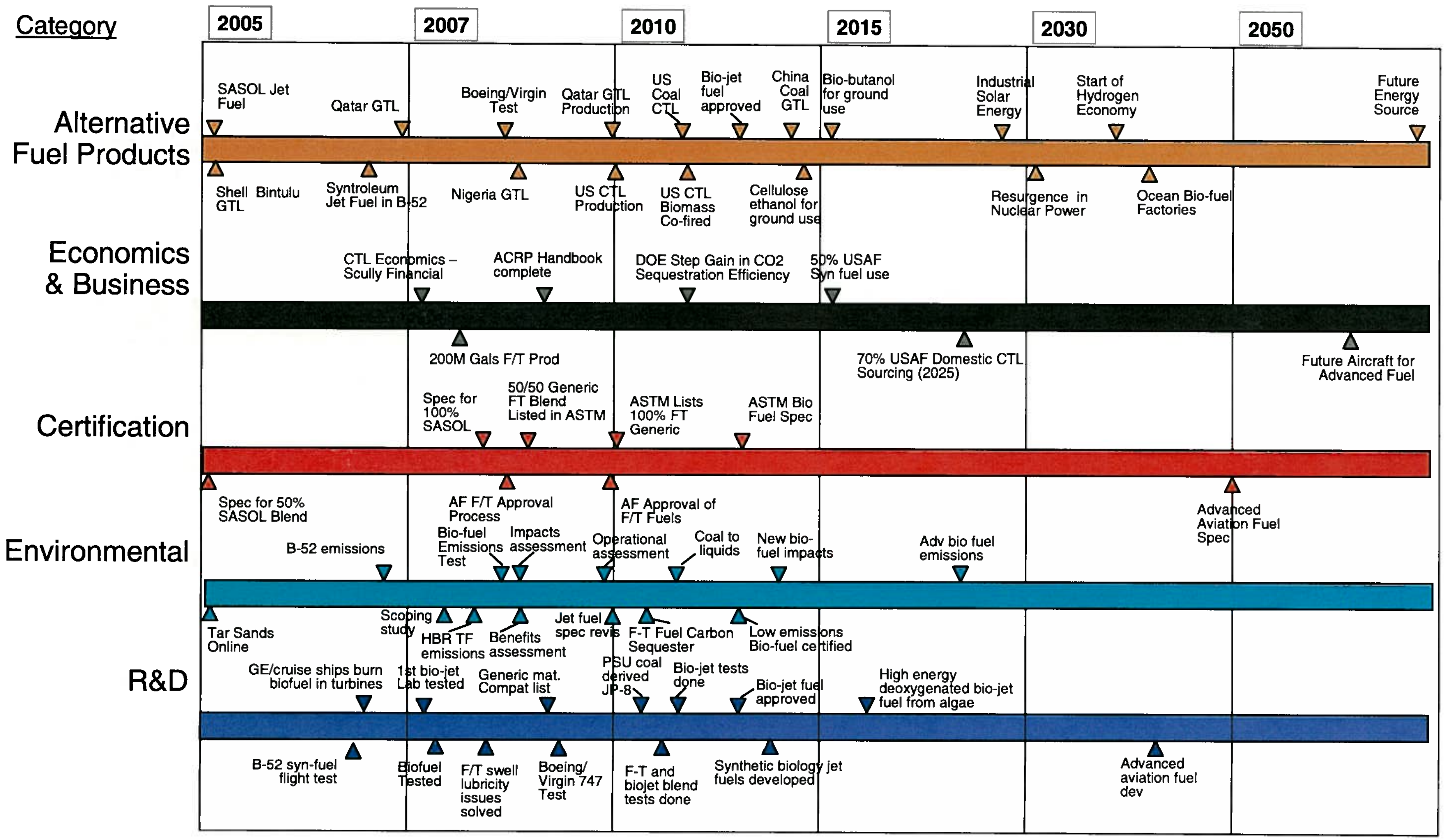
Status as of July 27, 2007

Aviation Alternate Fuels Roadmap

(Level 2 / Scenario 1 - Long Term)



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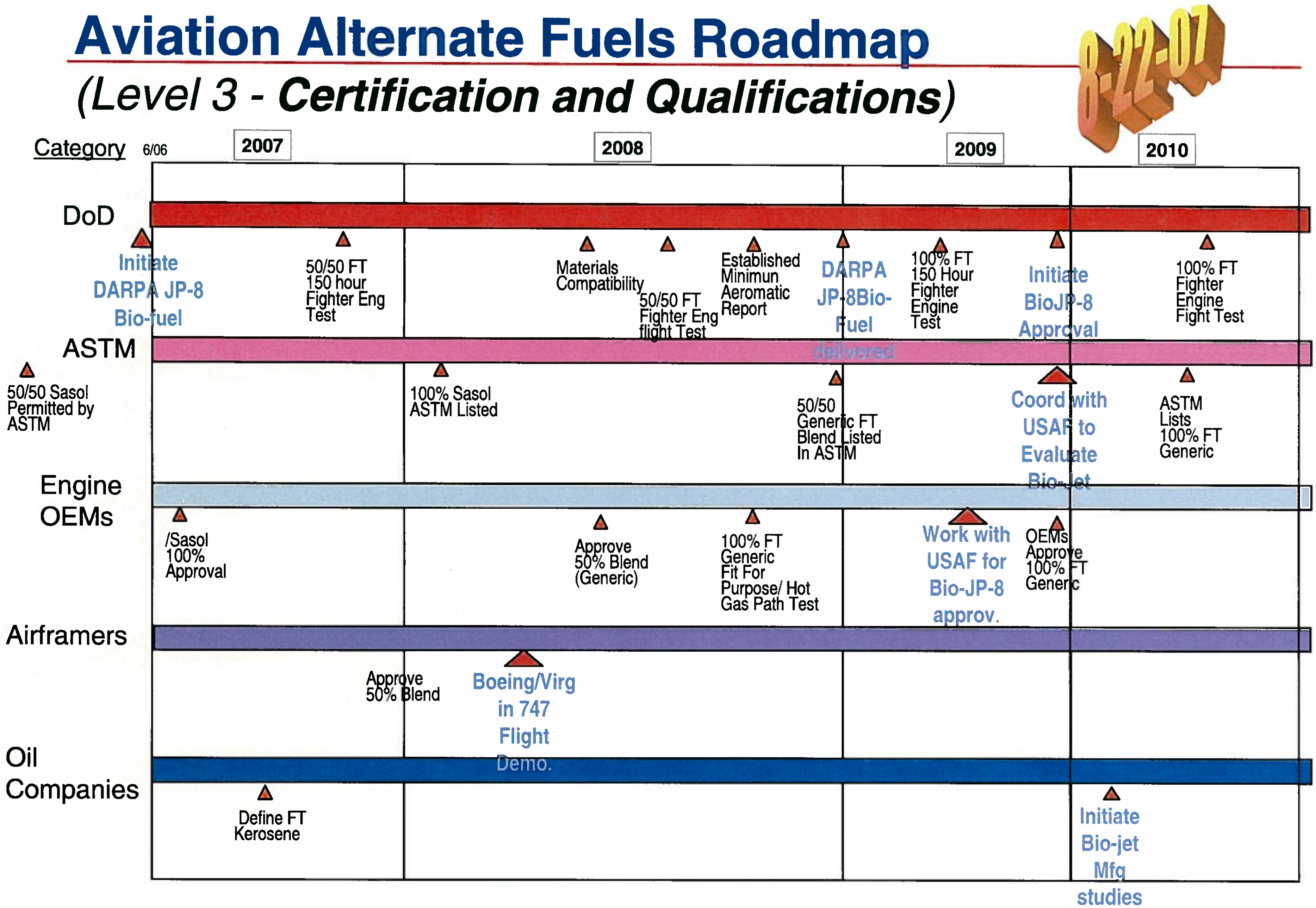
Aviation Alternate Fuels Roadmap

(Level 3 - *Certification and Qualifications*)



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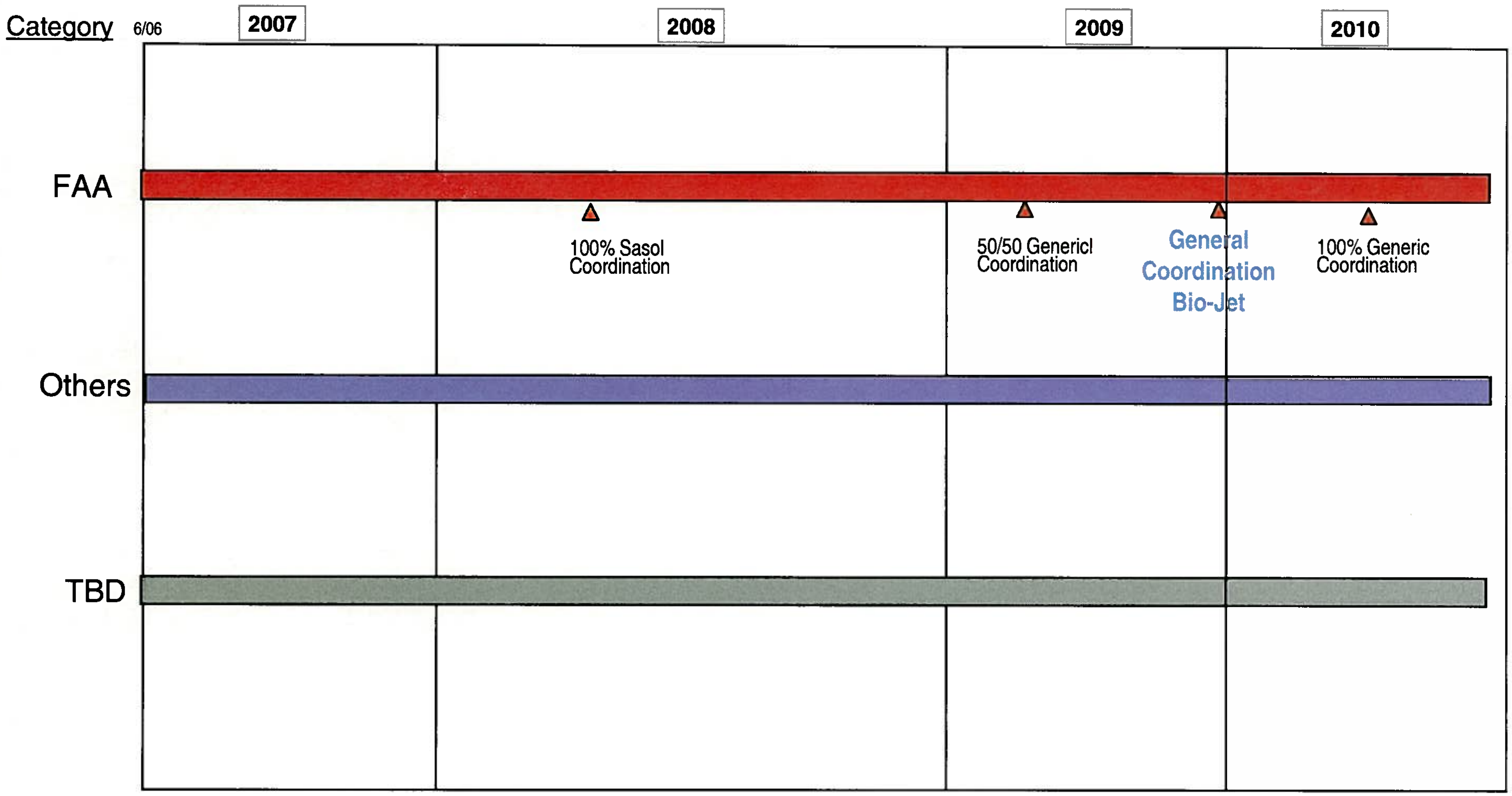

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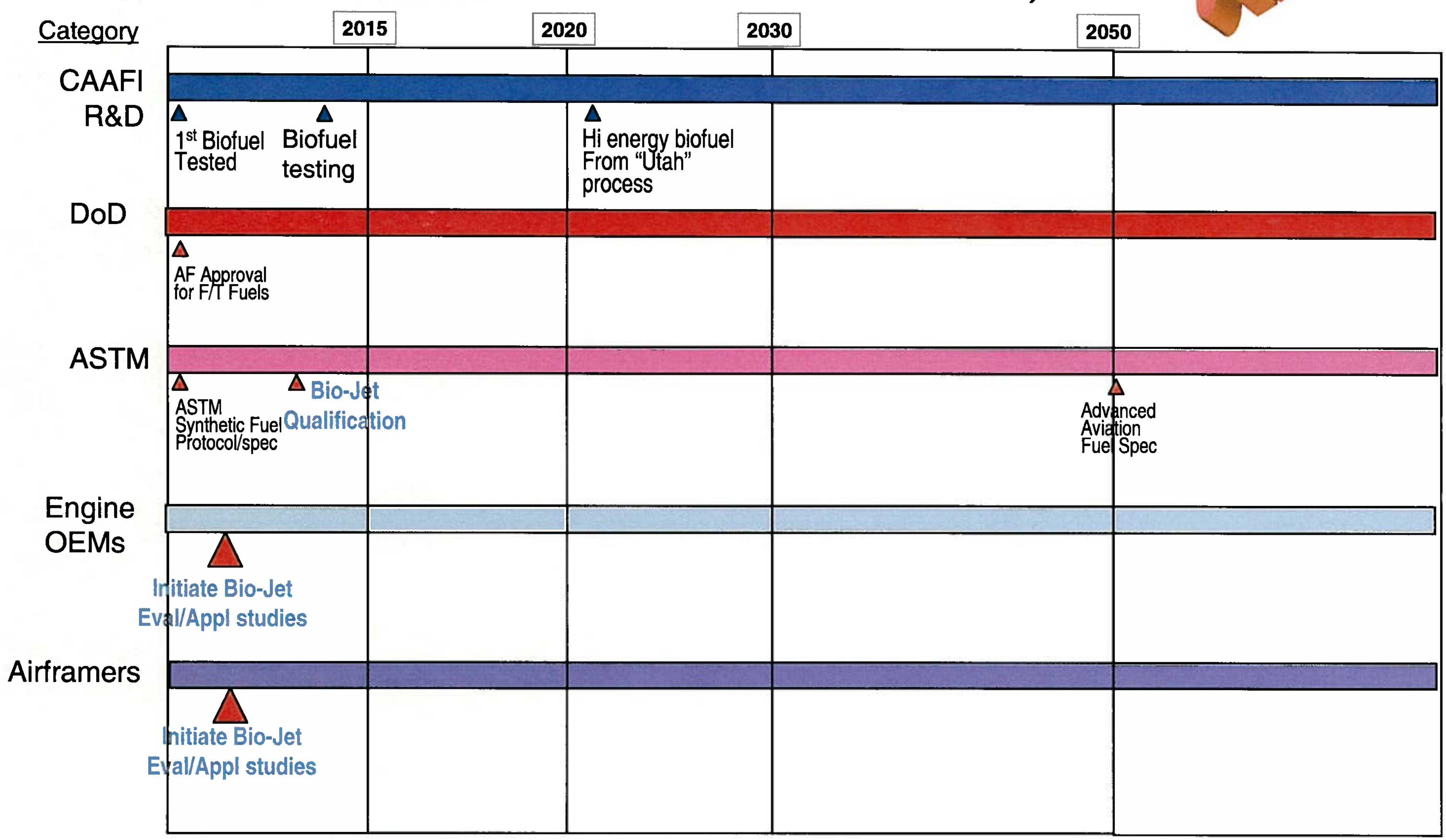

Aviation Alternate Fuels Roadmap

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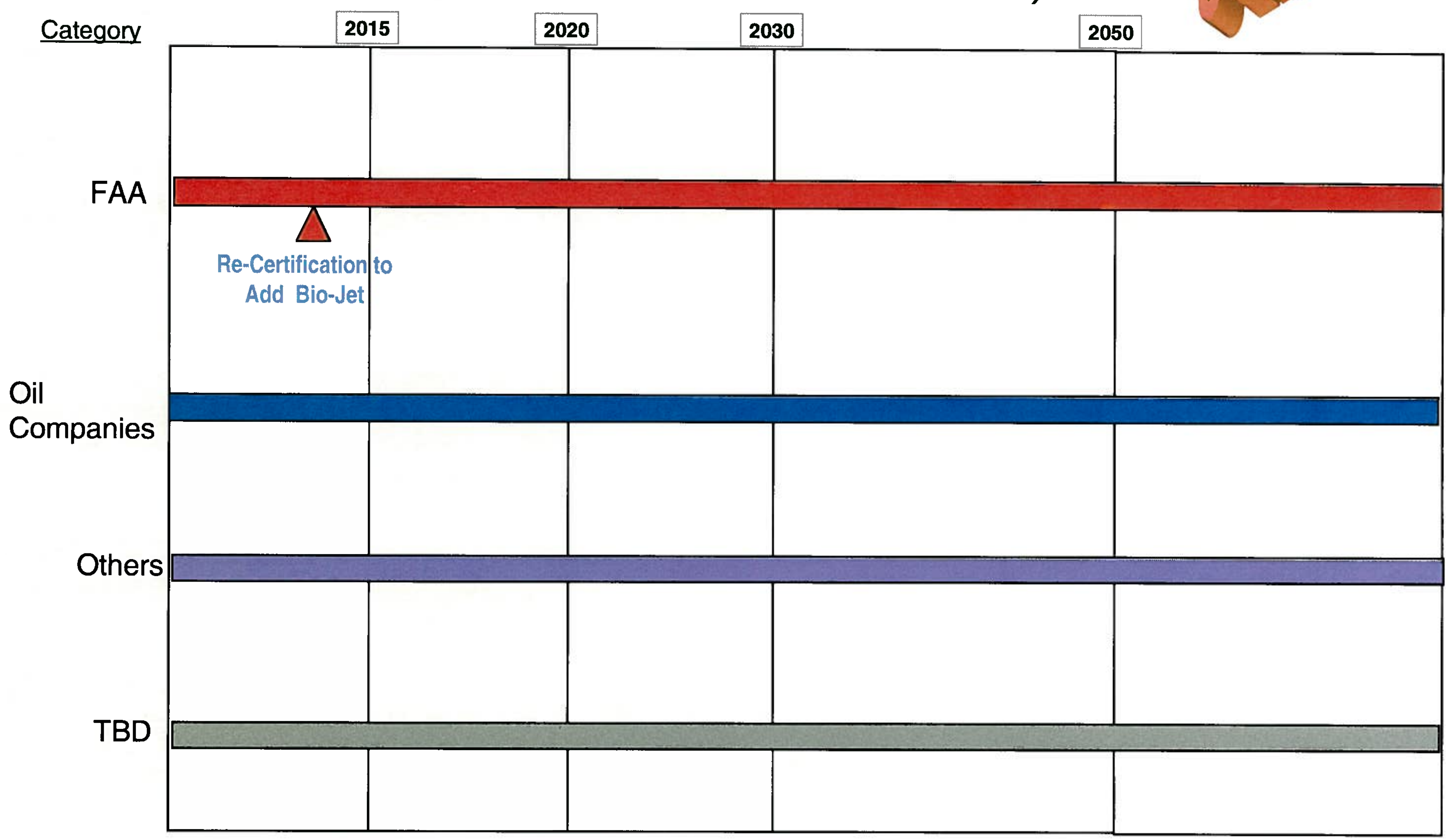
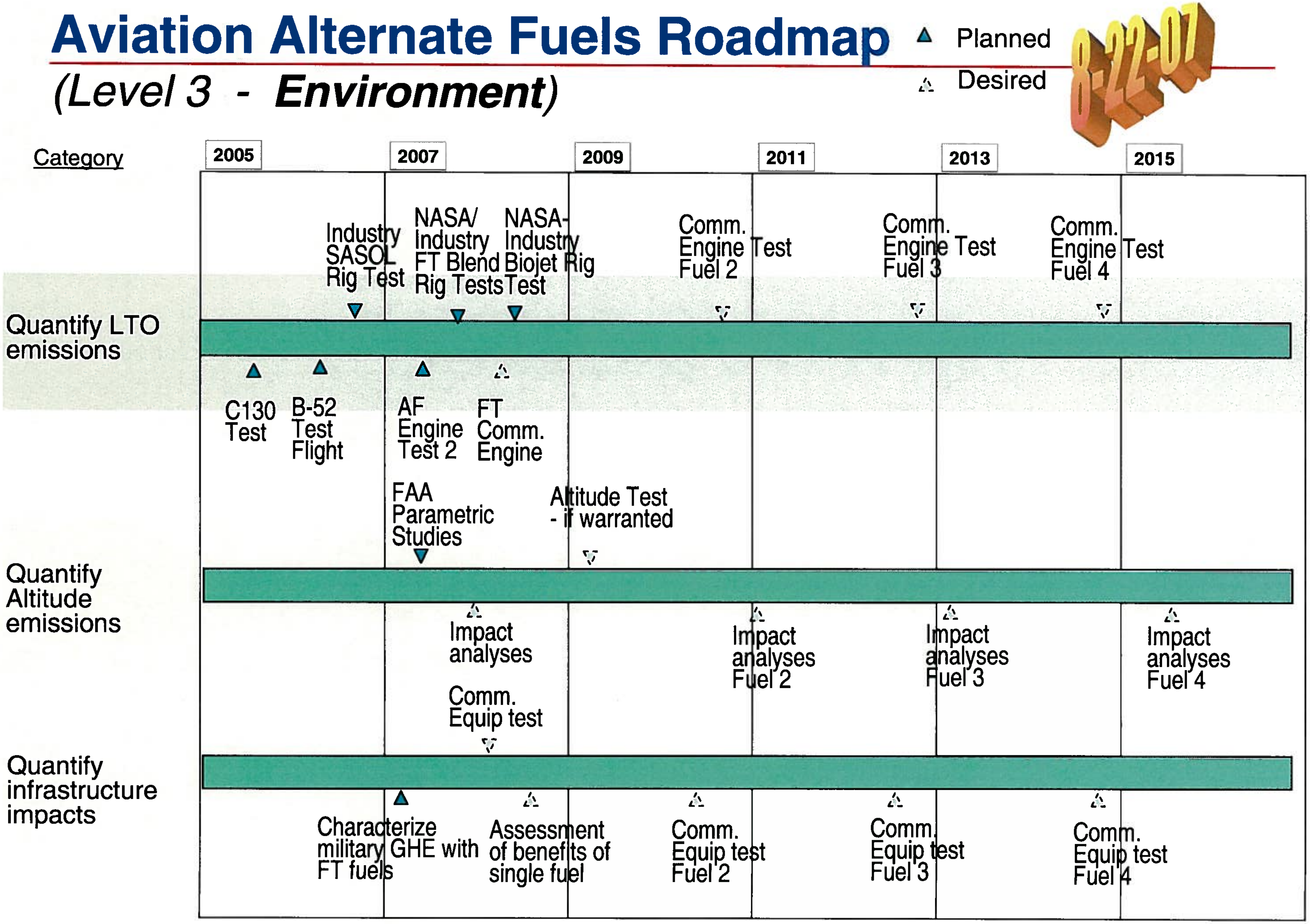


Aviation Alternate Fuels Roadmap

(Level 3 - *Environment*)



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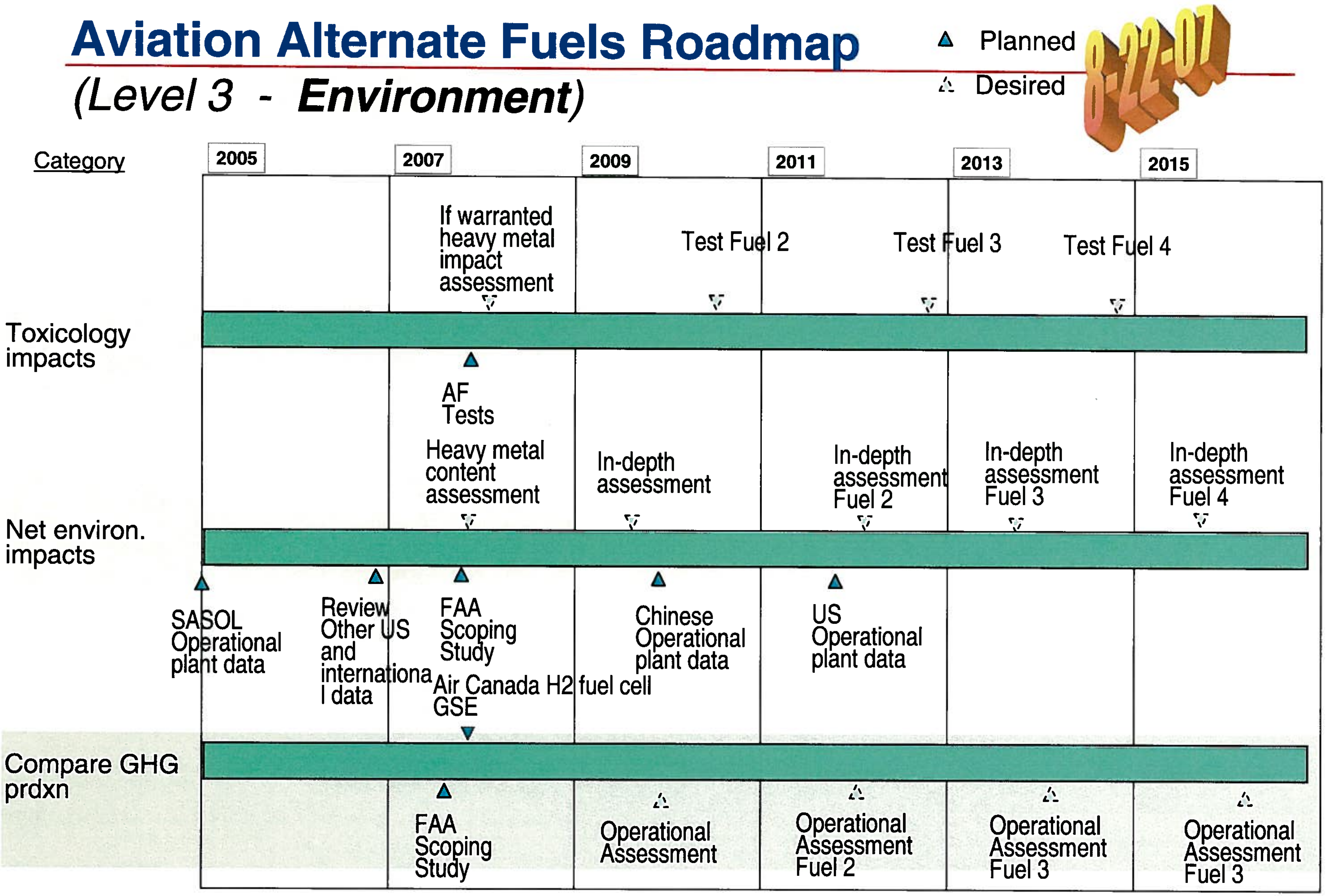

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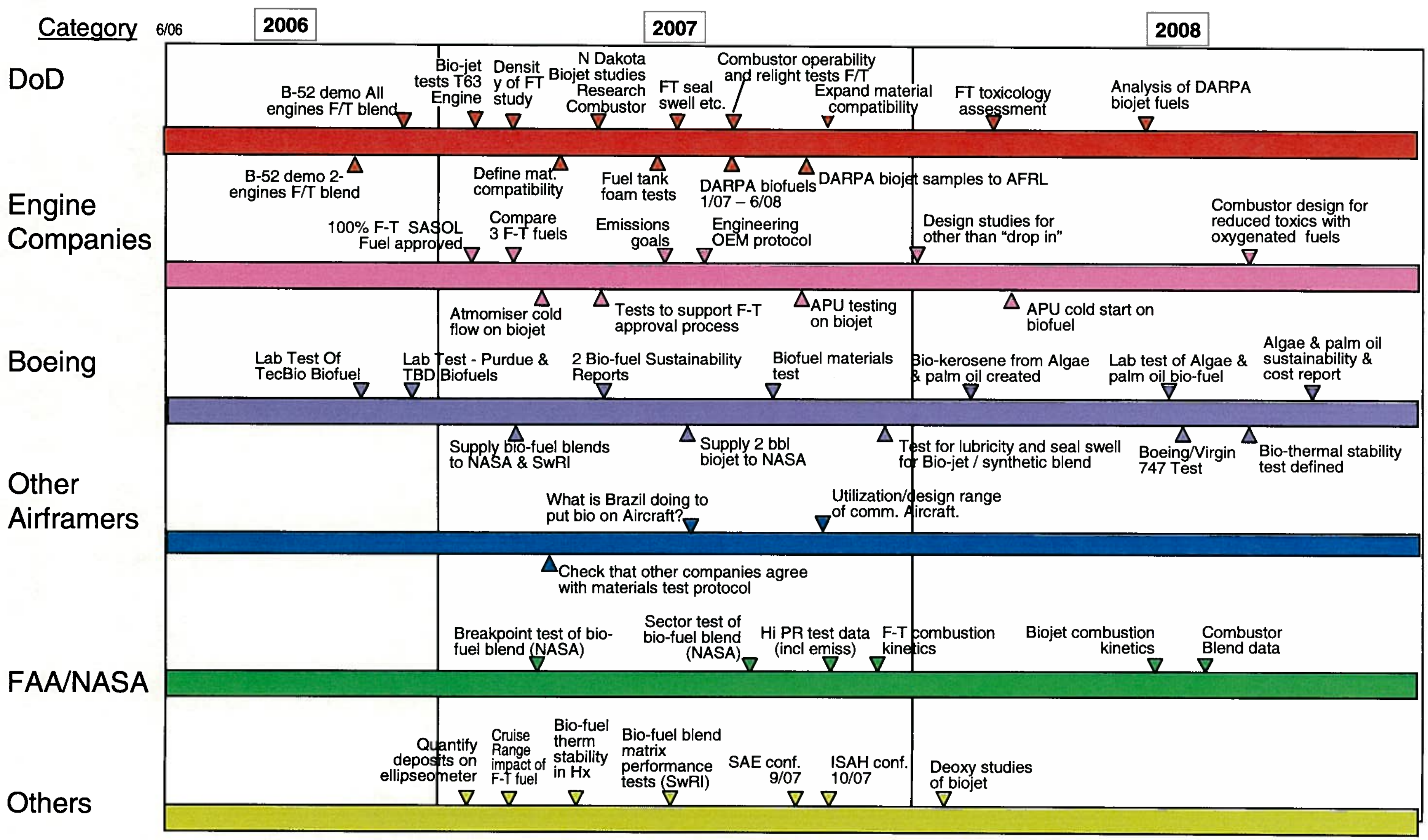
(Level 3 / Scenario 1, **R&D** Near Term Only)



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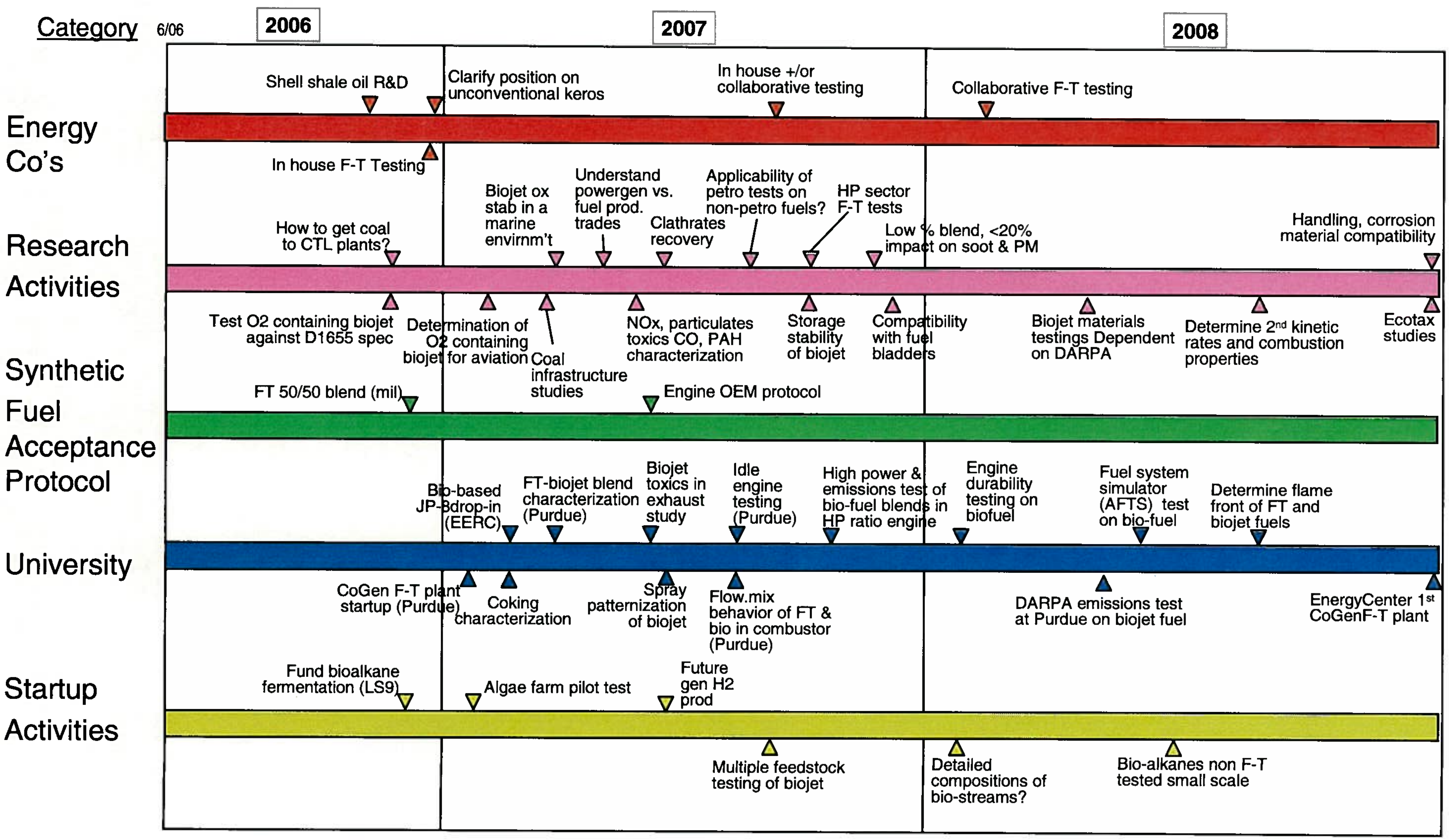

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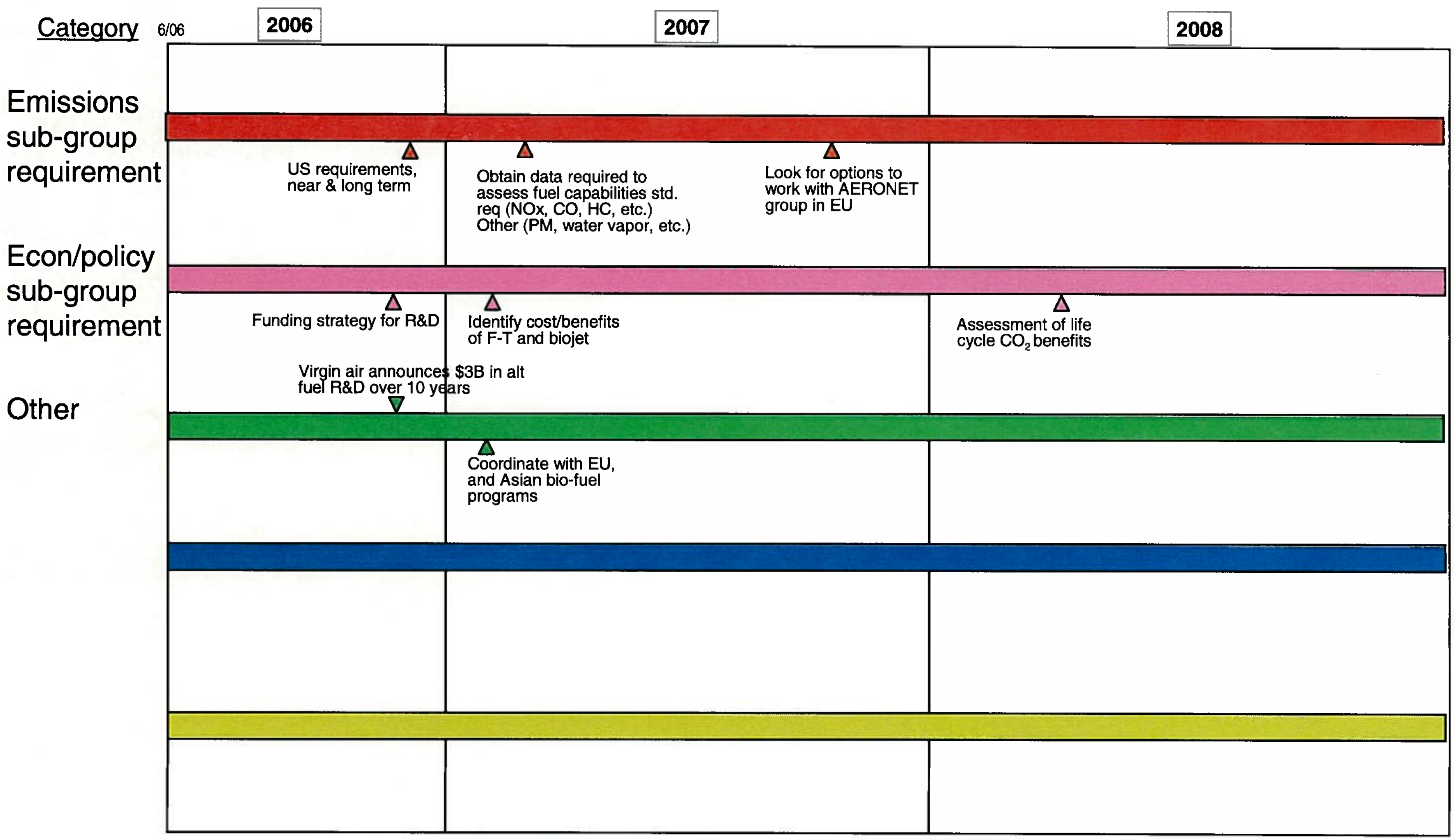

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Aviation Alternate Fuels Roadmap

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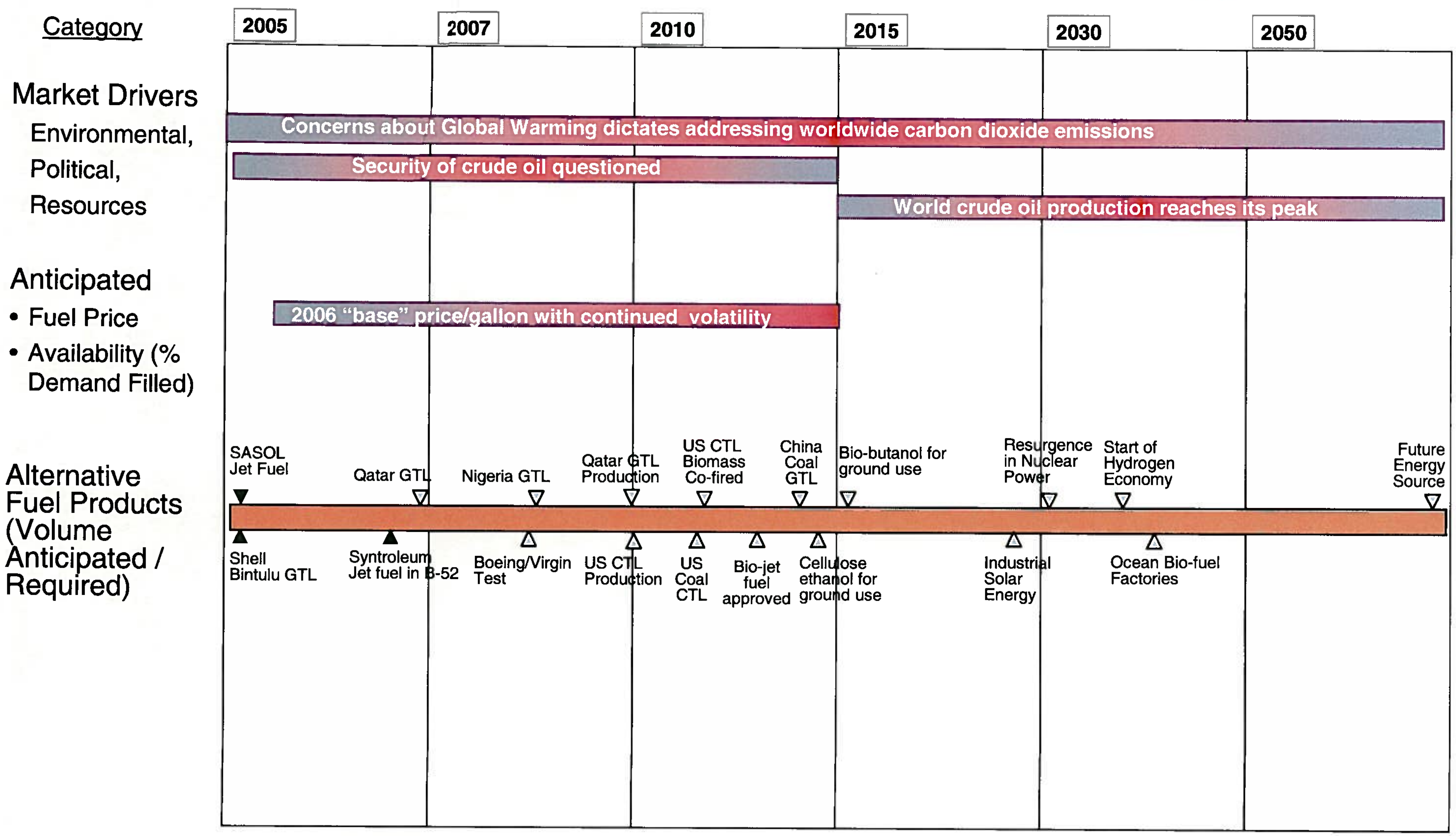

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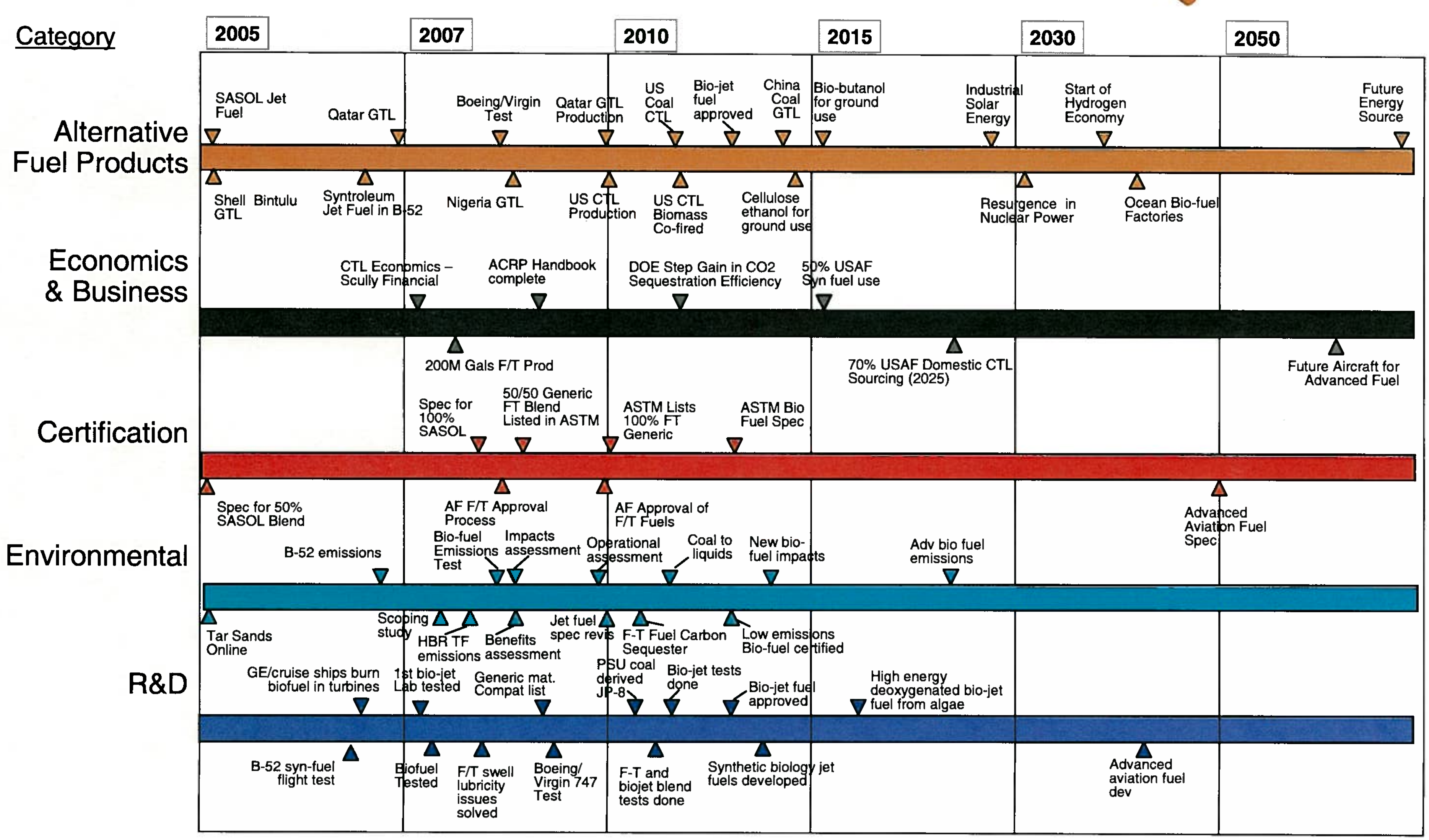

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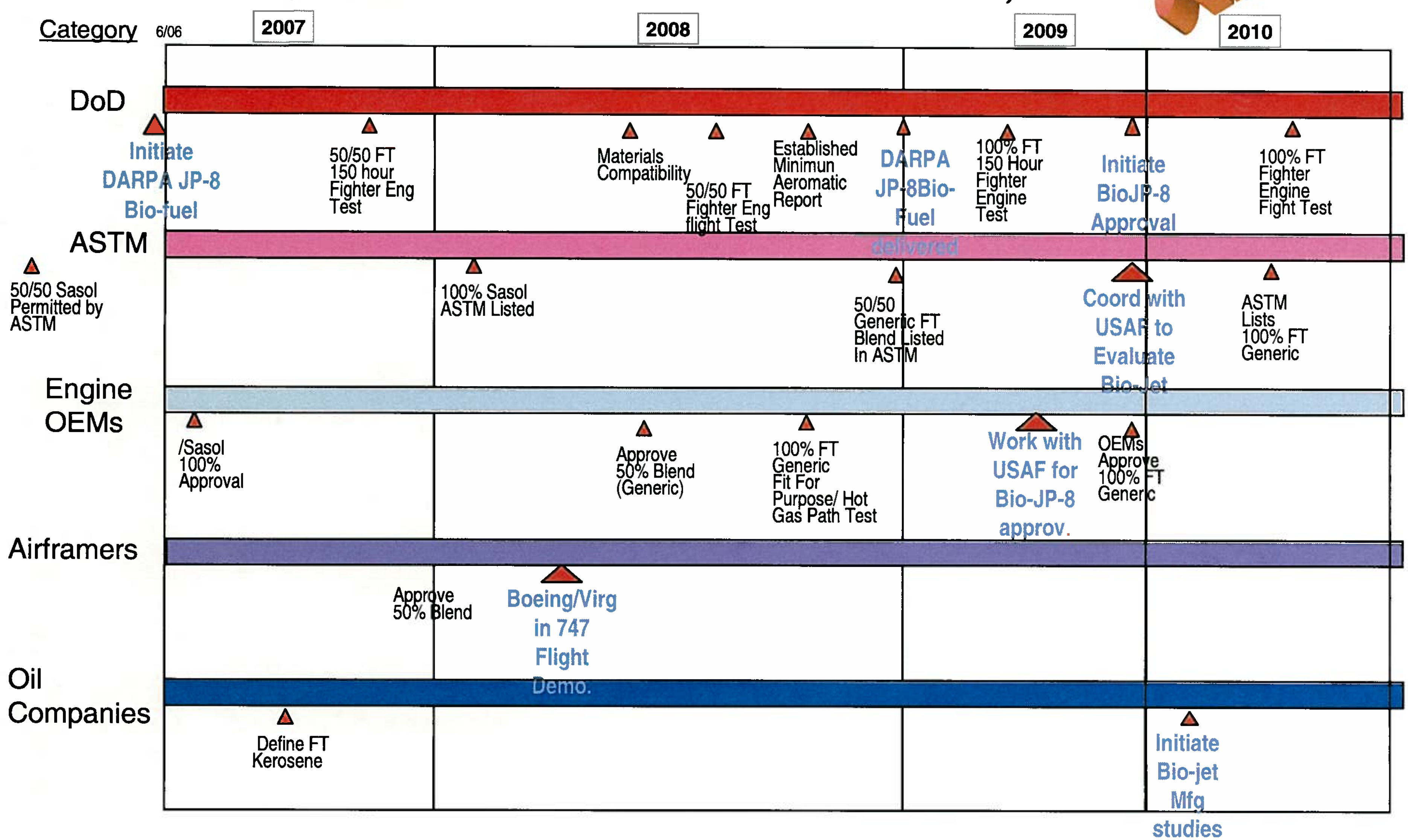

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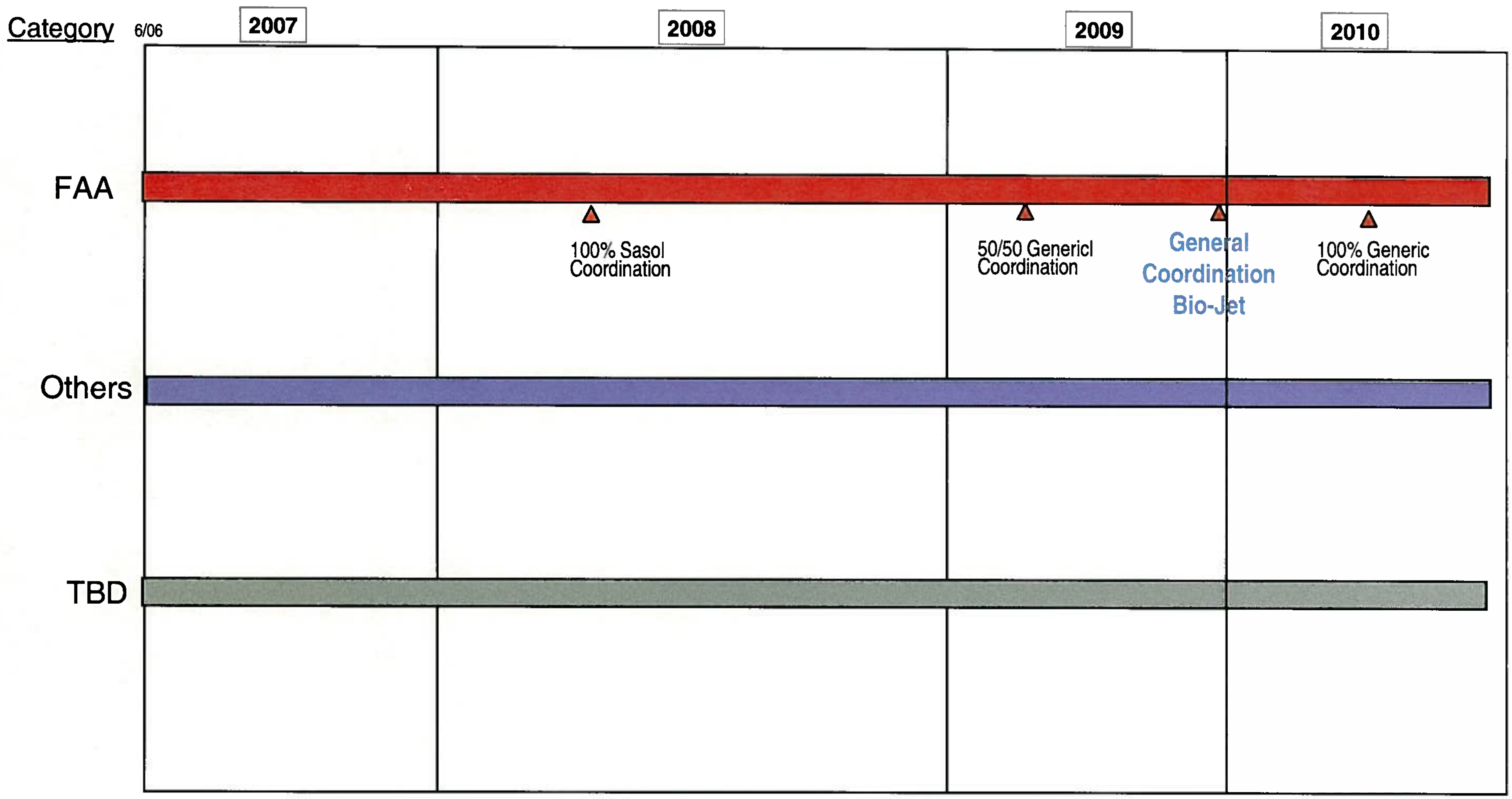

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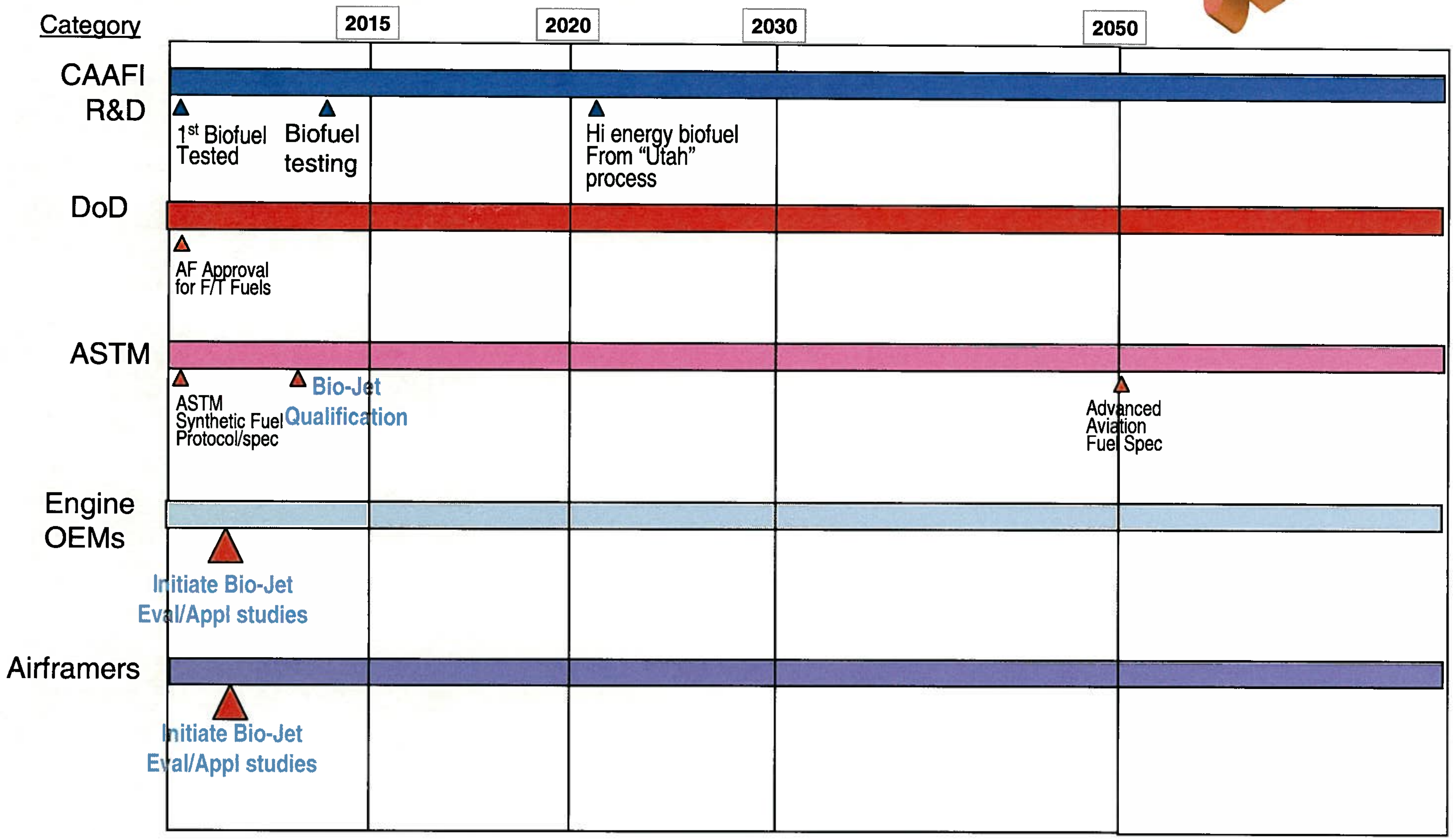

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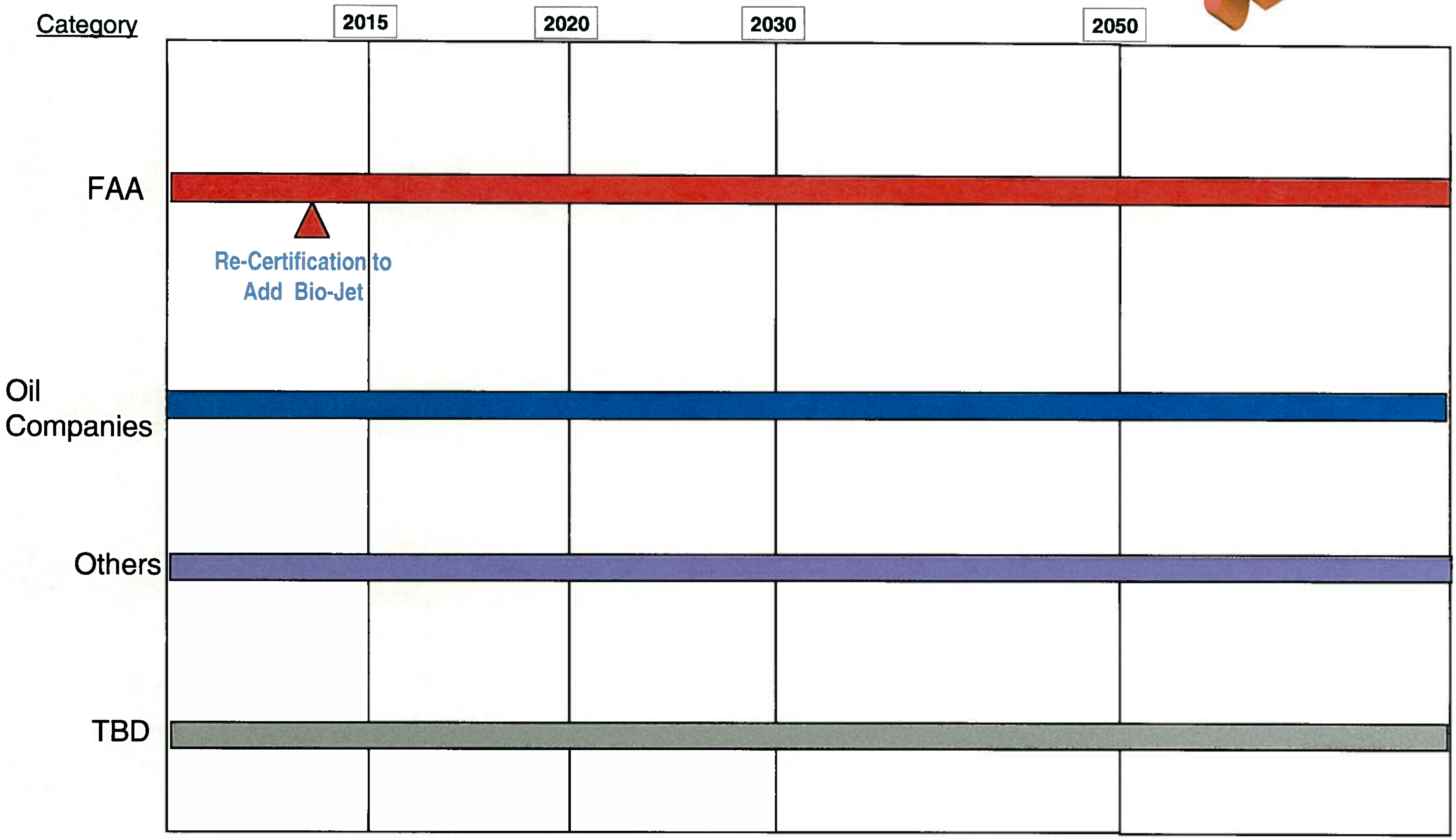

Aviation Alternate Fuels Roadmap
(Level 3 - *Environment*)

▲ Planned
△ Desired

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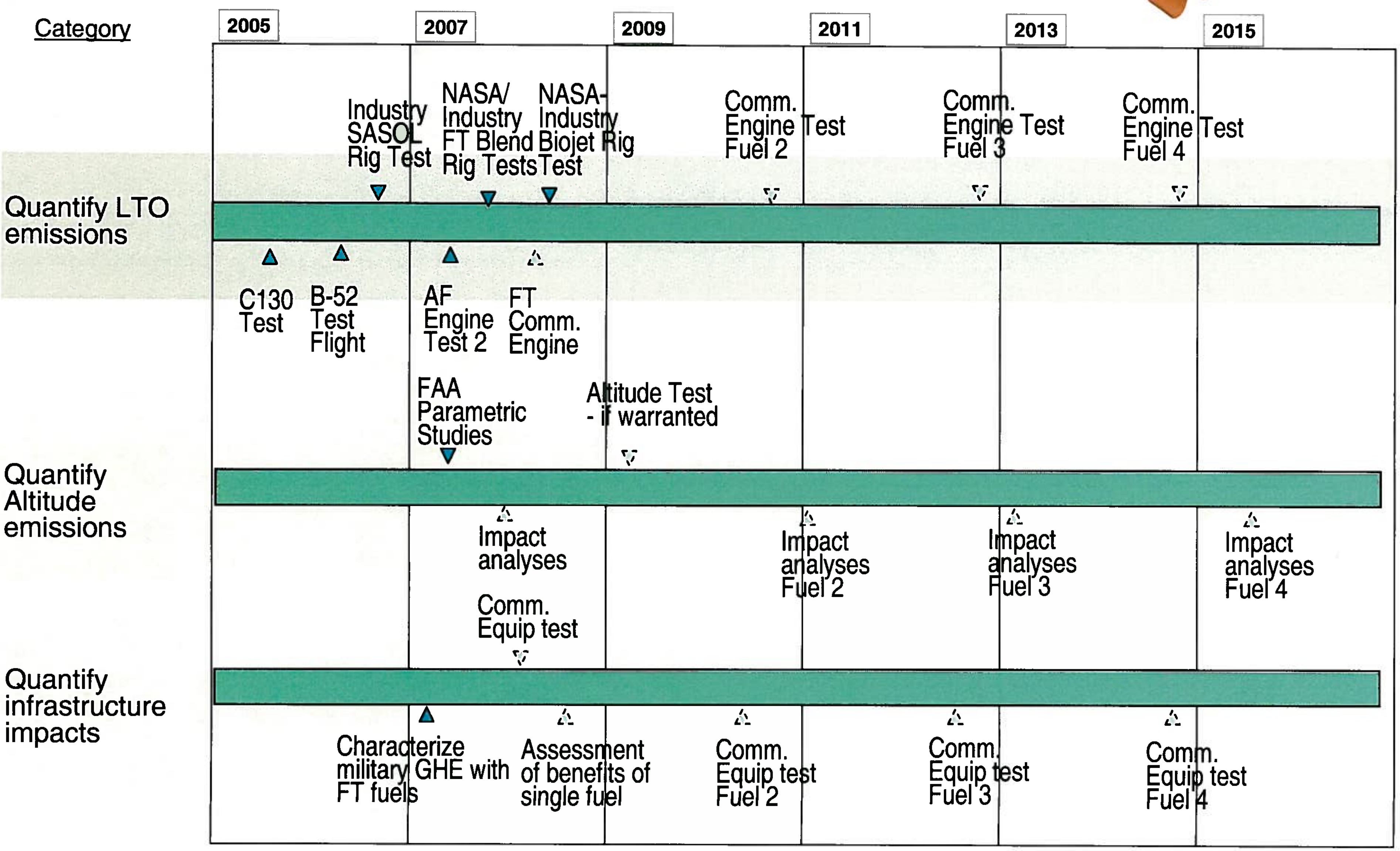

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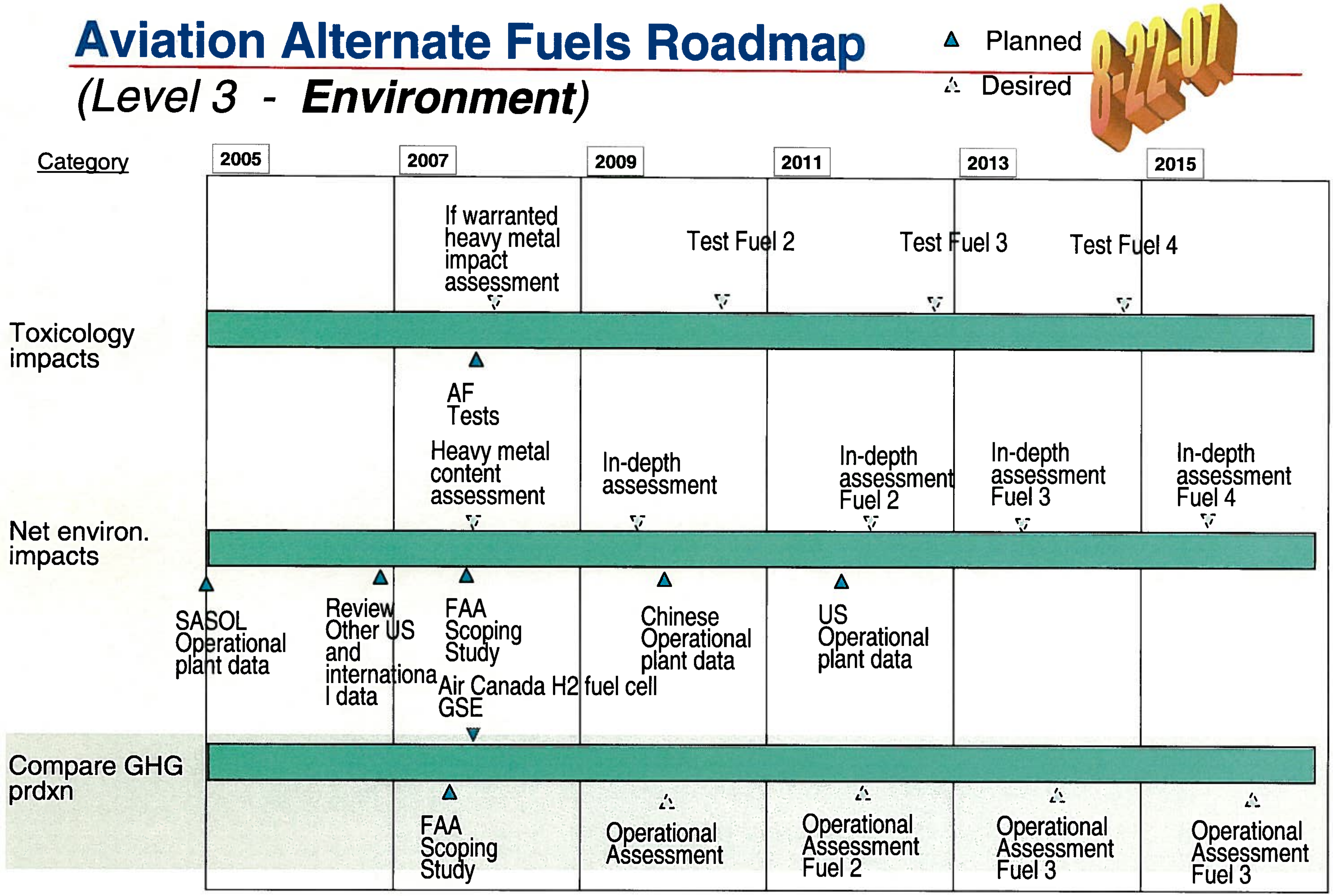

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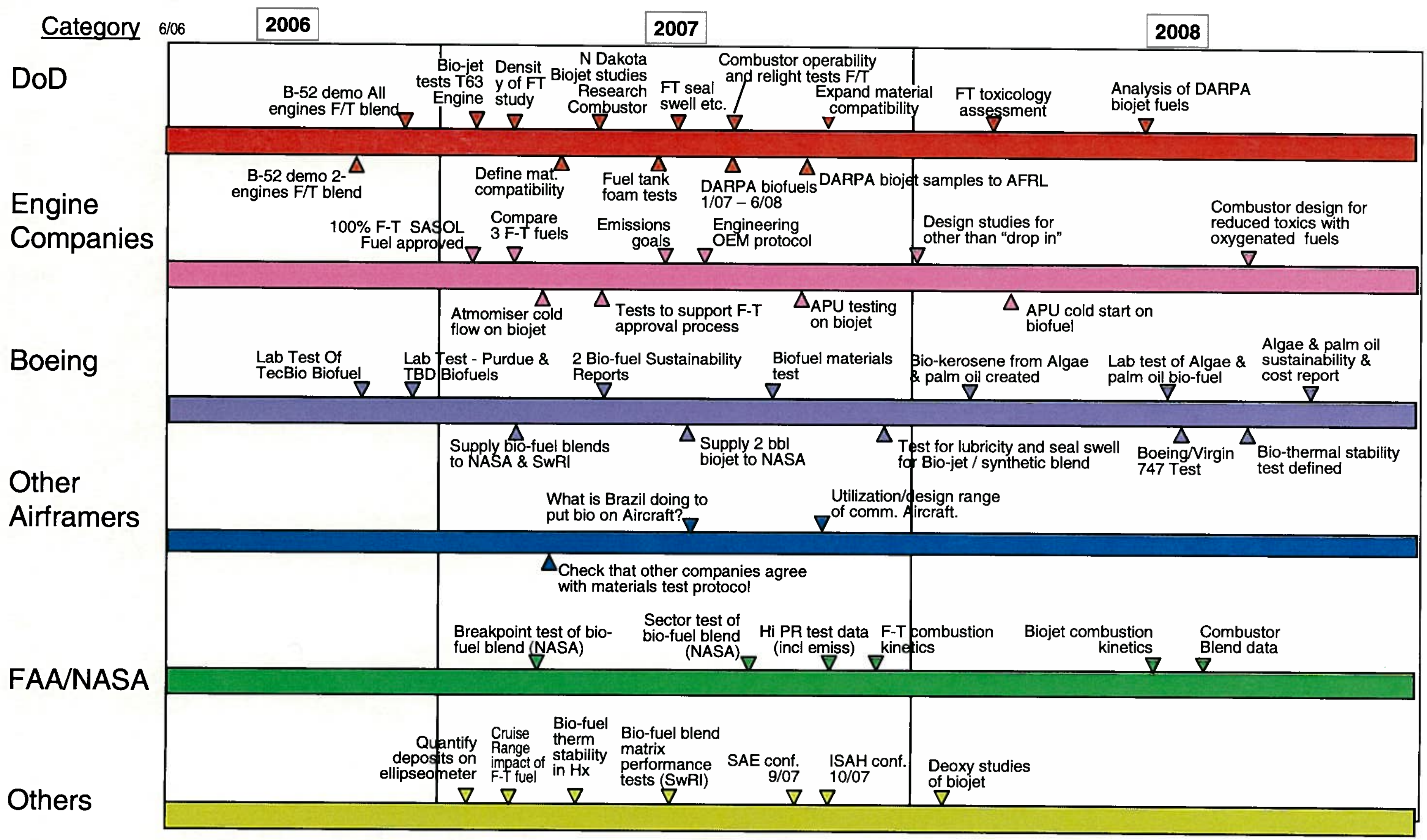
Aviation Alternate Fuels Roadmap

(Level 3 / Scenario 1, **R&D** Near Term Only)



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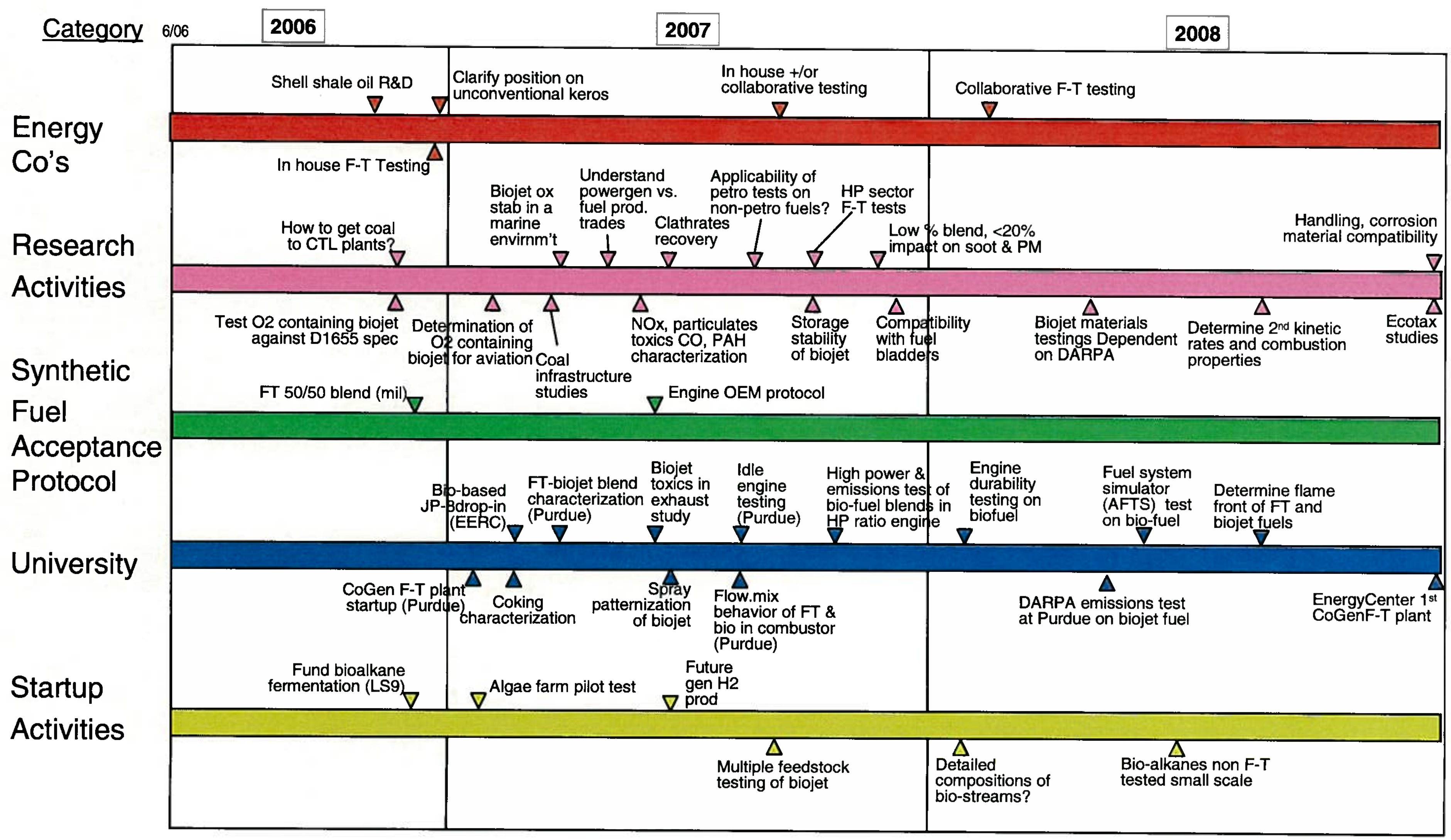

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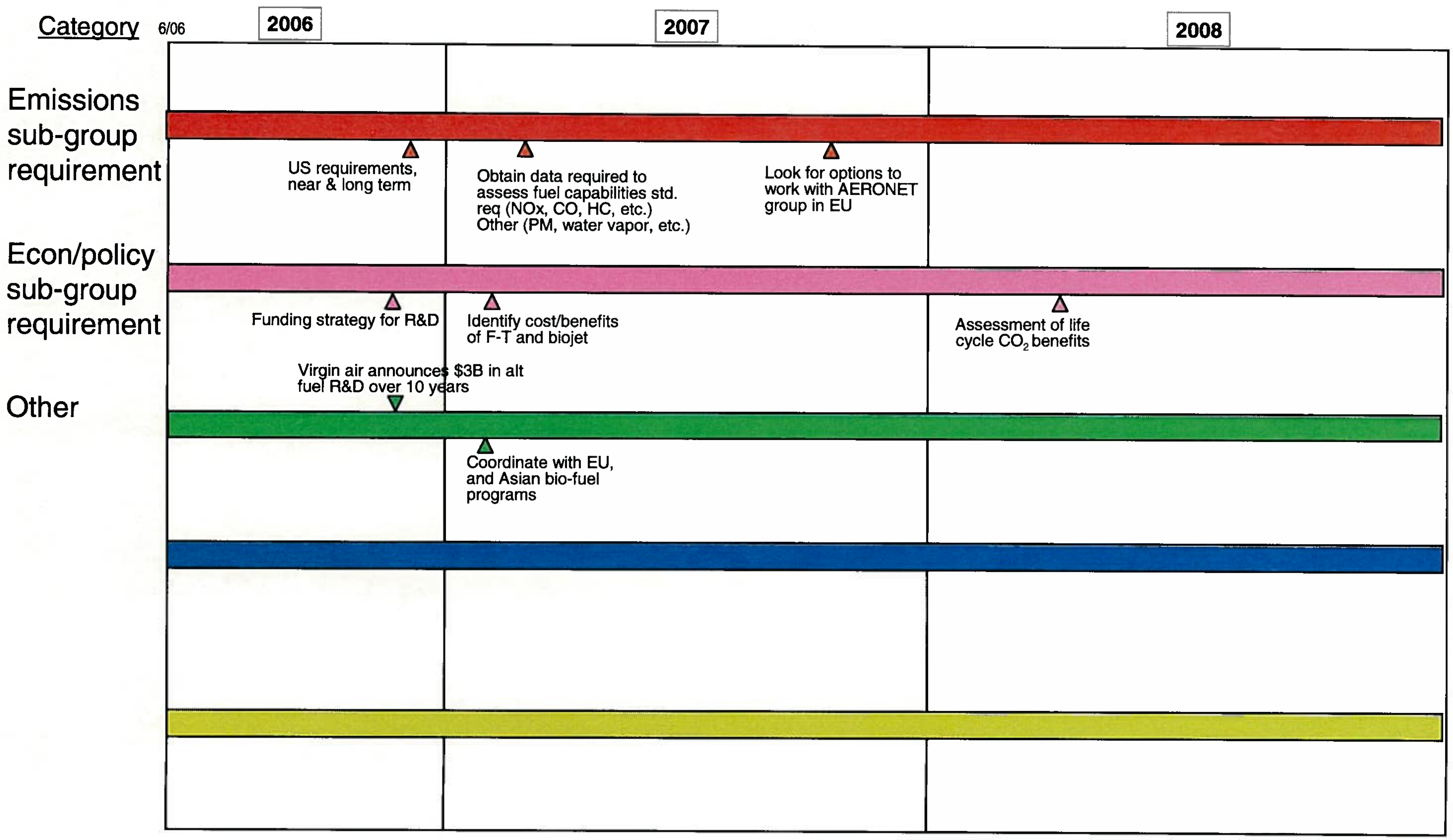

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