An Overview of the NASA Aeronautics Test Program Strategic Plan

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U.S. leadership in aeronautics depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. These systems include major wind tunnels and propulsion test facilities and flight test capabilities. The federal government owns the majority of the major aeronautics test capabilities in the United States, primarily through the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD), however an overarching strategy for management of these national assets was needed. Therefore, in Fiscal Year (FY) 2006 NASA established the Aeronautics Test Program (ATP) as a two-pronged strategic initiative to: (1) retain and invest in NASA aeronautics test capabilities considered strategically important to the agency and the nation, and (2) establish a strong, high level partnership with the DoD Test Resources Management Center (TRMC), stewards of the DoD test and evaluation infrastructure. Since then, approximately seventy percent of the ATP budget has been directed to underpin fixed and variable costs of facility operations within its portfolio and the balance towards strategic investments in its test facilities, including maintenance and capability upgrades. Also, a strong guiding coalition was established through the National Partnership for Aeronautics Testing (NPAT), with governance by the senior leadership of NASA's Aeronautics Research Mission Directorate (ARMD) and the DoD's TRMC.

As part of its strategic planning, ATP has performed or participated in many studies and analyses, including assessments of major NASA and DoD aeronautics test capabilities, test facility condition evaluations and market research. The ATP strategy has also benefitted from unpublished RAND research and analysis by Antón et al. (2009)[1]. Together, these various studies, reports and assessments serve as a foundation for a new, five year strategic plan that will guide ATP through FY 2014. Our vision for the future is a balanced portfolio of aeronautics ground and flight test capabilities that advance U.S. leadership in aeronautics in the short and long term. Key to the ATP vision is the concept of *availability, not necessarily ownership*; that is, NASA does not have to own and operate all facilities that are envisioned for future aeronautics testing. However, ATP will enable access to capabilities which are needed but not owned by NASA through strategic partnerships and reliance agreements. This paper will outline the major aspects of the ATP strategic plan for achieving its mission.

Nomenclature

AEDC	=	Arnold Engineering Development Center
APG	=	Annual Performance Goal
ARC	=	Ames Research Center
ARMD	=	Aeronautics Research Mission Directorate
ATP	=	Aeronautics Test Program
DoD	=	Department of Defense
DFRC	=	Dryden Flight Research Center
FTE	=	Full-time equivalent

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FY	=	Fiscal Year
GRC	=	Glenn Research Center
LaRC	=	Langley Research Center
NASA	=	National Aeronautics and Space Administration
NPAT	=	National Partnership for Aeronautical Testing
OSD	=	Office of the Secretary of Defense
POC	=	Point of contact
R&D	=	Research and Development
TRMC	=	Test Resources Management Center
T&E	=	Test and Evaluation

I. Introduction

The NASA Aeronautics Test Program is a long-term, funded commitment by NASA Headquarters and the NASA Aeronautics Research Mission Directorate (ARMD) to retain and invest in test capabilities considered to be strategically important to both the agency and the nation. ATP's primary objective includes development of centralized management processes and procedures that are consistent across NASA Research Centers for operating and maintaining the program's major ground test facilities (generally, large wind tunnels and propulsion test facilities) and its flight operations and test infrastructure at Dryden Flight Research Center (DFRC).

Overall, the program will:

1. establish strategic corporate management of NASA's aeronautics ground and flight test capabilities
2. ensure that a minimum core testing capability is both available and accessible
3. ensure efficient and cost-effective operation of its assets
4. sustain and improve existing core test capabilities
5. pursue strategic partnerships and test capability reliance agreements

II. The ATP Vision, Mission and Guiding Principles

A. Vision

ATP's vision is *a balanced portfolio of major aeronautics ground and flight test capabilities that advance U.S. leadership in aeronautics in the short and long term*. "Balanced" implies tradeoffs between different characteristics of the ATP portfolio and a variety of factors shaping it, including:

1. Demand vs. capacity
2. Near-term vs. far-term needs
3. Cost vs. benefit
4. New vs. established technologies
5. Productivity for T&E vs. flexibility for R&D
6. Internal vs. external capabilities (e.g., NASA and DoD)

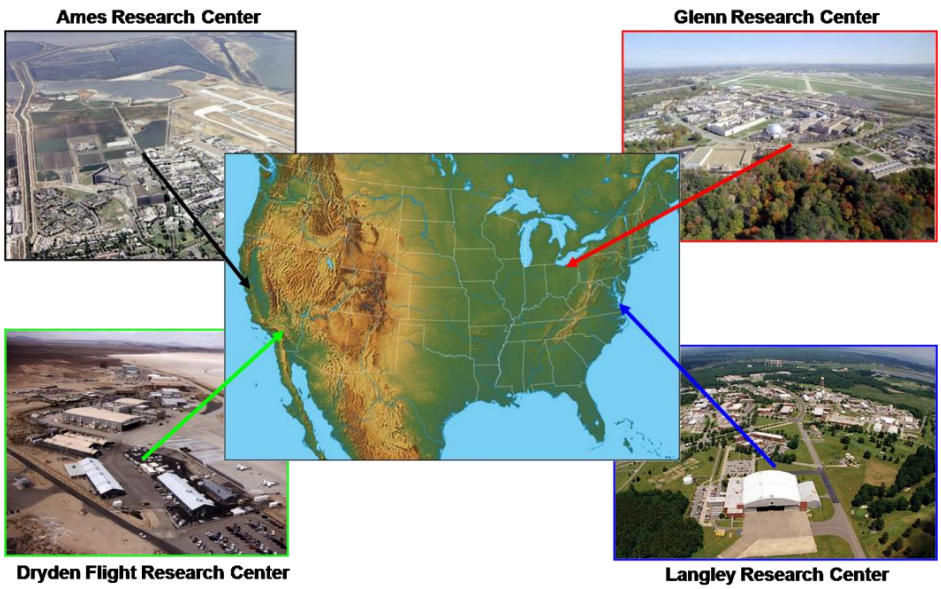

Figure 1 Location of Aeronautics Test Program Capabilities

It's important to acknowledge that major test capability exists outside of NASA. Examples are the numerous wind tunnels at AEDC which NASA has and will continue to utilize. Realizing this, the ATP vision does not necessarily require that all major test capabilities reside within NASA. But it does call for them to be available in a way that addresses U.S. strategic concerns and fosters U.S. competitiveness in aeronautics. Whether NASA or other entities own and operate these capabilities will be determined by ongoing analysis and strategic planning, given specific factors and realities outlined in the ATP Strategic Plan.

As a government agency, NASA has a role in providing test capabilities when, and only when, they are unavailable elsewhere and not commercially viable. NASA values the public good and does not compete with commercially viable industry ventures.

B. Mission

To realize its vision, ATP will implement a fourfold mission:

1. Provide *strategic management guidance and recommendations* to the NASA ARMD Associate Administrator and Research Center Directors concerning NASA aeronautics test capabilities
2. *Represent NASA's and the nation's interests* related to ground and flight test capabilities with U.S. and foreign governments as well as user and management communities within industry and academia
3. *Provide strategic direction* to test capability managers
4. *Provide financial support* to NASA test capabilities by funding
    a. expenses for testing and support facilities
    b. major maintenance, repair and improvements
    c. strategic workforce initiatives
    d. test technology development

This four-part mission ensures that test customers from NASA, DoD, and other governmental, industry, and academic entities in the United States have a readily available portfolio of aeronautics test capabilities.

C. Guiding Principles

Overarching principles will guide ATP in delivering value (see Figure 2) to the Nation:

1. *National stewardship:* ATP has an obligation to both the Research & Development (R&D) and Test & Evaluation (T&E) communities to ensure healthy and available aeronautics test capabilities for the nation
2. *Availability, not necessarily ownership:* NASA does not have to own and operate all facilities needed, but ATP will enable access through strategic partnerships
3. *Relevance:* Capabilities must evolve to meet future requirements
4. *"The Big Stuff":* ATP will focus on national-class test capabilities rather than quantity or breadth of laboratory facilities
5. *Value:* Competent testing personnel, reliable facilities and efficient processes will help customers get the most benefit from testing

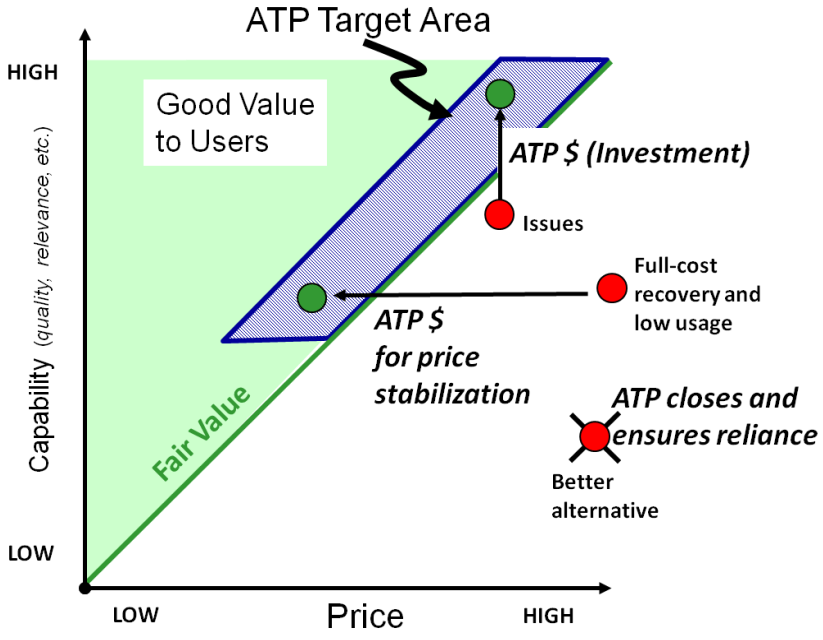

Figure 2 The ATP Value Proposition

6. *Public good:* e.g. full-cost recovery is not always necessary
7. *R&D and T&E:* A facility can evolve to enable both R&D) and T&E

III. Strategic Concerns, Challenges and Uncertainties

A. Strategic Concerns

ATP was given the mandate to ensure access to a portfolio of aeronautics test capabilities necessary to satisfy national aeronautics test customer requirements in the future. Makeup of the portfolio was based primarily on research published by the RAND Corporation in FY 2004 for NASA and the Office of the Secretary of Defense – *Wind Tunnel and Propulsion Test Facilities – An Assessment of NASA's Capabilities to Serve National Needs*.[2] In that report, approximately 30 NASA ground test facilities were categorized as strategically important and those facilities were selected by NASA to comprise the ground test portion of the ATP portfolio. Flight test assets in the ATP portfolio were selected on the basis of analysis documented in a FY 2006 NASA Program Decision Memorandum.

Before ATP was created, a shrinking customer base and cuts in available resources resulted in a decline in the condition and capability of NASA's aeronautics test systems. The strategic support and financial resources to ensure that important capabilities were maintained, relevant and appropriately priced were lacking. Prices were at risk of becoming unstable, burdening testers with broader non-recurring infrastructure costs when utilization was low, and prices were incommensurate with the value facilities provided to users. Furthermore, the suite of U.S. test capabilities was in danger of becoming inferior to foreign capabilities.

Since its inception, the customer base for ATP has continued to shrink. Utilization of ATP wind tunnels has declined by more than 50% from the FY 2006 levels, and demand for flight testing has declined similarly. This significant decrease in customer usage is attributable to several factors, including the overall decline in new programs and projects in the aerospace sector; the impact of computational fluid dynamics (CFD) on the design, development, and research process; and, the reduction in procurement funding within the largest consumer of ATP wind tunnel and flight test time, the Aeronautics Research Mission Directorate (ARMD). Retirement of the Space Shuttle Program and the recent perturbations of the Constellation Program will exacerbate this downward trend.

Utilization is a critical factor for a program that relies on customer revenue to recover cost, and continued decreasing utilization is an indicator of excess capacity and in some cases low-risk redundancy (i.e., several facilities with basically the same capability and overall low utilization). However, low utilization does not necessarily translate to lack of strategic importance. Some facilities with relatively low utilization are nonetheless vitally important, usually because of the uniqueness of the capability. Therefore it's crucial that ATP periodically revisit and determine which of its test capabilities are strategically important and then address the challenges associated with both sustainment and improvements. Strategic concerns for the program map to the following areas of program responsibility:

1. Ownership and management of test capabilities
2. Workforce
3. Strategic alliances and partnerships
4. Understanding industry needs
5. Condition of capabilities
6. Capability improvements
7. Price stability

B. Challenges and Uncertainties

Uncertainties with respect to *demand* for test time using ATP capabilities leads to uncertainty with respect to *budgetary* sufficiency of the program to make those capabilities available, given that a substantial portion of the test facility operating costs (approximately 50%) are recovered from user occupancy fees. Together, these uncertainties present significant programmatic challenges for ATP and are stated below in the form of risk statements:

1. *Uncertainty about test requirements*: Given the downward utilization trends and increasing uncertainties with respect to demand for the national aeronautics test capabilities as indicated in Figure 3, there is a risk that ATP fails to accurately identify test requirements and invest accordingly across its portfolio in order to sustain the suite of capabilities necessary to advance U.S. leadership in aeronautics. Investing across the portfolio indiscriminately (in operations, maintenance and upgrades) compromises ATP's ability to meet the test requirements of the future. Several mitigations will be employed:

    a. Work through NPAT to develop a process to provide insight into future government programs and aeronautics testing needs
    b. Work closely with ARMD research programs to understand and plan for required research testing
    c. Work with industry groups to develop a process to provide understanding of future potential needs
    d. Work to support the National Aeronautics R&D Plan (NSTC, 2010)[3] and National Aeronautics RDT&E Infrastructure Plan[4], NASA internal aeronautics test capability needs and infrastructure reviews, etc.
    e. Work through NPAT to establish appropriate reliance and partnership agreements

2. *Uncertainty about budget sufficiency*: Given the relatively flat NASA program budgets for the coming years as well as the continued low or declining facility utilization and resulting inadequate cost recovery from user fees, there is risk of a significant mismatch between the cost for providing the strategically important aeronautics test capabilities and the available budgetary resources. Mitigations include:

    a. Establish and maintain consistent and comprehensive business policies and practices to ensure ATP stays within statutory budgetary levels across its entire portfolio, constantly assessing budgetary sufficiency, including shifting money between projects as required
    b. Work with Research Centers to ensure a proper focus on facility utilization status, operational readiness, workforce competency and facility reliability
    c. Work with the DoD (through NPAT) and others to identify approaches to pursuing significant funding justifications based on explicit mappings to U.S. competitiveness, national defense, and space exploration
    d. Develop partnerships and reliance agreements to reduce the total size of aeronautics testing infrastructure
    e. Establish pricing policies and strategies that will maximize the dollars recovered from user fees

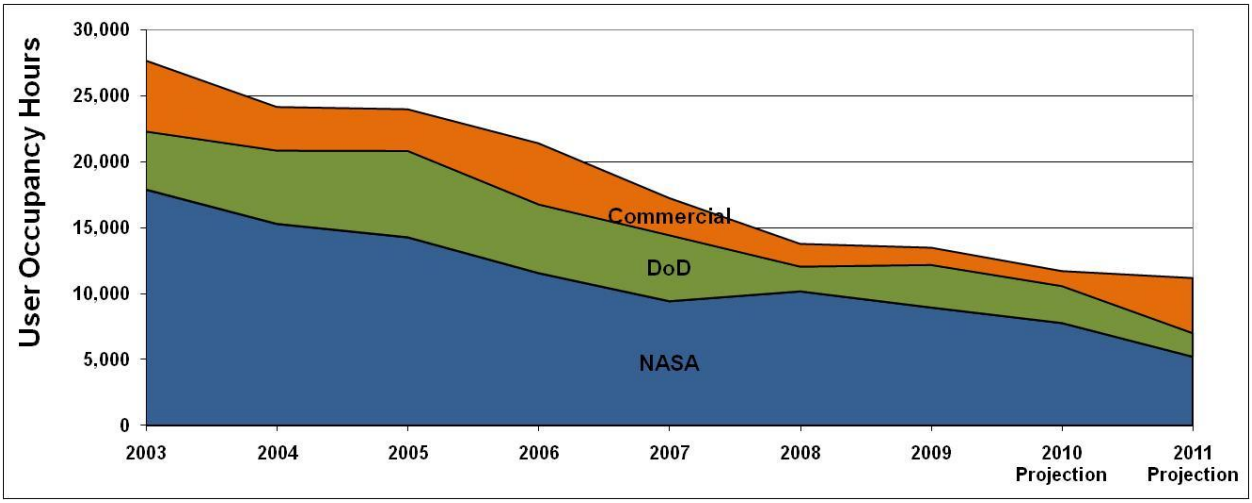

Figure 3 The ATP Portfolio Utilization Trends

IV. Strategic Goals, Objectives and Initiatives

A. Strategic Goals

As shown in Figure 4, ATP's goals and objectives, as well as its strategic initiatives and measures of success all flow from its vision and mission, and are strongly influenced by the realities and responsibilities of operating a large and costly portfolio. Six strategic goals reflect the desired ends that ATP will strive to achieve:

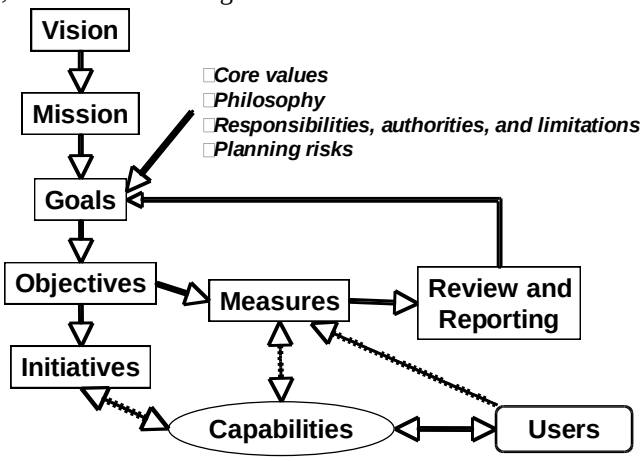

Figure 4 ATP Components of the ATP Strategic Plan

Strategic Goal #1: Ensure that Test Capabilities Meet Current and Projected Customer Requirements
ATP will provide the optimal set of aeronautics test capabilities given the resources it has available, for current and future needs. At the same time, it will ensure that the nation has access to the capabilities necessary to advance U.S. aeronautics leadership.

Strategic Goal #2: Satisfy Test Customers through Operational Excellence
ATP and the relevant NASA Research Centers will understand and meet their customers' current expectations along multiple dimensions — providing available, productive, reliable, and secure facilities; high-quality data; and cost efficiency. The Research Centers are primarily responsible for operating NASA's test capabilities. ATP's role will be to provide financial underpinning and oversight and facilitate the ongoing operational improvement of the capabilities in its portfolio.

Strategic Goal #3: Sustain ATP's Capabilities over the Long Term
ATP facilities average more than 50 years old and need maintenance and revitalization. ATP directly controls the bulk of the funds for maintaining and improving NASA aeronautics test capabilities. At the same time, funding income for testing is decreasing. Together, these two factors will compel ATP to make tough decisions about which test capabilities to sustain in its portfolio. Delay in making these decisions, or failure to do so altogether, will likely be at a cost to the nation — either in the loss of other capabilities due to closures or system failures, or in unnecessary expenditures.

Strategic Goal #4: Maintain Workforce Excellence
The workforce that operates ATP capabilities is essential to productive, safe and responsive testing. NASA's Research Centers manage that workforce. Consequently, here ATP's role is limited to providing guidance and oversight in support of the centers.

Strategic Goal #5: Ensure Balanced Budgets
Currently, almost half of cost to operate and maintain ATP's ground test facilities is recovered from customer fees. Flight test capabilities initiated nominal customer fees in FY10. But in any given fiscal year, customer programs can experience unanticipated delays and cancellations, making those revenue streams unreliable. Over multiple years, the program testing needs and budgets are variable, causing revenue from individual facilities to fluctuate; sometimes dramatically. ATP will work to match capacity with demand to limit the impact of customer revenue shortfalls.

Strategic Goal #6: Provide Coherent Cost and Pricing Structures
Experience has shown that full-cost recovery and rapid price fluctuations greatly aggravate the effect of unsteady revenue streams on pricing and facility management. These in turn undermine customer confidence and make it difficult to plan for usage of facilities. Budgeting processes applied in the past through NASA's research centers obscured the actual costs of various testing capabilities, preventing meaningful comparisons of different facilities. ATP will provide stable and competitive pricing so that testing customers can develop effective, productive and reasonable testing plans.

B. Strategic Objectives, Initiatives and Annual Performance Goals

While strategic goals provide a concise description of ATP's priorities and describe the basic outcomes for which the program aims, they are too broad and general to indicate a clear course of action, allow for direct assessment of progress, or function as accountability targets. At the true center of the ATP strategic plan are specific supporting objectives with associated strategic initiatives. Together, the program's goals, objectives and initiatives provide a viable path towards achieving ATP's mission. ATP's strategic initiatives can be grouped into three categories:

1. *Assessments*: To make the decisions and investments that will enable it to achieve its strategic goals and objectives, ATP must have the necessary information and facts. This group of initiatives focuses on assessing the current and future state of ATP's and the nation's aeronautics test capabilities.

2. *Decision Frameworks*: The decision frameworks aid ATP in making programmatic decisions by assembling pertinent capability-based information into a single document. The frameworks also allow stakeholder insight into the decision making process. Given ATP's strategic role in managing NASA's and the nation's test capabilities, transparency about its plans and activities is important to all of the stakeholders in the aeronautics testing community. NASA Centers, which provide the actual testing capabilities, need to understand ATP's goals and understand how their individual center's facilities fit into the big picture of ATP test capabilities. Partners, such as the DoD, need to be assured that ATP decisions, where relevant, are aligned with their interests. The public's representatives need to know that ATP has considered the alternative facility options and is delivering the required capabilities. Finally, ATP's customers need to know what capabilities will be available to them in the future.

3. *Investments:* The primary method ATP employs for managing test capabilities in its portfolio is by making well-informed investments of its resources. This group of initiatives primarily includes programs for distributing these resources. This occurs in both a broad sense and a narrow sense. The more narrow sense is limited to choosing which capabilities ATP must support. The broader sense looks to finding the correct balance of funding across operational support, maintenance and improvement of facilities, development of the workforce, or building new capabilities.

ATP has established Annual Performance Goals (APG) to determine the extent to which the program's mission and top level goals and objectives are being achieved. For FY 2011 ATP will be evaluated by both NASA and the Office of Management and Budget against the following two APGs:

APG 11AT12: Achieve customer satisfaction ratings > 90% for overall quality and timeliness of ATP facility operations, based on documented customer feedback

APG11AT13: Deliver at least 90% of on-time availability for operations and research facilities

V. Conclusion

Ensuring access to a balanced portfolio of national aeronautics test capabilities is a compelling vision and ATP is highly committed to make that vision a reality. The U.S. needs to right-size its portfolio of aeronautics test facilities across the government and fill gaps between existing and needed capabilities. Fiscal realities dictate that low-risk redundancies will have to be eliminated in order to focus resources on new and vital test capability development. By reducing redundancies and costs, ATP will lay the groundwork for NASA to invest in new test technologies and new capabilities that will advance U.S. aeronautics leadership in the future. This work will require a new level of cooperation and a long-term view from stakeholders. Explicit reliance relationships are required between entities that have previously operated independently; today neither NASA, nor the DoD, nor the private sector can afford to provide independent capabilities. To accomplish its mission ATP needed a strategic plan to identify a path forward, guide progress and offer transparency to all involved. This paper has defined ATP's challenges and outlined the approach the program will take over the next five years to address them and realize its vision for a relevant and robust portfolio of aeronautics ground and flight test capabilities that advance U.S. leadership in aeronautics.

References

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[4] National Plan for Aeronautics Research and Development Test and Evaluation Infrastructure, Committee on Technology Aeronautics Science and Technology Subcommittee, National Science and Technology Council, Washington DC, 2010