IAIPT: A Government Partnership, Developing Advanced Concepts and Capabilities for the NAS

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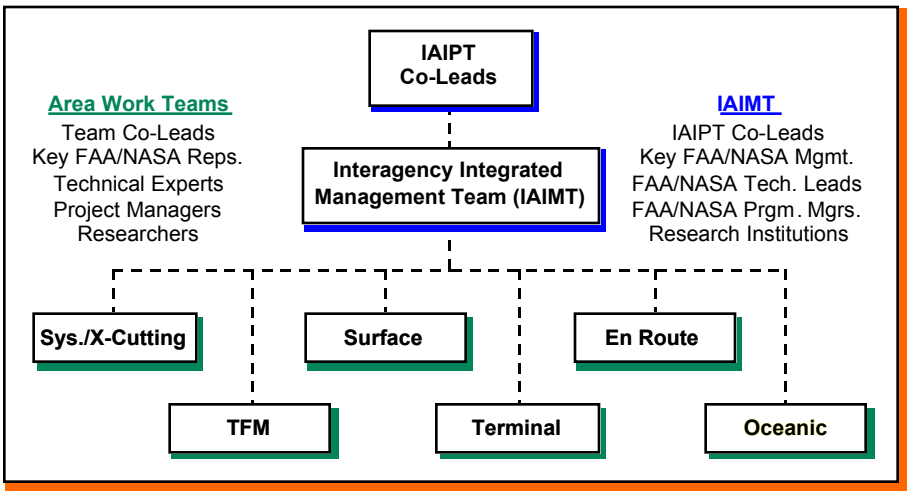
The FAA and NASA have a long history of working together on integrated air traffic management (ATM) systems to enhance the capacity, efficiency, and safety of the National Airspace System (NAS). Examples of FAA/NASA collaboration include: 1) NASA's development of Center-TRACON Automation System (CTAS), an integrated set of automation tools for assisting air traffic controllers in handling terminal area traffic, which began in 1986, 2) FAA's Terminal Air Traffic Control Automation (TATCA) Program, established in 1991 to develop automation functions/tools to meet the operational needs in the terminal area, and 3) the 1991 Memorandum of Agreement between NASA and the FAA for development, evaluation, and implementation of CTAS at the William J. Hughes Technical Center and selected operational sites. In September 1995, both federal agencies reconfirmed their partnership by signing a Memorandum Of Understanding on Airspace System User Operational Flexibility and Productivity. As a result, the FAA/NASA Interagency ATM Integrated Product Team (IAIPT) was formed. The IAIPT[1] has since evolved to what the organization is today.

[1] The IAIPT Co-Leads are the FAA's Thomas Proeschel, Lead, FAA/NASA Integrated NAS Research (AAR-230), and NASA's Robert Jacobsen, Director, Aviation System Capacity Program and Advanced Air Transportation Technologies Project. The IAIPT Executive Secretaries are Del Weathers (NASA) and Kenneth Cobb (FAA).

The IAIPT's mission is to plan and conduct integrated ATM R&D activities to maximize the safety, efficiency, and flexibility of the current and future NAS. In this context, ATM comprises air-based and ground-based air traffic control and traffic flow management tools and procedures. The emphasis of the IAIPT is on the development and validation of system improvements that can be implemented within the next 15 years. As shown in the figure below, the three major elements of this organization are: 1) the IAIPT Co-Leads, 2) the Interagency Integrated Management Team (IAIMT), and 3) Area Work Teams (AWTs). The IAIPT Co-Leads develop the overall research approach to accomplish the ATM R&D agenda for both



IAIPT Organization

agencies. They also provide the leadership of the Interagency Integrated Management Team. The IAIMT consists of the ATM research managers of NASA, FAA, and supporting external research organizations (e.g., MITRE CAASD, Volpe National Transportation Systems Center, MIT Lincoln Laboratory). The IAIMT works together to solve resource issues, determine schedules for research products, and develop linkages for collaboration. The AWTs execute specific research activities in each of the research areas encompassed by the IAIPT (e.g., system/cross-cutting, traffic flow management, surface, terminal, en route, oceanic). Together, these elements provide the structure and means for communications and resolution of issues as well as integration across research domains.

Oversight of the IAIPT is accomplished by the FAA ATS Subcommittee on Air Traffic Services and the NASA ATM R&D Executive Steering Committee, subcommittees of the R,E&D Advisory Committee and the Aero-Space Technology Advisory Committee, respectively. The subcommittees are comprised of users, industry representatives, and technical and operational experts.

The IAIPT is responsible for initiatives, feasibility demonstrations, program planning, oversight, and communications with the user community. Specifically, the IAIPT coordinates the agencies' planning and execution of the concept exploration and concept development phases of the ATM product development life cycle. As the research matures to a certain point, the responsibility for managing the

prototype development and validation, full-scale development, deployment, and operations is transferred from the IAIPT to the appropriate domain IPT within the FAA (e.g., En Route IPT, Terminal IPT, Traffic Flow Management (TFM) IPT, Free Flight Program Office).

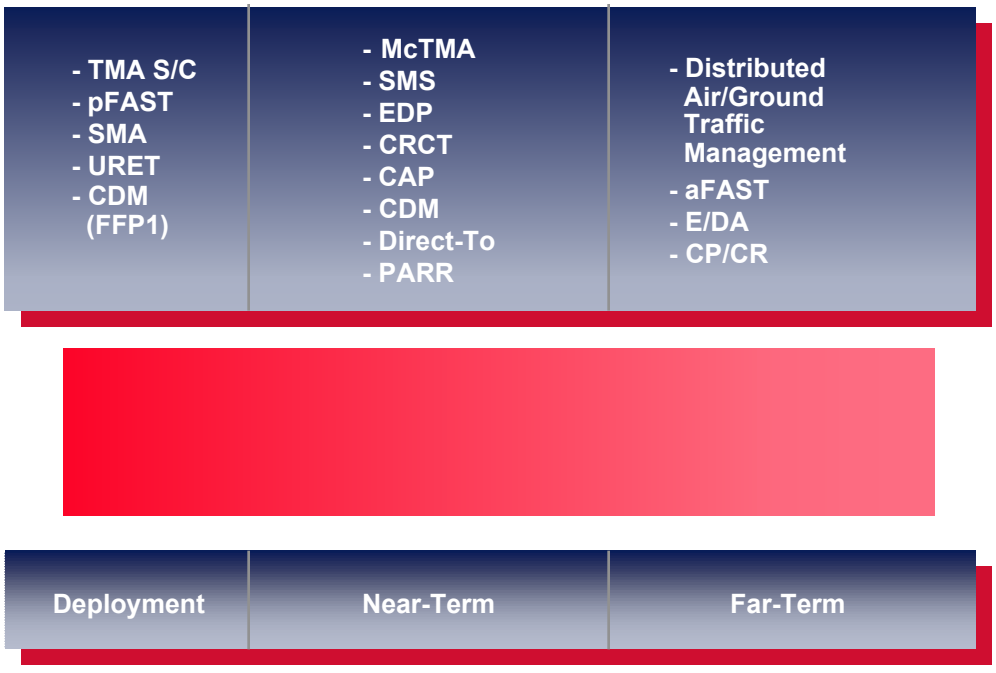
Within the IAIPT, the FAA provides the guiding operational concept and architecture for the NAS that serves as the framework under which much of the research is performed. The FAA also provides leadership, direction, and guidance relating to acquisition policy, research, and system prototyping of the air traffic system.

NASA provides technical leadership and expertise relating to concept exploration and concept development of designated sub-elements of the NAS Concept of Operations and NAS Architecture. NASA brings forth, for FAA's consideration, advanced technologies and transfers those technologies when they achieve sufficient maturity for prototype and full-scale development.

NASA activities related to ATM technology are encompassed within its Advanced Air Transportation Technologies (AATT) Project. FAA activities related to ATM technology are contained in R,E&D programs and portions of its F&E programs.

Together, the FAA and NASA use their technical expertise to develop advanced air traffic decision support tools, improve training efficiency, and enhance safety through human factors research.

The scope of IAIPT research, shown in the figure below, focuses on near-term and far-term research products. These include:
IAIPT products that have transitioned to the FAA's Free Flight Phase 1 (FFP1) Program include: Traffic Management Advisor - Single Center (TMS S/C), Passive



Scope of IAIPT Research

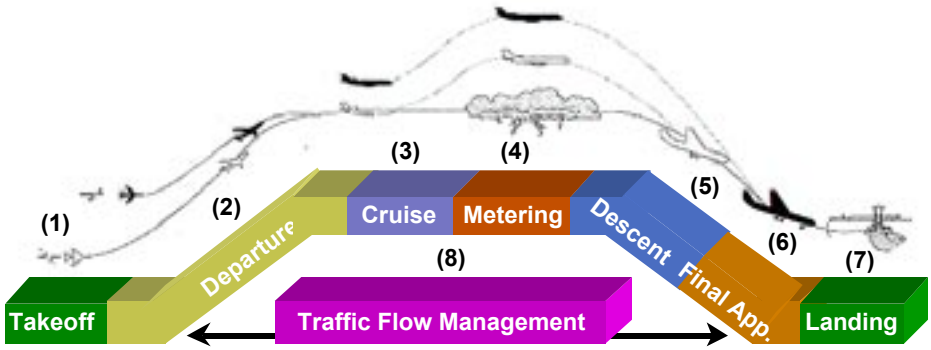
Final Approach Spacing Tool (pFAST), Surface Management Advisor (SMA), user Request Evaluation Tool (URET), and Collaborative Decision Making (CDM) tools.

Included under far-term research is NASA's AATT activity, Distributed Air/Ground Traffic Management (DAG-TM). DAG-TM is a proposed Free Flight concept for gate-to-gate NAS operations for beyond 2015 in which flight deck crews, air traffic service providers, and aeronautical operational control facilities use distributed decision-making to enable user preferences and increase system capacity, while meeting air traffic management requirements. DAG-TM addresses several ATM gate-to-gate operational challenges of the current NAS.

In August 1999, the RTCA Select Committee on Free Flight Implementation, 2003-2005 Capabilities Working Group, identified the next set (post-FFP1) of low-risk capabilities to deliver benefits to NAS users for the 2003 through 2005 period. In December 1999, the working group presented its recommendations to the RTCA Select Committee. The working group developed a set of government/industry recommendations for the FAA to use in developing a Free Flight Phase 2 (FFP2) Program. These recommendations included: (a) capabilities believed mature enough for implementation during the 2003-2005 period, and (b) other needed capabilities not believed ready for implementation during this period, and include some of the IAIPT near-term research products on the previous page.

This past January, 2000, the IAIPT developed the *Integrated Plan for Air Traffic Management Research and Technology Development,* Version 4.0, which describes the joint research projects being conducted by, and the combined resources and expertise of, the FAA and NASA in the area of ATM. The integrated research program described in the Integrated Plan comprises a total of $629.7M in FAA and NASA resources over a six-year period (2000-2005).

Brief descriptions of the IAIPT research products, as applied over the different phases of flight, are provided below:



Air Traffic Management Phases of Flight

◊ Multi-Center Traffic Management Advisor [4]
◊ Surface Management System [1,7]
◊ Expedite Departure Path [2]
◊ Collaborative Routing Coordination Tool [8]
◊ Problem Analysis, Resolution, and Ranking [3]
◊ Active Final Approach Spacing Tool [6]
◊ En Route/Descent Advisor [3,4]
◊ Airborne Self Spacing Planner [6]

◊ Collaborative Arrival Planner [6]
◊ Future Collaborative Decision Making Tools [8]
◊ Direct-To [3,4]
◊ Airborne Hazard Avoidance Planner [2,3,4,5]
◊ Dynamic Route Planner [8]
◊ Conflict Probe/Conflict Resolution [3]

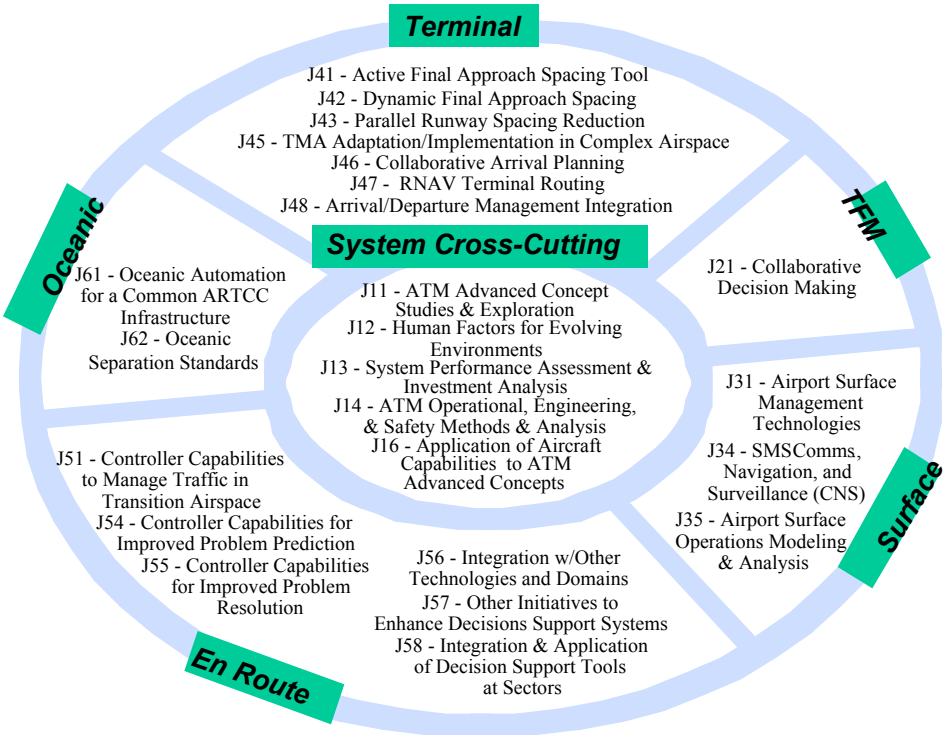
- Multi-Center TMA (McTMA) – Provides aircraft sequences and spacing information to air traffic controller while coordinating arrivals from multiple ARTCCs into a single TRACON.
- Surface Management System (SMS) - Advises airlines, ramp controllers, and air traffic control on push-back and taxi navigation for efficient surface operations.
- Expedite Departure Path – Coordinates departure sequencing and scheduling to enable efficient departures ascent and merges.
- Collaborative Routing Coordination Tools (CRCT) – Identifies and analyzes flow problem situations, locates flights involved in the problem, develops and evaluates the reroute strategy, and coordinates the implementation of the reroutes strategy.
- Collaborative Arrival Planner (CAP) – Accommodates user preferences in arrival flow management through collaborative decision support tools for users and air traffic service providers.
- Future CDM Tools – Provide ATM controllers with a common picture of the NAS, provides NAS airline customers and FAA flow managers with enhanced operational flexibility, and enables on-line, operational analyses of past, current, and future TFM conditions to monitor and continually enhance the TFM process.
- Direct-To (D2) – Advises sector controllers of time-saving direct routing options for aircraft within an ARTCC.
- Problem Analysis, Resolution, and Ranking (PARR) – Analyses an aircraft-to-aircraft or aircraft-to-airspace problem and generates a set of ranked resolutions for controller evaluation. PARR is an enhancement to FFP1 URET.
- Active Final Approach Spacing Tool (aFAST) – Provides arrival aircraft speed and heading advisories to the TRACON arrival controllers.
- En Route & Descent Advisor (E/DA) – Provides advisories to ARTCC sector controllers on merging, sequencing, and spacing of aircraft for efficient climb, cruise, and descent constraint and flow management.
- Airborne Self Spacing Planner – Provides aircraft flight crew with merging and self-spacing guidance cues to manually or automatically manage the aircraft speed profile from terminal entry to final approach. (DAG-TM)
- Airborne Hazard Avoidance Planner – Provides aircraft flight crew with tactical situational awareness of surrounding traffic enabling efficient self-separation. (DAG-TM)
- Dynamic Route Planner – Enables flight crews to plan and re-plan new flight routes in real time based on current NAS status and AOC directed requirements. (DAG-TM)
- Conflict Probe/Conflict Resolution – Provides enhancements to aircraft-to-aircraft and aircraft-to-airspace problem prediction, enables aircraft-to-hazardous weather conflict detection, and provide trial planning and automated problem resolution.

Version 4.0 of the Integrated Plan introduces IAIPT research linkages to the following: 1) FAA Research Management Process, 2) FAA Process Guidelines for System Prototypes in Active Air Traffic Control Facilities, 3) NASA Air Traffic Management System Development and Integration Procurement, 4) RTCA 2003 - 2005 Capabilities Working Group, 5) FAA Safe Flight 21/Capstone Program and

NASA Support/Participation, and 6) Tie-In Between the National Science and Technolgy Council NAS Efficiency Roadmap and FAA/NASA Planning. Also, the capabilities needed for the NAS 2005 environment, as described in *A Concept of Operations for the National Airspace System in 2005,* dated September 30, 1997, are identified and clearly linked to research activities which are now more consistent with anticipated budgets.

The specific research projects and activities, collaboratively planned and performed by the FAA and NASA, are described through a set of Joint Research Project Descriptions (JRPDs). As shown in the figure below, the JRPDs are encompassed within six IAIPT ATM research areas: System/Cross-Cutting, Traffic Flow Management, Surface, Terminal, En Route, and Oceanic. The specific research activities are executed by the respective Area Work Teams.

Recent successes of the IAIPT include:



IAIPT ATM Research Areas and JRPDs

- National Airspace Redesign Management Strategy Plan completed
- DAG-TM Operational Concept developed
- Deployed CDM decision support tools improved the ground stop process through increased predictability
- Data Link Human Factors and Pilot/Flight Deck CHI evaluations completed
- aFAST and Initial Surface Management System Operational Concepts developed

- Multi-Center TMA at Philadelphia Initial Benefits and Concept of Use Studies completed
- Joint Human Factors Air-Ground Integration Experiment (AGIE) planning completed and first phase of experiment started
- Initial Direct-To/NAS compatibility testing completed at WJHTC
- PARR decision support tool demonstration to Eurocontrol
- DAG-TM Workshop at NASA Ames
- Continuing transition support to FAA's FFP1 Program.

Near-term plans of the IAIPT include:

- Air/Ground Integration Experiments
- DAG-TM methods and metrics for procedures
- CDM Ground Delay Program Enhancements (GDPE), Control by Time of Arrival, and expanded GDPE FSD
- Dynamic Final Approach Spacing CD
- Parallel Runway Spacing Reduction CD
- Multi-Center TMA Initial Phase 1 adaptation
- AVOSS Version 2 algorithms validation
- RNAV concept procedures evaluation
- Expedite Departure Path CD
- Direct-To CE and field evaluation of concept prototype
- Conflict Probe/TMA Metering Scheduling evaluation
- PARR lab explorations
- Transition to FAA's FFP2 Program.

Through the IAIPT and additional management involvement, including NASA participation in FAA R,E&D Advisory Committee meetings, and similarly, FAA participation in NASA ATM Executive Steering Committee Meetings and Non-Advocacy Reviews, the FAA and NASA have formed a productive partnership that continues to work toward an ATM system of the future that meets the expectations of the aviation community. Further information concerning the IAIPT is available on the Internet: http://www.faa.gov/ara/iaipt