Technology Needs for Civil Operations: NASA Perspective

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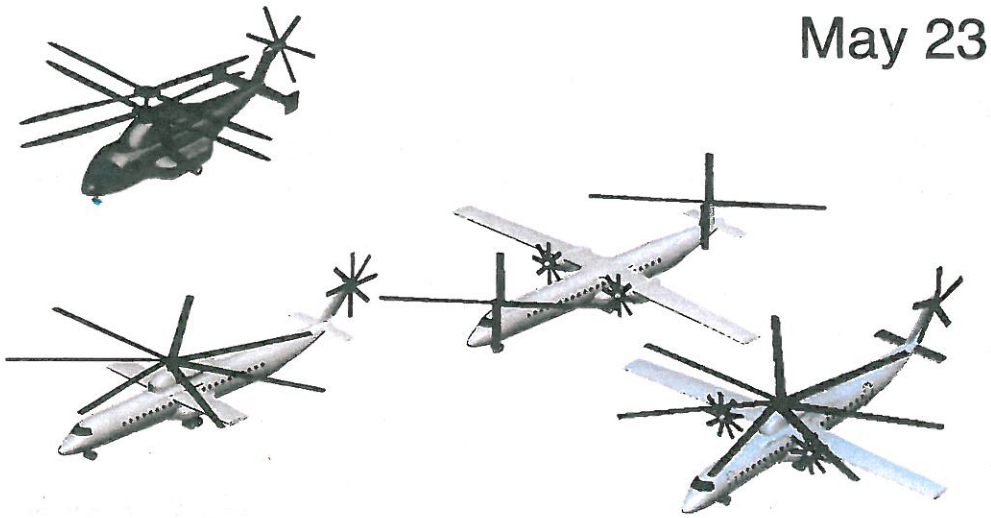
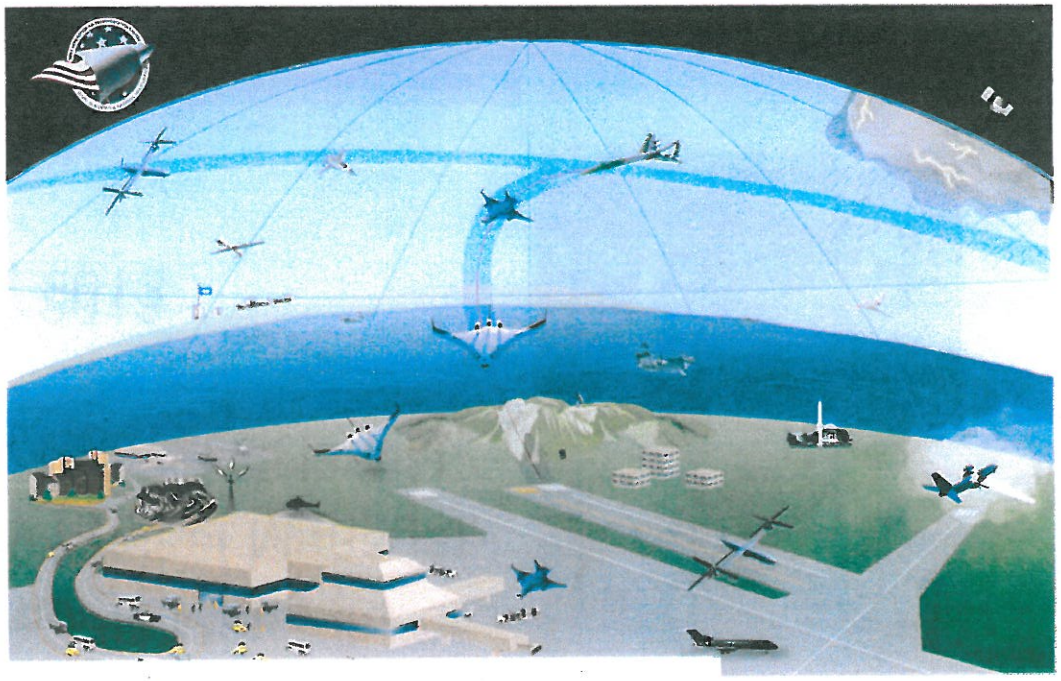
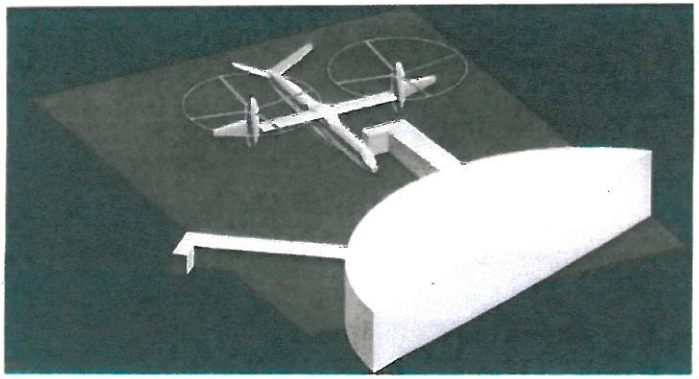
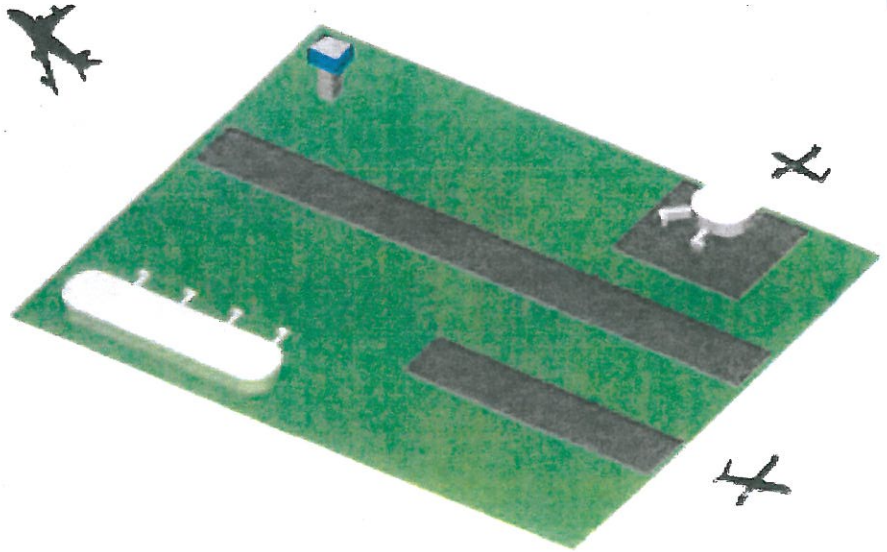


Outline

- NASA vision for future of civil aviation and rotary wing aviation
- Technical Challenges
- Near Term Challenges



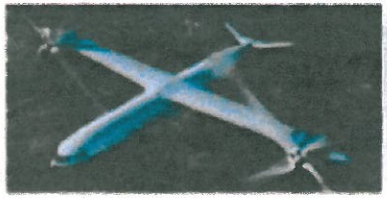




Solving Aviation's Challenges Through NASA Innovation

NASA Aeronautics Programs



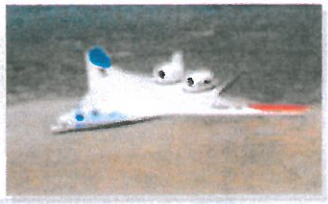


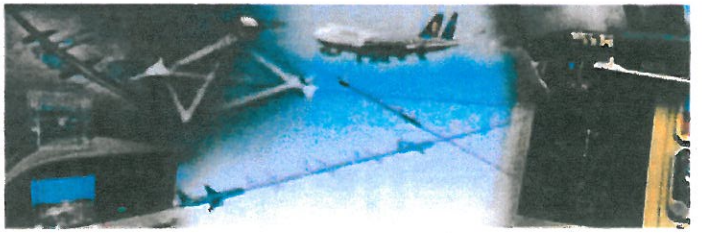

Fundamental Aeronautics Program

Conduct fundamental research that will produce innovative concepts, tools, and technologies to enable revolutionary changes for vehicles that fly in all speed regimes.

Integrated Systems Research Program

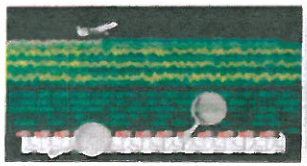
Conduct research at an integrated system-level on promising concepts and technologies and explore/assess/demonstrate the benefits in a relevant environment

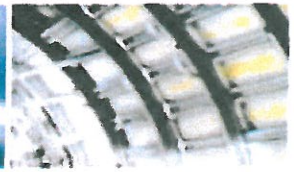
Airspace Systems Program

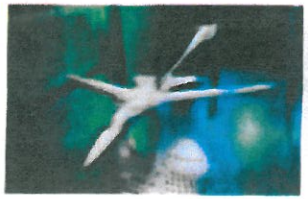
Directly address the fundamental ATM research needs for NextGen by developing revolutionary concepts, capabilities, and technologies that will enable significant increases in the capacity, efficiency and flexibility of the NAS.




Aviation Safety Program

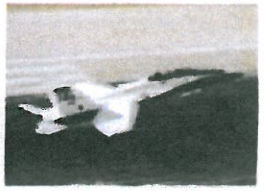
Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to improve the intrinsic safety attributes of current and future aircraft.

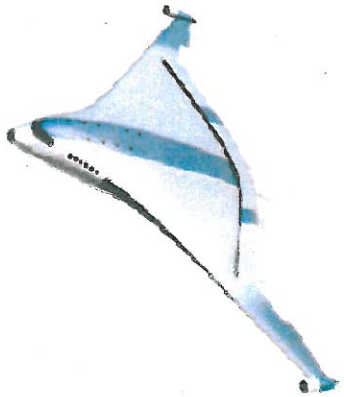



Aeronautics Test Program

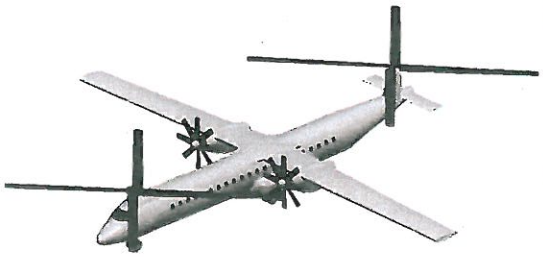
Preserve and promote the testing capabilities of one of the United States' largest, most versatile and comprehensive set of flight and ground-based research facilities.

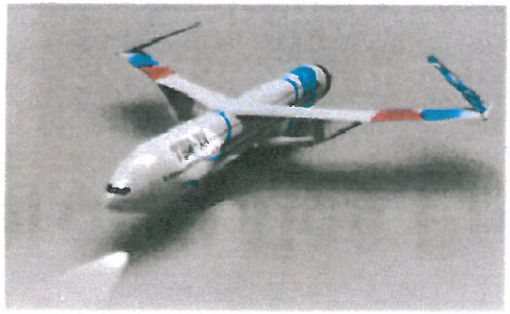



New Vehicle Capabilities Needed



- Energy and efficiency challenges will require much greater performance from future aircraft
- These future aircraft also bring opportunities for greater air mobility options
- Integrating new vehicles with future operations is critical
- NASA is developing tools and technologies to enable industry to design build new vehicles

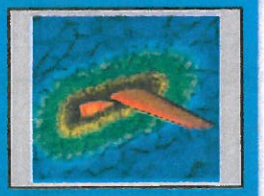


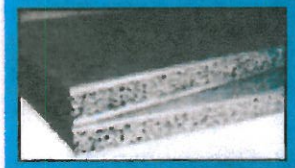


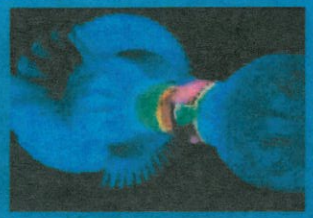
Fundamental Aeronautics Program

Fundamental Aeronautics Program Office

Aeronautical Sciences Project





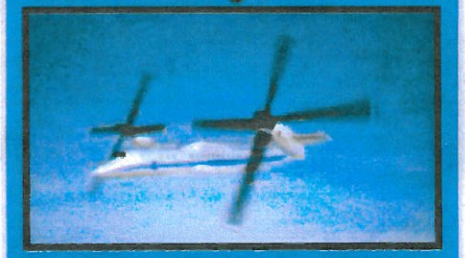


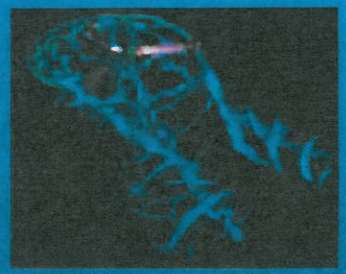
Aeronautical Sciences (AS)
Enable fast, efficient design & analysis of advanced aviation systems by developing physics-based tools and methods for cross-cutting technologies.

Fixed Wing Project

Fixed Wing (FW)
Explore & develop technologies and concepts for improved energy efficiency & environmental compatibility of fixed wing, subsonic transports

Rotary Wing Project



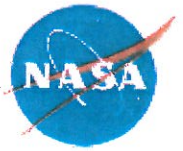


Rotary Wing (RW)
Develop and validate tools, technologies and concepts to overcome key barriers for rotary wing vehicles

High Speed Project

High Speed (HS)
Enable tools & technologies and validation capabilities necessary to overcome environmental & performance barriers to practical civil supersonic airliners.

Rotary Wing Project



Develop and Validate Tools, Technologies and Concepts to Overcome Key Barriers for Rotary Wing Vehicles

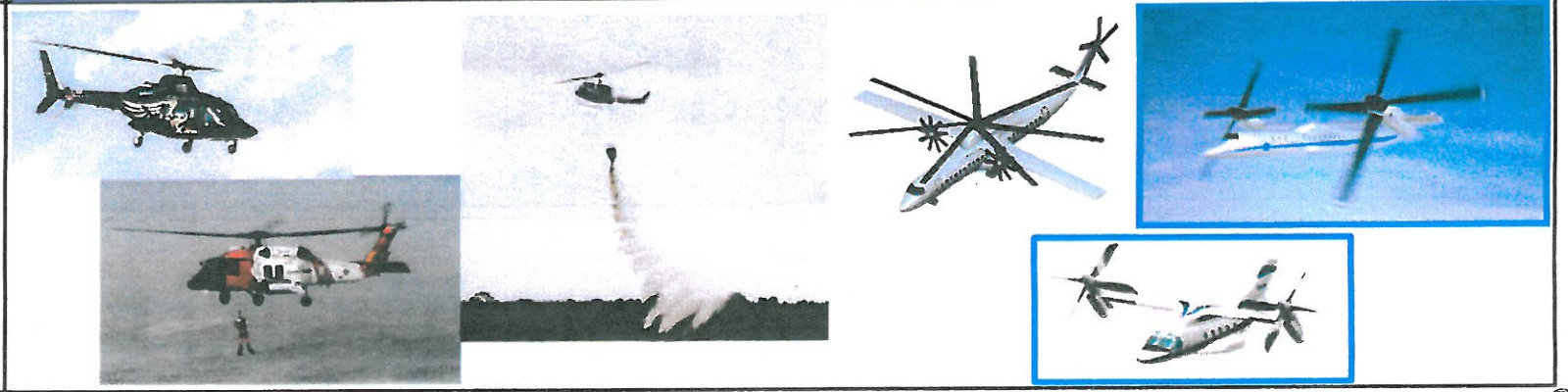
Vision

- Improve capabilities, performance and acceptance of existing and future rotorcraft configurations for civil and dual-use military missions
- Explore and develop new capabilities for rotorcraft use as commercial transportation in national airspace

Scope

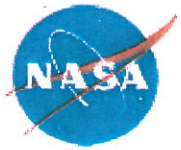
- Conventional and non-conventional light, medium, heavy and ultraheavy rotorcraft
- Technologies that address performance, noise, efficiency, safety, passenger acceptance and affordability

Envisioned Common Civil Configurations and Missions in 2030 and beyond

	Configurations (Definition follows DOD convention for rotorcraft)				
	Very Light	**Light**	**Medium**	**Heavy**	**UltraHeavy**
Missions	•surveillance •delivery •spraying •cargo	•police •training •traffic/ news •power line service •spraying •cargo	•police •EMS •traffic/news •tourism •executive •charter •oil platforms •SAR •cargo	•oil platforms •disaster relief •cargo •logging •construction •firefighting •commuter (30 pax) •cargo	•commercial transport (90-120 pax) •disaster relief •civil reserve aircraft fleet (CRAF) •cargo
	autonomous capability				
Configura-tions					

blue highlight: new mission and/or new configuration

Technologies for Spectrum of Civil Missions and Configurations



	Configurations (Definition follows DOD convention for rotorcraft)				
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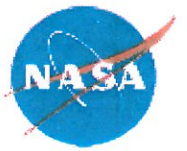
	autonomous capability				
	Most likely to be candidates for autonomous and electric propulsion technologies		Most likely to be candidates for scheduled commercial air service		

blue highlight: new mission and/or new configuration

Technologies for Spectrum of Civil Missions and Configurations



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	Very Light	**Light**	**Medium**	**Heavy**	**UltraHeavy**
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	autonomous capability				
Technology Investments	•autonomous and airspace-related technologies •sensors •batteries •noise	•weight •speed •safety	•payload •SFC •green	•range •noise •cost	

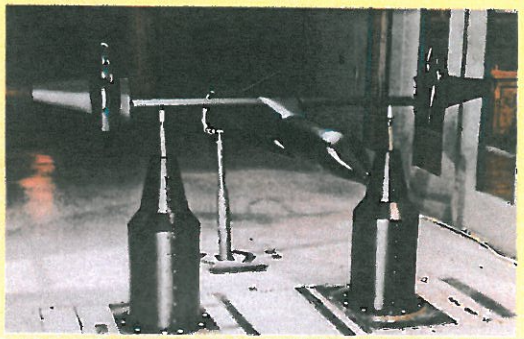
NASA Focus

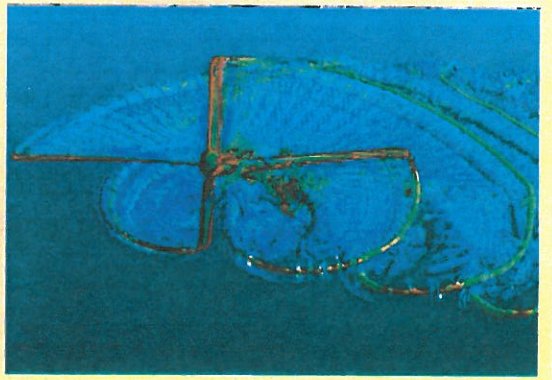
blue highlight: new mission and/or new configuration

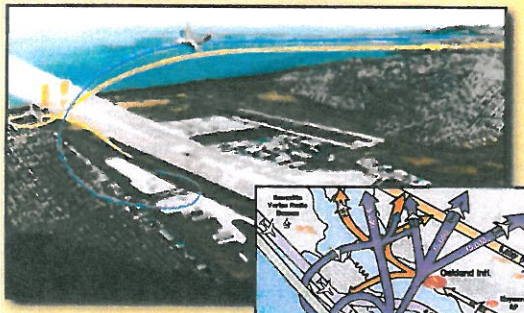
Challenges for Future Rotary Wing Aircraft
(Performance, speed, mobility, payload, efficiency, environment)

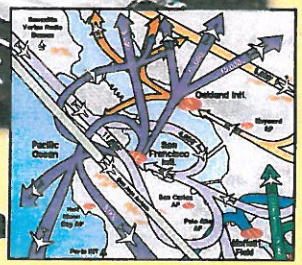
Active Rotor Systems

Modeling and Validation



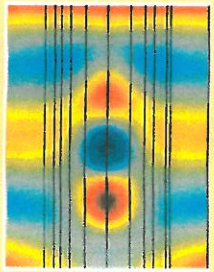


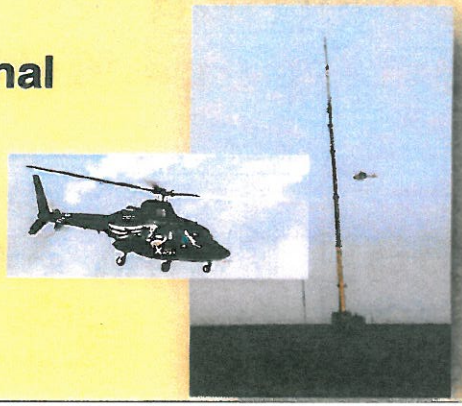




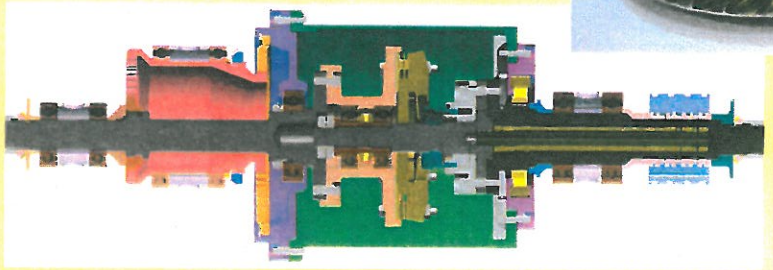
NextGen Integration

Low Noise: External and Internal





Efficient Engines and Drive Systems



NASA Rotary Wing Research Themes

Develop and Validate Tools, Technologies and Concepts to Overcome Key Barriers for Rotary Wing Vehicles

Advanced Efficient Propulsion:

- Demonstrate and mature engine and drive system technologies to enable main rotor RPM variations up to 50% while maximizing propulsive efficiency and minimizing weight penalty.

Advanced Concepts and Configurations:

- Extend flight envelope and maximize capabilities of rotorcraft vehicles with goals of 350 knots, range of 1000 nm, and payloads of up to 13 tons or 120 passengers.

Rotorcraft Integration into NextGen:

- Foster, develop and demonstrate technologies that are critical to the successful commercial operation and passenger acceptance of large rotary wing transports in Nextgen airspace.

Rotary Wing Project Research Areas

Ames Research Center

- Aeromechanics
- CFD
- Flt Dyn & Ctrl
- Experimental Capability
- System Analysis

Glenn Research Center

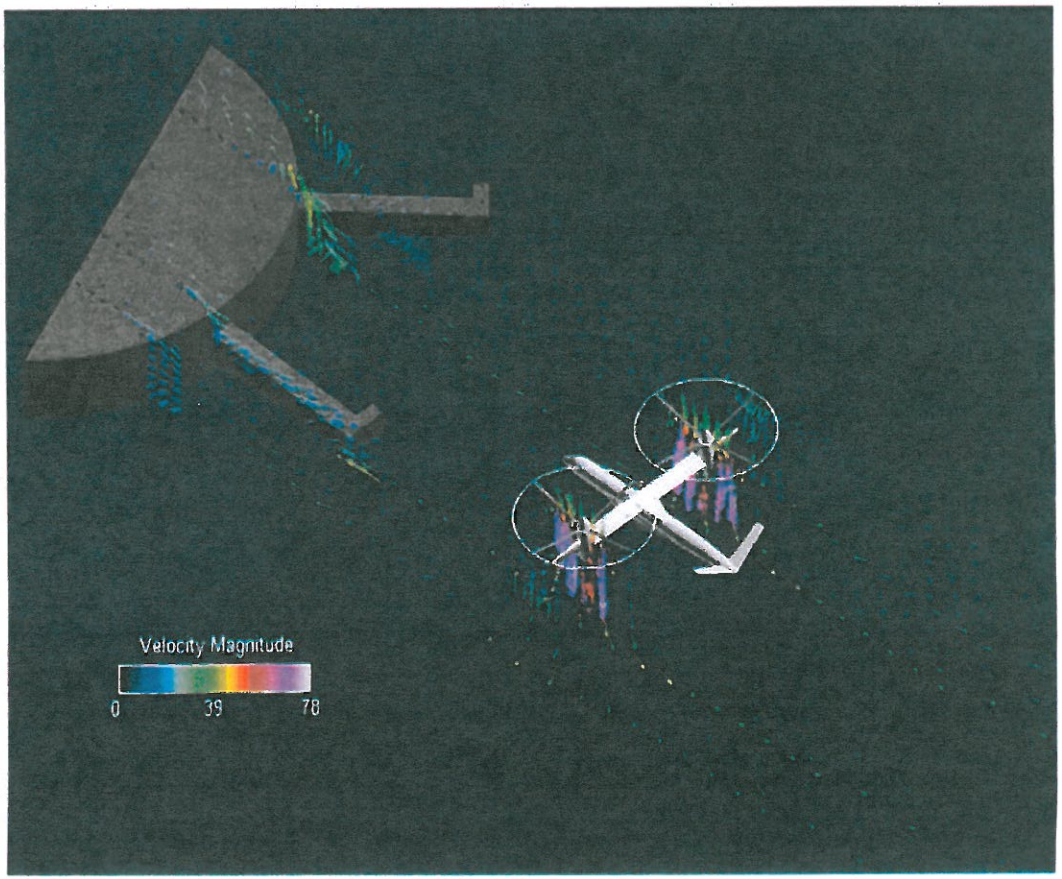
- Drive Systems
- Engines
- Icing
- System Analysis
- CBM

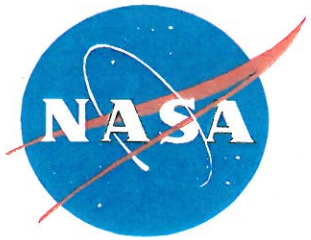
Langley Research Center

- Acoustics
- Aeromechanics
- Experimental Capability
- CFD
- Crashworthiness

To Realize Full Potential of Rotary Wing

- Identify path to develop advanced technology
  - System integration
  - Cost effectiveness
  - Certification
- Investment in infrastructure
  - Laboratories
  - Test Facilities
  - Rapid prototype flight test capability
- Grow a skilled workforce
  - Educational investment
  - University partnerships
  - Hire in time for mentoring
- Educating the general public
  - Safety
  - Noise
  - Capabilities

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