THE FUTURE OF AEROSPACE: ITS CHALLENGES AND OPPORTUNITIES FOR THE 21ST CENTURY

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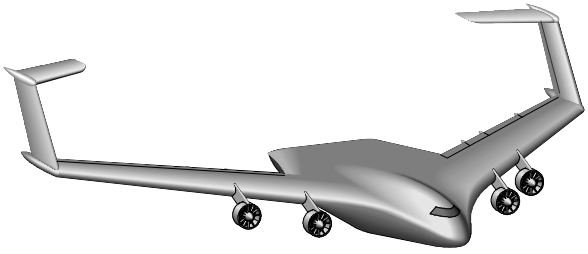
INTRODUCTION

The United States will boldly pioneer new frontiers in aerospace technology, commerce, and exploration in the 21st century with a broad spectrum of revolutionary vehicles designed to pursue our nation's future civil and military vision as presented by the President's *Commission on the Future of the U.S. Aerospace Industry*: ***Anyone, Anything, Anywhere, Anytime***. Over the next 25 to 50 years, we will see far more capable vehicles operating at higher altitudes and speeds, and utilizing more energetic (and potentially more dangerous and difficult-to-handle) fuels; we will see a greater diversity and number of vehicles operating within and through our national airspace; and we will see a new, modern national RDT&E infrastructure evolve to test and evaluate this myriad of new systems. This future vision potentially presents new challenges and opportunities for the fire protection community from a safety and survivability perspective.

NEW, MORE CAPABLE AEROSPACE VEHICLES

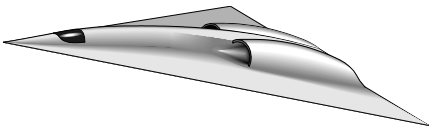
The vehicles supporting this 21st century aerospace vision will include advanced, fuel-efficient military transports with global reach capability and long-range civil transports operating between worldwide commercial hubs; as well as regional jets and a new generation of subsonic and supersonic business aircraft capable of providing air taxi services directly to municipal and community airports – bypassing the major hubs and significantly reducing point-to-point travel times for both business travelers and the general public alike.



Global Reach Military Transports

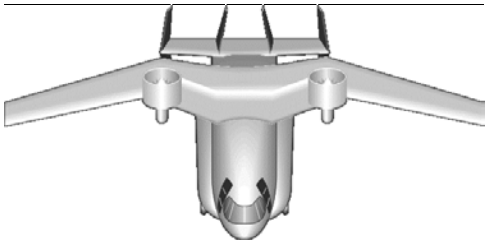
Air Taxis

They will include a host of new air-launched, hydrocarbon-fueled military weapons and aircraft operating in the atmosphere at speeds of up to Mach 8 or greater – changing the current paradigm of subsonic cruise with supersonic engagement to supersonic cruise with hypersonic engagement; and a family of new vertical-/ultra-short takeoff and landing (STOL) aircraft capable of rapidly delivering military assets to the forward edge of the battlefield – as well as bringing people and products closer to, or directly to, their final destinations in the civil sector.



Hypersonic Weapons and Aircraft

Ultra STOL
Intra-Theatre Transports

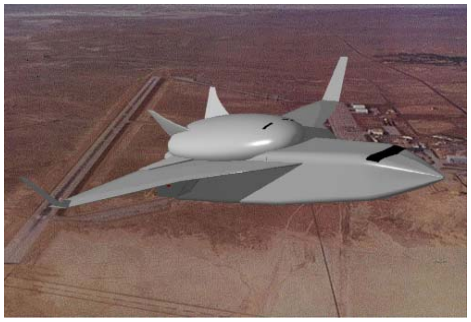


They will include a bevy of small and large unmanned platforms capable of operating autonomously over a broad range of speeds, both for high-risk military operations as well as overnight package and mail delivery – while unmanned combat air vehicles (UCAVs), operating both individually and in swarms, will provide greater military capability in a high-threat environment.

Unmanned Platforms

Unmanned Combat Air Vehicles

They will include a family of trans-atmospheric vehicles that seamlessly traverse the air and space continuum on their way to and from Low Earth Orbit, in similar fashion to the way commercial airliners operate today between city-pairs around the world – providing rapid global response for military purposes, quickly whisking commercial goods and services to an awaiting global marketplace, or transporting excited tourists to their long-awaited vacation in outer space.



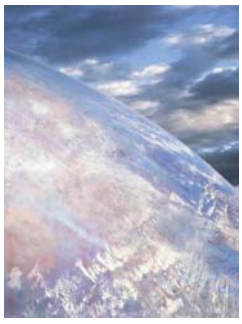
Two Stage-To-Orbit Vehicles

And they will include a family of light-, medium-, and heavy-lift space vehicles – powered by rockets, hydrogen-fueled air-breathers, or a combination of the two – that will help to launch mankind on exciting missions of exploration to the Moon, Mars, and beyond.

Rocket-Based Space Access

Air-breathing/Hybrid Space Access

A NEW, MORE CAPABLE AIRSPACE MANAGEMENT SYSTEM



This wide variety of new military and civil aerospace vehicles will all have to share a common national airspace – one that must be capable of handling 3-5X the number of operations compared to our present system. In addition, the number of airports, way-ports, and spaceports in America's 21st century air traffic system will double (or even triple) compared to those currently in use today as smaller regional and community facilities are effectively utilized to handle the growing numbers of flight operations. Civil airliners (both manned and unmanned), military aircraft (both manned and unmanned), vertical and horizontal takeoff air taxis, vertical and horizontal takeoff space vehicles, and a growing number of general aviation aircraft will all be arriving and departing simultaneously – and they must all do so safely, without an increase in the number of accidents or lives lost. This will, no doubt, be of primary concern to both equipment operators and airport managers alike as they cope with the pressures of moving ever-increasing numbers of people and goods more quickly – anywhere, anytime – in and through the seamless air and space continuum.

A NEW NATIONAL RDT&E INFRASTRUCTURE

Our nation will also see the evolution of new, state-of-the-art research, development, test and evaluation (RDT&E) facilities and ranges that will give America the ability to test these new concepts and capabilities in realistic operational environments. This will include our ability to test new and emerging technologies (such as hypersonic propulsion concepts) in both sub-scale and full-scale, and assess system operational performance and suitability (as well as evaluate system survivability and vulnerability).

A NEW SET OF CHALLENGES -- AND OPPORTUNITIES

The *Commission on the Future of the U.S. Aerospace Industry* recommended that the Administration and Congress adopt the following set of technology demonstration goals as a national priority for the 2010 timeframe:

- In the Area of Air Transportation:
  - Demonstrate an automated and integrated air transportation capability that would triple capacity by 2025
  - Reduce aviation noise and emissions by 90%
  - Reduce aviation fatal accident rate by 90%
  - Reduce transit time between any two points on earth by 50%

- With Regard to Space:
  - Reduce cost and time to access space by 50%
  - Reduce transit time between two points in space by 50%
  - Demonstrate capability to continuously monitor and surveil the earth, its atmosphere and space

- And Relative To Product Cycle Time/Time-to-Market:
  - Cut the transition time from technology demonstration to operational capability from years and decades to weeks and months

A number of activities (such as the National Aerospace Initiative being jointly pursued by the Department of Defense and National Aeronautics and Space Administration and the new Moon/Mars initiative established by the President) have already begun to boldly pioneer new frontiers in aerospace technology, presenting new challenges, as well as opportunities, for the fire protection community – both in the air and on the ground.

Fortunately, the Technology Development Plan (TDP) completed in 1997 and the Next-Generation Fire Suppression Technology Program (NGP) slated for completion in

2006 provide a solid foundation of research and understanding with respect to the physics of fire propagation and suppression applicable to the broad spectrum of current and developmental aircraft systems. As a result of these activities, a number of viable solutions have been identified, developed, and implemented to meet the needs of the Department of Defense, as well as the aerospace community at large. Many of these solutions are relevant to the subsonic and supersonic systems described above.

However, America's future vision foretells a new set of challenges – and opportunities. Hypersonic and trans-atmospheric vehicles will operate at much higher speeds and altitudes – and thus, temperatures, pressures, and flows. This will create different, and potentially more hostile, environments in critical areas throughout the vehicle, such as engine bays and ullage spaces. New and more energetic fuels (such as endothermic fuels and liquid hydrogen), and new fuel delivery systems, will present greater opportunity for fire and explosion, as well as potentially greater challenges for their suppression and mitigation. The demand to reduce the fatal accident rate by 90%, while concurrently increasing air traffic capacity by 3-5X, not only dictates significant increases in fire suppression system effectiveness but also significant reductions in system cost to make them viable for the broad spectrum of vision vehicles.

SUMMARY

The fire protection community has done an outstanding job in identifying viable halon alternatives – the TDP and NGP stand as testaments to your success – but we cannot afford to rest on our laurels, as we did after the implementation of halon; lest we find ourselves, once again, behind the power curve. We must continue to actively pursue new concepts and alternatives to meet the challenges and needs posed by our nation's future vision vehicles. I thank you for your support, and encourage you to keep up the good work!