

Technology Opportunity

Balloon-Launched Remotely Piloted Vehicle

The National Aeronautics and Space Administration (NASA) seeks partners to further develop an aerial observation vehicle system for commercial applications. Under the eXperimental Aerial Platform (XAP) program at Wallops Flight Facility in Virginia, NASA Goddard Space Flight Center (GSFC) originally designed the unmanned, balloon-launched, remotely piloted vehicle for in situ sensing of atmospheric properties. The XAP vehicle system also can be used for real-time aerial observation for security, natural hazard damage assessment, law enforcement, videography, and other applications. GSFC's lightweight, electric-powered system is a versatile, low-cost, and safe monitoring vehicle.



Benefits

- *Controllable*—The XAP vehicle's flight pattern and landing can be controlled remotely with "pilot-in-the-loop" operation, allowing for flight at a constant altitude and low velocity and for recovery without a parachute or net. It also is compatible with commercially available unmanned aerial vehicle autopilot systems.
- *Lightweight*—The vehicle is constructed of hobby-type materials and uses a small propulsion system and microelectronics.
- *Low cost*—This system uses commercial-off-the-shelf technology.
- *Flexible*—Multiple sensors can be used simultaneously.
- *Low power and noise*—The twin electric engines can run on rechargeable batteries, allowing for quiet propulsion with extremely low vibration.

- *Environmentally friendly*—Unlike internal combustion engines or rockets, the XAP vehicle emits no exhaust gases or measurable heat.

Applications

- Environmental monitoring
- Traffic control
- Security surveillance
- Law enforcement
- Border patrol
- Disaster monitoring
- Fire fighting
- Search and rescue
- Military intelligence



The Technology

NASA Goddard Space Flight Center has developed a balloon-launched aerial observation system that offers many advantages over other atmospheric sensing techniques—balloons, other unmanned aerial vehicles, satellites, and ground-based monitoring systems—and can be used in video observation for a variety of applications.

In atmospheric sensing, typical monitoring methods have many limitations. Satellite and ground-based methods do not provide for in situ sensing of conditions. Balloons and most unmanned aerial vehicles cannot provide constant-altitude, low-velocity flight profiles at low cost. In addition, most unmanned aerial vehicles are gas-powered, producing undesirable exhaust, heat, and vibration that affect atmospheric sensing and video observation.

To address these limitations, GSFC created the XAP vehicle—a lightweight, electric-powered unmanned aircraft that is released from a lighter-than-air balloon. The aircraft has an 8-foot wingspan, weighs about 5 lbs., and can carry a miniature video camera and/or atmospheric sensors. Constructed of hobby-type materials, the aircraft requires only a small propulsion system of efficient, quiet, environmentally friendly electric motors powered by rechargeable batteries. The electrical energy stored for propulsion can be used for maintaining altitude or penetrating winds. Operating at an altitude of 500 feet, the aerial observation system can fly for 20 minutes at 10 miles per hour. Lithium batteries might increase motor endurance to over 30 minutes. Balloon launching makes this endurance possible; motors on ground-launched electric vehicles suffer from the high current demand required for climb.

Tethered balloons allow the system to be released at 6,000 ft. above sea level. Future versions of the

system could be released from free-flying balloons at altitudes above 30,000 ft. This high-altitude capability will enable the future systems to gather in situ data from within clouds and storms. The quiet propulsion system also allows unobtrusive video observation over areas such as golf courses, malls, or residential communities. (Legislation and regulations for unmanned aerial vehicle operations, including operation over populated areas, are being developed.)

Commercial Opportunities

The XAP vehicle has been proven conceptually in the eXperimental Aerial Platform program, which focuses on obtaining atmospheric measurements such as temperature, humidity, and winds using a test vehicle. In addition to environmental monitoring applications, the XAP vehicle can have broad commercial appeal. However, further technical and manufacturing developments are required before the system can become commonplace in the market. NASA seeks a company interested in working with GSFC to further develop the technology and assist in transferring it to commercial applications.

Contact

If you would like more information or are interested in pursuing partnership opportunities with GSFC, please contact:

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