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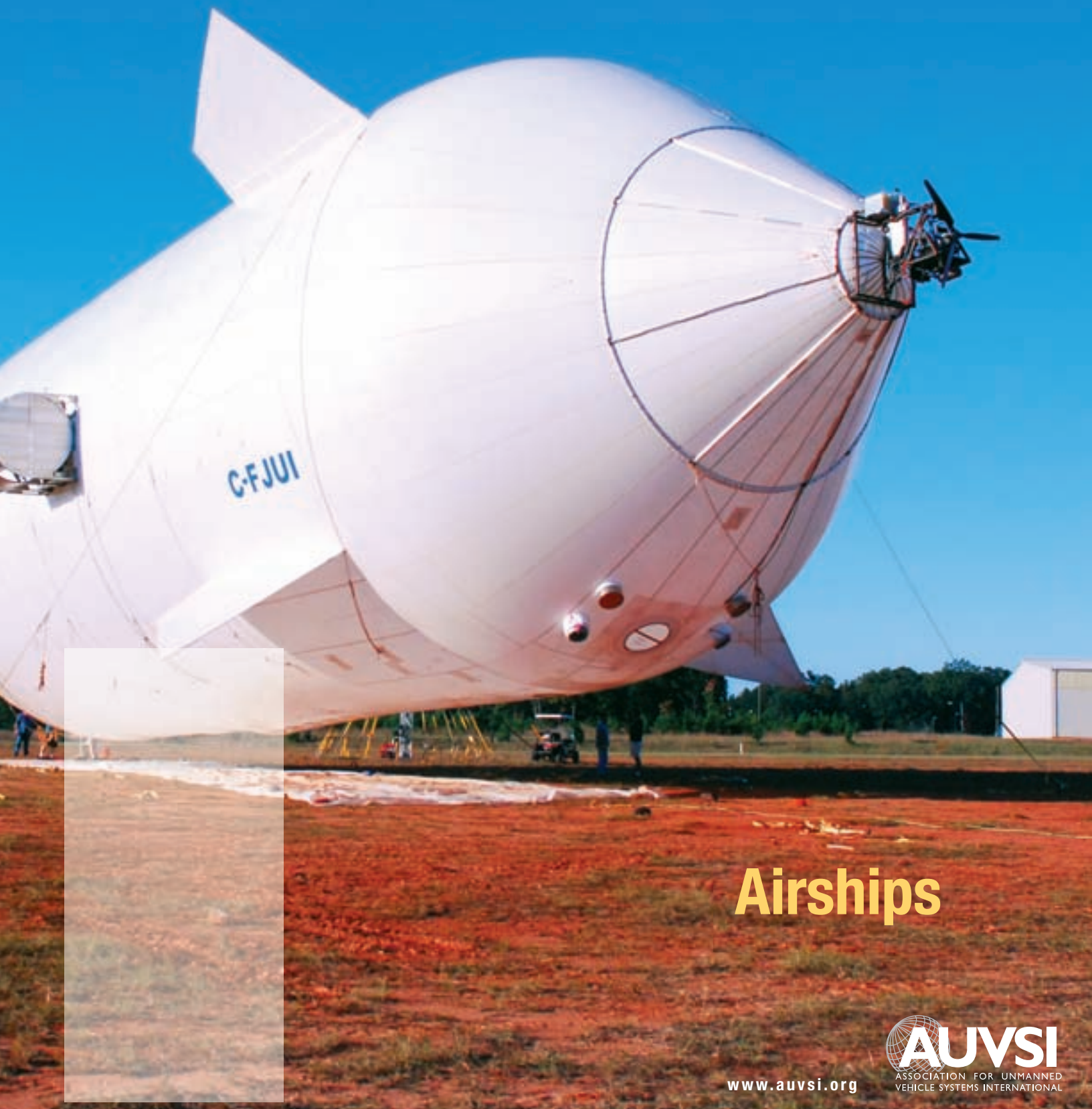

Airships

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Rising Interest in Unmanned Airships Attracts Major Contractors

By Lee Ewing

A new generation of unmanned airships is being developed to meet increasing demand for economical aerial platforms capable of longer endurance surveillance and communication relay.

Airships have engines that provide maneuverability, so they are affected much less than unpowered balloons by the whims of the wind. Helium, which expands as altitude increases, provides most of the lift for airships but engines increase lift as well as maneuverability. Today's airships are designed to be maneuverable even at low speeds and can be handled by small ground crews.

Many of the new unmanned airships can operate autonomously and can maintain position over a target area—an important advantage for platforms used for surveillance and communication relay at altitudes of 65,000 feet or higher. Some high-altitude unmanned airships in development are being marketed as less expensive alternatives to satellites.

"I think there is a general trend where there is increasing interest in airships in general," says Jonathan Leinwand, CEO of Fort Lauderdale, Fla.-based Sanswire Corp. "They are seen as a lower-cost alternative to different types of platforms. In the unmanned area, I think there's even more interest than in the manned airship."

Unmanned airships are increasingly attractive in part because they require less logistical support, which means lower cost. And, having no need to accommodate air crews, they could fly for days, weeks or even months at altitudes up to the verge of space. High-altitude airships, which operate where winds are minimal, are of particular interest.

The success of unmanned aerial systems used for intelligence, surveillance and reconnaissance in Iraq and Afghanistan has fueled military demand for lower-cost platforms that could provide the longer-endurance flights desired for enhanced persistent surveillance and communication relay. Civilian agencies also are considering unmanned airships for missions such as maritime surveillance, special events surveillance and emergency communications relay in the wake of disasters.

Advances in autonomous operation systems, materials and propulsion technologies are enabling developers to meet the growing demand by building unmanned airships designed to avoid problems of earlier airships and deliver new capabilities.

While several smaller companies are focused on developing, testing and refining concepts and designs, major aerospace and defense industry players like Lockheed Martin, Northrop Grumman and BAE Systems are among those working on unmanned airship projects. Most of the work to date has been in research, development and testing rather than production of airships. A look at some of the work follows.

High Altitude

One prominent program is the High Altitude Airship (HAA), which Lockheed Martin is building for the U.S. Army Space and Missile Defense Command (SMDC) of Army Forces Strategic Command. The goal is

Lockheed Martin's High Altitude Airship.

to develop a large, unmanned helium-filled airship that can fly at more than 60,000 feet, carrying a multi-mission payload that provides surveillance throughout a 325-mile radius. The spiral-development effort initially will use a demonstrator that can carry a 50-pound, 500-watt payload for 15 days and then produce the objective HAA, which is to carry a 2,000-pound, 15-kilowatt payload at 65,000 feet for 30 days. Payloads can be configured for missile warning, surveillance, target acquisition, communications and weather and environmental monitoring.

The current version, the High Altitude Long Endurance-Demonstrator (HALE-D), is a non-rigid airship which uses helium for lift and air to maintain its shape. The craft is 240 feet long with a diameter of 70 feet. Thin-film solar cells atop the envelope power its electric motors during the day and charge batteries that power the motors at night. Cruising speed is approximately 20 knots at its normal operating altitude of 60,000 feet.

"We're on schedule to do a flight demonstration the summer of 2009," says Mike Lee, chief of the force enhancement branch at SMDC's technical center. "We're going to fly for about two weeks and provide about 80 pounds of payload weight and 150 watts of payload power."

SMDC also is working on HiSentinel, a 179-foot unmanned airship with a diameter of 40 feet that is designed to fly for at least 24 hours. Southwest Research Institute of San Antonio, Texas, is the prime contractor. Both the HAA and the HiSentinel, at least initially, will carry identical payloads consisting of high-definition electro-optical sensors and communications equipment, Lee says.

HiSentinel is launched in a flaccid state, like a balloon, but as it rises it takes on a cigar shape like that of the familiar Goodyear blimp. This feature allows its launch in theater without a hangar and with little logistical support.

Advances in fabric, material and the power technologies have made it possible to build the new unmanned airships. Light, high-efficiency power systems and light but strong fabrics are the key enabling technologies, Lee says.

HiSentinel has flown twice. In November 2005, a technology demonstrator reached 74,000 feet. The second flight, in June, was cut short because of a leak in the envelope, Lee says. A flight demonstration of a HiSentinel with a payload of 80 pounds and 50 watts is planned for fall of 2009.

Challenges abound in the quest to create practical high-altitude unmanned airships. One is the need for these craft to endure mid-altitude high winds and turbulence, which can blow airships miles off course, en route to the placid stratosphere.

"Our solution is to use segments," Sanswire's Leinwand says. The segmented design of the Stratellite airship, developed by Sanswire's partner, TAO Technologies, resembles a caterpillar. One or more engines power it. The company has tested internal combustion and

Southwest Research Institute's HiSentinel takes shape.
Photo courtesy U.S. Army SMDC.

solar-powered electric propulsion systems.

The current 76-foot demonstrator model has on its first segment a single swiveling engine that incorporates vectored thrust.

"That first segment pulls itself through the winds and then the tail section, which has either a fuel gas or buoyancy gas, trails along behind it but can be blown sideways without affecting the course of the vehicle," Leinwand says.

In December, Sanswire announced it had completed a series of flight tests for this airship.

"The Stratellite is our ultimate-goal product," Leinwand says. It is intended to carry a payload of 2,000 pounds for a year or more at speeds up to about 60 miles per hour. The company's mid-altitude SkySat and low-altitude SAS-51 cigar-shaped unmanned airships are ready for production now, Leinwand says. The Stratellite will be tested during the next six to 12 months, he said in December, and could be ready for commercial production in 12-18 months.

A unique effort is Project ISIS (Integrated Sensor is Structure), in which Raytheon curved radar arrays of "unprecedented proportions" are to be built into the envelope of an unmanned, solar-electric-powered stratospheric airship designed to fly for a year, says Tim Clark, the U.S. Defense Advanced Research Projects Agency's program manager. The airship will address the need for persistent wide-area surveillance, tracking and engagement for hundreds of time-critical air and ground targets and provide extensive communication links, he says. Lockheed Martin and Northrop Grumman are the contractors for its system design.

Clark says technology developers have met goals for their critical technologies and system design contractors have conducted a preliminary design review for the demonstration system, intended to be a one-third scale airship with 100 square meters of dual-band aperture that would remain aloft for 90 days. A flight demonstration is planned for fiscal year 2011.

Mid-Altitude

21st Century Airships Team, Inc., of Newmarket, Ontario, Canada, is part of a team that has developed a prototype mid-altitude unmanned airship. The non-rigid, cigar-shaped Bullet 580 is 231 feet long and 67 feet in diameter. Earlier versions have flown successfully and the Bullet 580 is scheduled to fly this spring, says Hokan Colting, the company's CEO.

A partner company, E-Green Technologies of Kellyton, Alabama, is part of a team holding a U.S. Navy contract to demonstrate an unmanned airship to operate at 15,000-20,000 feet, says E-Green's CEO, Mike Lawson. The Bullet 580 test is part of that program.

Sanswire Corp.'s segmented Stratellite airship.

"We'll be on station 48-72 hours," he says. For this test, the optionally manned airship's five engines will burn a 100-octane bio-diesel fuel made from algae, he says. "We're eventually going to convert it to hybrid electric."

The next step, Lawson says, is to build a high-altitude airship that could fly at 68,000 feet for 30 days and attain speeds of 60-70 miles per hour.

For More Information:

www.21stcenturyairships.com

www.baesystems.com

www.egreentechnologies.us

www.lockheedmartin.com

www.northropgrumman.com

www.sanswire.com

www.swri.org

Low-Altitude

BAE Systems is developing the GA22 unmanned airship, which will draw on the company's experience with unmanned autonomous systems. Based on an original design by Lindstrand Technologies, the GA22 is approximately 72 feet long and 18 feet in diameter. It can fly at more than 6,500 feet with a payload of 331 pounds.

The craft is intended for small-area surveillance, such as for special events and communication relay. The GA22 completed a series of brief flight tests inside a huge hangar in September. Further flight tests are planned for early this year as the company seeks certification for the GA22 to fly in civil airspace, says Andrew Mellors, director of civil autonomous systems for BAE Systems.

Mellors says interest from potential customers such as police and security forces has been "quite considerable."

Lee Ewing is the former editor of Aerospace Daily & Defense Report and Homeland Security magazine and is a frequent contributor to Unmanned Systems.