

A large, yellow, star-shaped antenna reflector is being moved by a crane in a warehouse. The reflector has multiple long, thin arms radiating from a central hub. The background shows the interior of a large industrial building with high ceilings and structural beams.

Via Satellite's

Tech Focus REPORT

READY FOR NEWSPACE!

Space, once the domain of large governments, is now for everyone. With commercial products and services comprising the majority of global space activity, the pressure is on to get payloads into orbit faster and more cost efficiently. Those who serve the NewSpace industry must consider the impossible as possible, look at problems with radically new perspectives, and deliver quality products at unprecedented speed. At Harris Corporation, teams of leading scientists, engineers, and technicians are actively applying innovative design concepts that push the boundaries of technology to meet the growing demand for more bandwidth, global coverage, and reduced costs.

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Photo: Harris is meeting the needs of NewSpace with innovations like the first commercially available 5-meter Ka-band unfurlable antenna reflector.

Harris Corporation has served the space industry with advanced technology products since the earliest days of America's space program. Nearly a half-century ago, this Florida Space Coast company made a commitment to advancing space communications through innovative satellite antenna solutions. By continually pushing the boundaries of technology, the company has earned its position as the most experienced antenna reflector manufacturer in the world and the number-one provider of large high-accuracy reflectors.

Harris has brought to market the first unfurlable Ka-band antenna reflector for commercial applications.

To date, more than 80 Harris unfurlable, large-aperture mesh reflectors have entered orbit. That's 10 times the number of Harris' closest competitor and represents 800 years of collective service. Similarly, Harris' spot beam antenna solutions have made their mark in the industry

by delivering greater amounts of bandwidth than standard satellite antenna technologies.

Now Harris is meeting the challenges of NewSpace by improving the capacity of high-throughput satellites with larger aperture antennas and unique technologies that exploit Ka bandwidth. The company is exploring systems that will enable better use of smallsats, which offer tremendous potential to both commercial satellite operators and governments with their advantages of greater revisit rates and significantly lower costs. And the unique Harris AppSTAR™ reconfigurable satellite platform serves multimission payloads, significantly streamlines costs, and helps mission managers keep pace with marketplace changes and technology advancement.

Enabling Tomorrow's High-Throughput Satellite Systems

The insatiable appetite of direct-to-home enterprise and mobility users for bandwidth has created a burgeoning market for Ka-band, high-throughput satellites (HTS) and communication solutions that use multiple spot beams to serve specific regions of interest. An important enabler for HTS systems are antenna reflectors with large apertures.

"Larger apertures let us provide smaller spot beams than typical solid reflectors," explains Jeff McGinn, director of the Space Antennas business area at Harris. "Smaller spot beams support frequency reuse strategies that increase capacity and also increase gain so that the aperture of the user antenna on the ground can be minimized. This is a huge advantage for mobile, low-cost receivers like smart phones and tablets."

To address this need, Harris has brought to market the first unfurlable Ka-band antenna reflector for commercial applications. This 5-meter reflector is based on the company's proven radial rib reflector design. It features a highly reliable deployment system coupled with a unique mounting scheme that enables the pointing mechanism to be located along the focal line. More than 60 Harris radial rib reflectors have been successfully deployed and operated over the past 30 years. Most recently, three 5.4 meter reflectors have been successfully deployed and are operating flawlessly on Mobile User Objective System (MUOS) satellites. The last one launched in February 2015.

An antenna pointing mechanism and a tracking feed in the feed network assures accurate beam pointing and mitigates the need for the more demanding satellite pointing required by smaller spot beams at Ka band. Surface shape control points and carefully selected material combinations achieve the best possible thermal stability.

A second Harris solution for HTS is the fixed-mesh reflector. Leveraging the company's patented mesh technology and lengthy history in high-accuracy, unfurlable reflectors, the Harris fixed-mesh reflector replaces the solid or tri-axial weave surface of a traditional, non-unfurlable re-



Turning conference rooms into think tanks. Multidisciplinary space systems specialists collaborate in the new Harris Technology Center to meet the needs of the burgeoning NewSpace industry.



A state-of-the-art factory for continual production. Harris maintains more than 65,000 square feet (6,039 square meters) of production, testing, and integration space for space antennas.

flector system with a highly reflective surface of mesh supported by a low-distortion graphite support structure.

The mesh surface has better RF performance at Ka-band than comparable tri-axial graphite surfaces and approaches that of a solid graphite surface with exotic surface treatments. The mesh material operates with minimal losses up to 50 GHz and beyond and can be readily applied today.

The fixed-mesh reflector is best suited for reflector systems ranging from 2.0 meters to 3.5 meters,

where substantial mass savings can result. The 3.5-meter aperture version allows for smaller spot beam coverage of a given geographic region over existing 2.6- to 2.7-meter standard systems and supports operator goals of increased capacity.

Getting More from Cubesats

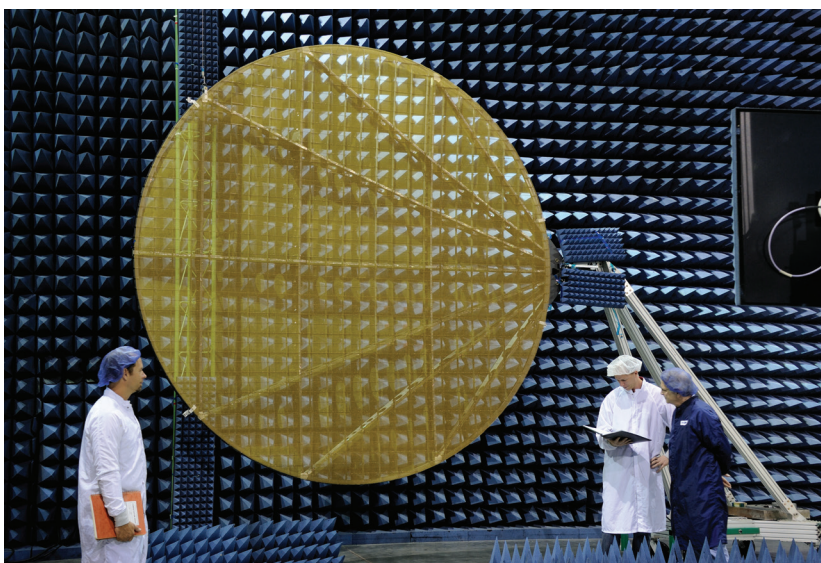
Capabilities and applications for cubesats continue to grow, due to the creativity of engineers driving advancements in miniaturization, weight, and efficiency. For these satellites to become mainstream,

cubesat payloads and antennas need to deliver capability and performance that approach what is currently available on larger satellites.

“Cubesats are inherently disadvantaged due to limited power availability from these small platforms,” says McGinn. “If we are to leverage these spacecraft for communications networks or remote sensing, high-efficiency payloads are essential.”

The Harris fixed-mesh reflector replaces the solid or tri-axial weave surface of a traditional, non-unfurlable reflector.

Harris is currently developing a series of payloads that leverage high-efficiency antenna apertures designed specifically for cubesat form factors. “These high-compaction-ratio antennas directly leverage our long legacy of unfurlable apertures,” McGinn adds. “We are excited to enable a new family of satellites.”



More than meets the eye. With a surface that is 85% optically transparent, the Harris fixed mesh reflector minimizes shadowing and solar torque on spacecraft. The patented high-density, gold-plated mesh facilitates exceptional RF performance at higher frequencies.



Creating tremendous efficiencies. The unique Harris AppSTAR™ reconfigurable satellite platform accommodates multiple missions with a single physical payload.

Gaining Flexibility with a Reconfigurable, Multimission Satellite Platform

NewSpace is all about efficiency—getting into space more quickly, maximizing satellite payload capacity and revenue, and adapting to unforeseen changes. The revolutionary Harris AppSTAR™ reconfigurable satellite payload enhances efficiency in all these areas. Highly flexible with a modular, soft-

ware-defined architecture, the Harris AppSTAR™ platform accommodates multiple customer mission applications with a single physical payload. Similar to the way a smart phone performs numerous tasks by downloading different applications, Harris AppSTAR™-equipped satellites have the flexibility to add new capabilities quickly and adjust to changing missions even after the system has launched. Ground

mission planners can easily change payload functionality by uploading new or selecting existing onboard software apps. New mission operations can be added in weeks rather than years.

New mission operations can be added in weeks rather than years.

“Combining the Harris AppSTAR™ platform with our space antenna technology epitomizes what NewSpace is all about: opportunity and efficiency for satellite operators and payload owners,” believes McGinn.

We think outside the bus.



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At Harris, we're accelerating innovation in space with technologies like our 5-meter Ka-band unfurlable antenna reflector for high-throughput communications. With a larger aperture than its solid reflector counterparts, this lightweight reflector supports small spot beams that increase frequency reuse and ultimately reduce the cost per bit of data delivered.

For more information on this and other Harris space innovations, please contact spacesystems@harris.com.