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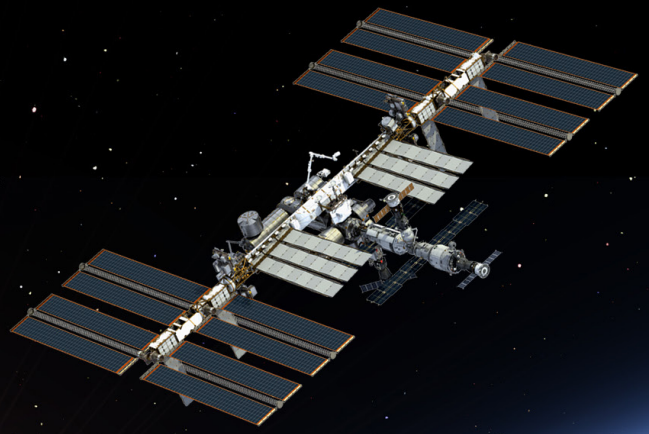
International Space Station

Capturing the Beauty of the Universe

The International Space Station (ISS) is the largest and most complex science and engineering project in history. The ISS has adopted industrial networking technology in its External Wireless Communication (EWC) system to transmit high-quality images and videos captured in outer space back to Earth.



AT A GLANCE

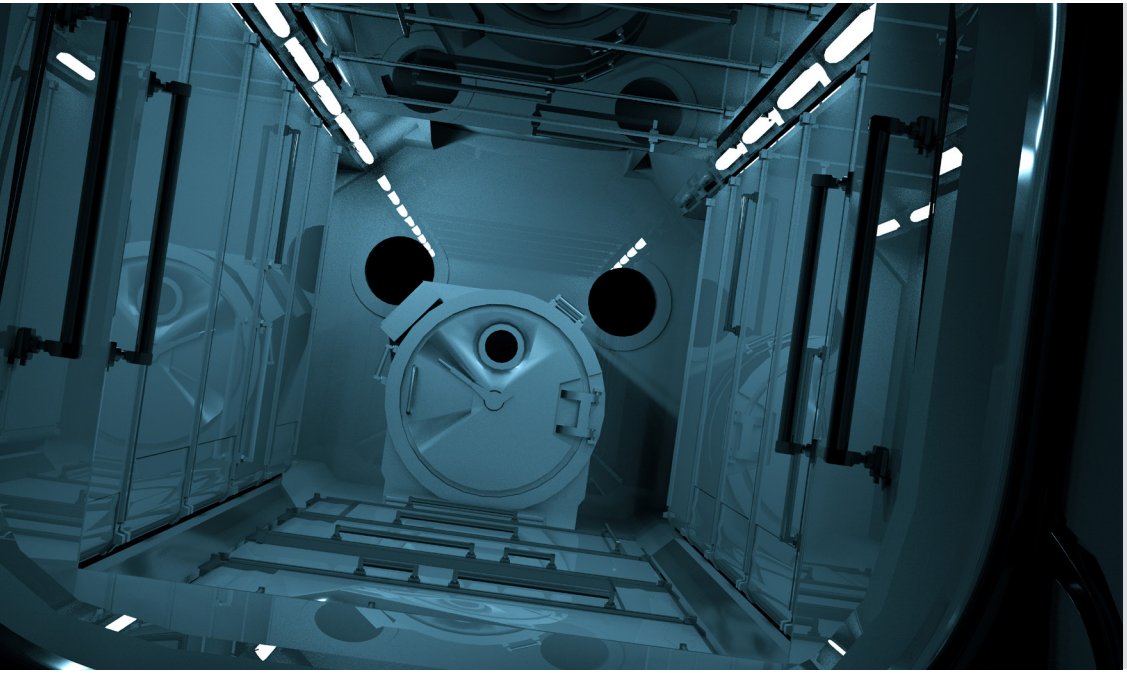
A Groundbreaking Space Laboratory

The International Space Station is an orbiting science and technology laboratory operated by five space agencies from the U.S, Canada, Russia, Japan, and the European Union. Completed in 2011, it operates as a proving ground for science and technology research and for developments in future human space exploration.

The ISS program requested engineering to provide an external high-definition (HD) video capability to view Earth and the ISS. The Nikon D4 DSLR was selected. This system needed to be installed outside of the ISS and integrated as part of the ISS Communications and Tracking system. It receives commands and sends imagery, health, and status through the EWC system.

The EWC system marks a major use of commercial off-the-shelf electronics (COTS). COTS wireless technology typically cannot withstand the harsh environments in outer space, so the ISS had to test technology from several vendors before finding the right fit.

Commercial off-the-shelf (COTS) wireless technology typically cannot survive in the harsh environment outside the space station.



Boeing

Founded in: 1916

Headquarters: Chicago, US

Industry: Aerospace

Number of Employees: 140,000

Website: www.boeing.com

Results

- Transmits data reliably in extremely harsh conditions without electrical failures
- Fast data transmission speeds

Withstanding the Harshest Environments

The engineering team had to find a robust and reliable wireless access point to transmit images from space. The EWC Wireless Access point (WAP) radio could not be used. The new radio had to be qualified for External High Definition Camera (EHDC) but due to the harsh environment with temperatures rapidly cycling between -100 to 100°C, finding the appropriate equipment was a challenge.

In addition to the extreme temperatures, the radiation environment is much harsher at the altitudes at which the ISS operates. These factors increase the risk of tin whiskers, electrically conductive, crystalline structures of tin that sometimes grow from surfaces where tin is used as a final finish. Tin whiskers have caused numerous short circuits that have led to electronic system failures. When the ISS orbits into extremely low temperatures, there is also the problem of tin pest, a change in the crystalline structure of tin, which causes deterioration and decomposes the material into powder. There were many factors to consider finding the right COTS for the harsh enviroments of outer space, making it an extremely complex project.

Challenges

- **Needed to be qualified for External High Definition Camera (EHDC)**
- **Rapidly cycling temperatures from -100 to 100°C**
- **Intense radiation**

SOLUTION

A Rugged Solution Tough Enough for Space

Finding a robust solution that qualified for EHDC was critical for the success of this project. Boeing provided a solution based on Moxa's AWK-4131. It was selected due to its ruggedized design. It can withstand the harsh environment in outer space, from the intense radiation to the temperatures that fluctuate between -100 and 100°C. It can accommodate the demand for faster data transmission speeds by supporting 802.11n technology and allowing 2x2 MIMO communication with a net data rate of 300 Mbps.

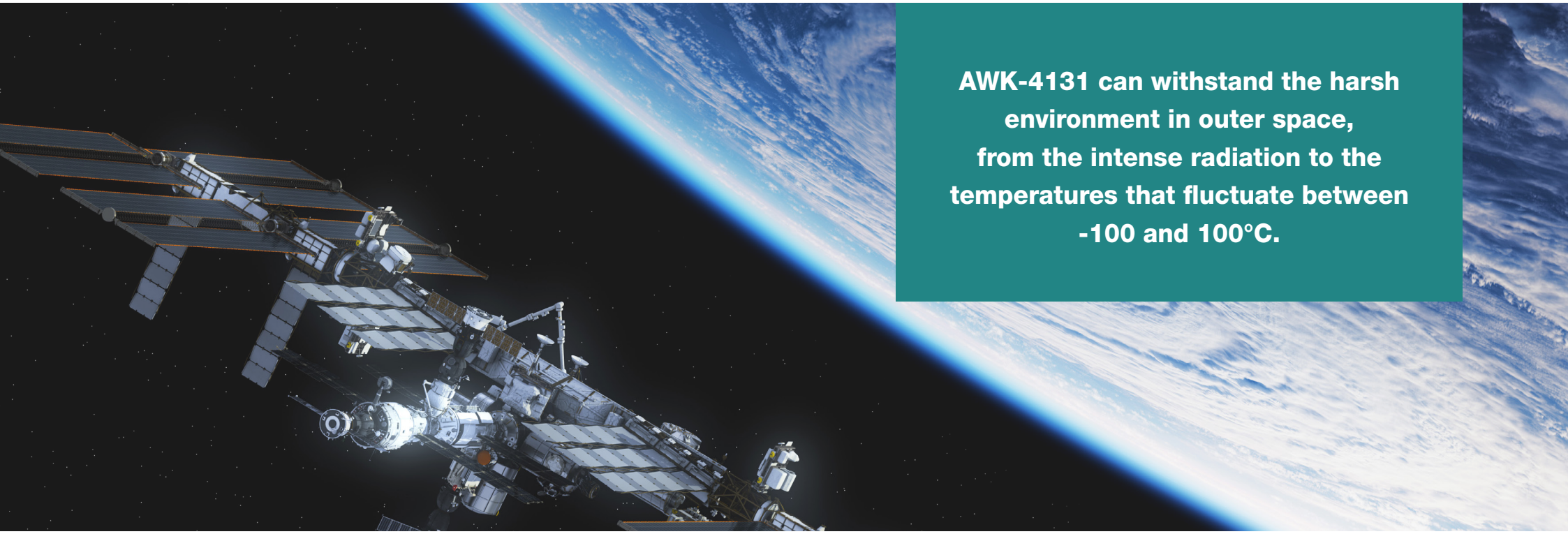
In addition, Moxa also provided customized firmware to increase the power output over the standard model, along with a circular polarized, wide beam, small 5.3 GHz antenna. The Moxa AWK-4131 devices will function as an access point, bridge, and client, enabling communication around the station.

Moxa Partner

Industrial Networking Solutions

Moxa Solutions

- AWK-4131, 2x2 MIMO 802.11 a/b/g/n AP/ bridge/client
- Rugged industrial design with integrated antenna and power isolation
- IP68-rated weatherproof housing designed to withstand -40 to 75°C operating temperatures
- 5 GHz DFS channel support



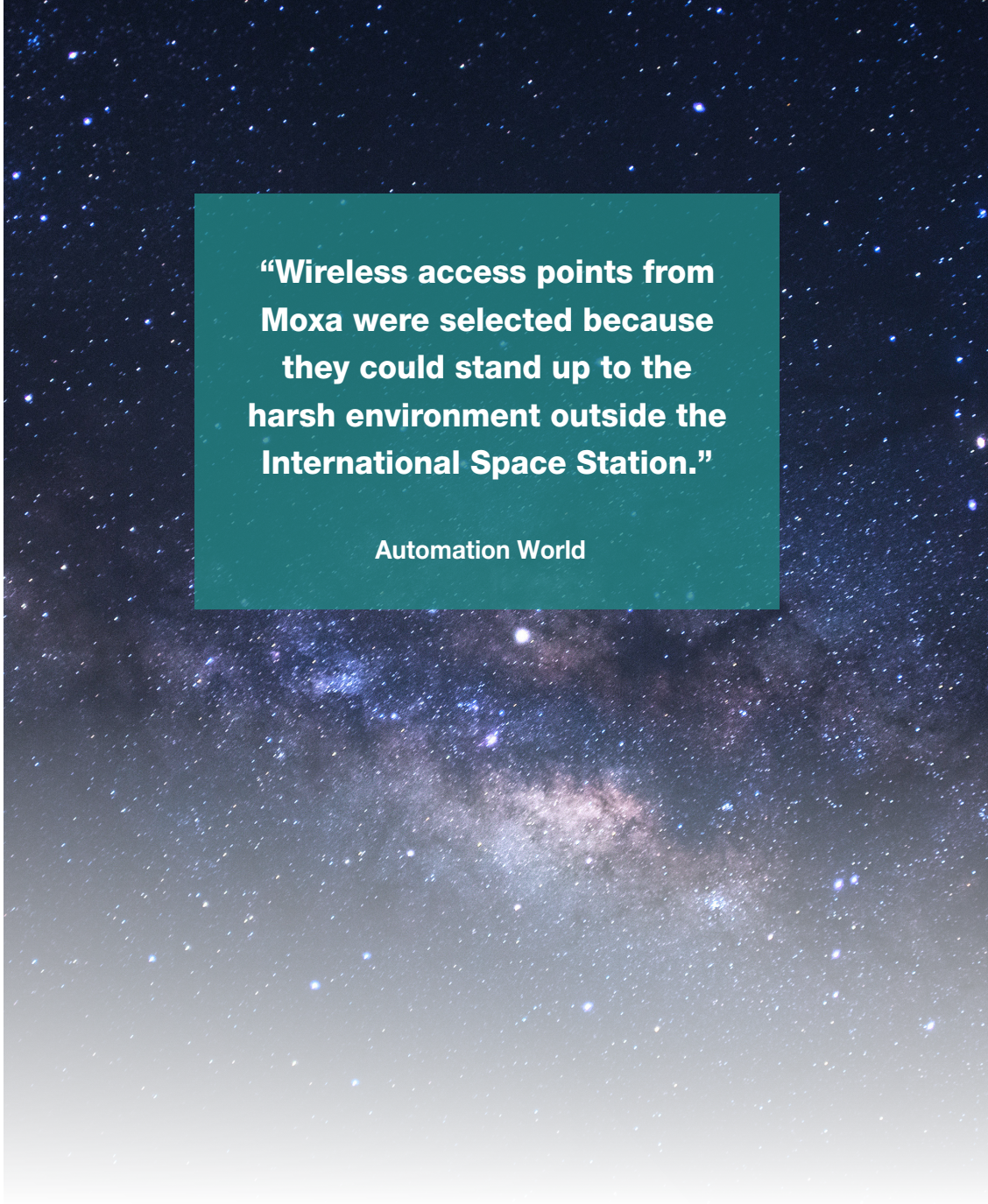
AWK-4131 can withstand the harsh environment in outer space, from the intense radiation to the temperatures that fluctuate between -100 and 100°C.

RESULT

Technology That Serves All of Humankind

Commercial off-the-shelf (COTS) wireless technology typically cannot survive in this environment. Only the Moxa units could withstand its tests after evaluating multiple vendors. According to Automation World, “Wireless access points from Moxa were selected because they could stand up to the harsh environment outside the International Space Station.” The ISS project marks the first time in history that Moxa’s products are now in orbit around the Earth.

After a highly successful series of functional tests, Moxa’s technology has lived up to expectations. It has been helping the ISS send photos and images captured from the ISS, the largest, most complex international scientific and engineering space project in history. These images will be critical in aiding science and technology research that benefits all of humankind now and in the future.



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