PIRPL

Prototype InfraRed PayLoad

BACKGROUND/PURPOSE:

The United States defense community has stepped up its pursuit of affordable, agile, and scalable missile defense systems. Northrop Grumman partnered with the Space Development Agency (SDA) and the Missile Defense Agency (MDA) to explore the idea of advancing the company's internal R&D efforts focusing on using space-based assets in low earth orbit (LEO) to track advanced threats.

ANSWERING THE CALL

Northrop Grumman answered the call of demonstrating the viability of affordable LEO solutions. It stood up a dedicated team to work on this cutting-edge project. Over a period of time, the team went from several ideas to settling on a modular design. It took a prototype concept through the various development stages (modeling, concept refinement, fabrication, integration and test) resulting in the Prototype Infrared Payload (commonly known as PIRPL) - from concept to reality in less than two years!

The PIRPL Team successfully proved that a rapid development and deployment of this technology to LEO is not only possible but also feasible while minimizing risk.

The team's approach leveraged and demonstrated viable use of Northrop Grumman's unique International Space Station (ISS) resupply spacecraft, Cygnus (Cygnus flights to the ISS are scheduled every 6 months). The PIRPL program will use Cygnus as a low-cost ride share to the ISS and then deploy after Cygnus completes its primary ISS resupply mission.

MODIFICATIONS FOR SPACE

During design stages, the team identified two challenges. The PIRPL design needed to compensate for spacecraft motion during image captures. Even the slightest vibration can reduce the effectiveness of an image collection. The team addressed motion compensation by using sensing, and image framing digital technologies.

Second, from LEO, PIRPL's IR sensor is affected by the relatively high heat from the earth's atmosphere. The team settled on using Northrop Grumman's Micro Cryocooler prototype technology to allow PIRPL to operate effectively on orbit and achieve near real-time multi-spectral image capture.

TRUSTED PARTNERS

Once the team had a balanced prototype architecture, hardware teams in Azusa, California took control and brought the concept to life. The Azusa group of advanced aerospace engineers reviewed the design and identified trouble spots. In parallel, subsystems were being built and tested by key suppliers. These subsystems include IR sensors, cameras, filters, mirrors, lenses and thermal controls.

EARTH SCIENCE APPLICATIONS

PIRPL's precise image technology and IR capabilities are also game-changers when it comes to monitoring and collecting usable data to address Climate Change. Beyond contributing to tracking and detecting advanced threats, the data gathered from PIRPL has the potential to shape studies at governmental agencies and universities studying the environment, as the technology could also be used to monitor volcanoes, forest fires, and natural phenomena.

LASTING IMPACT

This past May, PIRPL successfully mated and tested on the Cygnus spacecraft. It is now awaiting launch scheduled on August 10, 2021. The success of PIRPL will have a lasting impact on Northrop Grumman's missile defense tracking and scanning capabilities. It will enhance Northrop Grumman's existing advanced algorithms and assessment software.

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TEAM MEMBER HIGHLIGHTS:

Scott Sage is the Program Manager for the PIRPL project. A US veteran officer, he brought forth his experience and leadership skills to oversee the entire project while managing multiple sub-teams to ensure mission success.

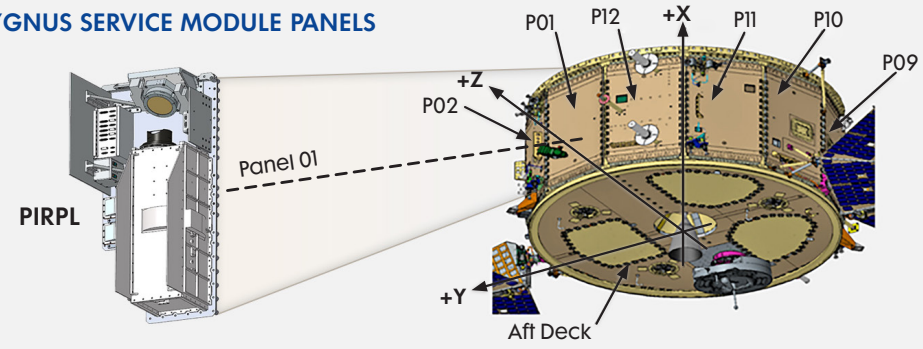
Brent Nielsen serves as the PIRPL Deputy PM during the design and build phase. He was key to PIRPL meeting the stringent Azusa testing and NASA-approved quality control requirements.

John Carattini works as the PIRPL Chief Engineer, and was critical in design development and approval, negotiating contracts, and ensuring the engineering team had the resources to meet condensed timelines.

Kevin Romero serves as the PIRPL Chief Scientist. He assisted with the PIRPL's radiometric and optical performance.

Cara Coleman is the Mission Operations lead for the PIRPL project. She was the main interface between the NG PIRPL team and the ISS planning teams meeting various design requirements. She also led the on-orbit planning and assessment of PIRPL with the Cygnus vehicle team.

CYGNUS SERVICE MODULE PANELS



PAYLOAD PROTOTYPE

FUN FACTS

- Subject matter experts from coast to coast across multiple NG sectors were involved in bringing PIRPL from concept to reality.
- Over 14,000 cups of coffee were critical to the success of PIRPL.
- The NG-16 Cygnus spacecraft will be named after former astronaut Ellison Onizuka. It is the company's tradition to name each Cygnus spacecraft in honor of an individual who has made great contributions to human spaceflight. Onizuka was selected in honor of his prominence as the first Asian American astronaut.
- PIRPL has traveled 2,782 miles on the ground from Azusa, CA to Wallops, VA and will soon travel over 45 million miles while berthed to the ISS and then another 9 million miles while in Free Flyer Ops before burning up in the Earth's atmosphere.

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