NASA'S Independent Verification & Validation Program (IV&V)

FY23 PROGRAM HIGHLIGHTS

In FY23, NASA IV&V supported 13 of NASA's highest-profile programs and projects, and two IV&V-supported missions successfully launched: Artemis I and JPSS-2. IV&V identified over 1,600 significant software-related issues, including 34 issues with the potential to cause loss of mission or degradation of an essential mission capability. IV&V also supported mitigation and closure of 13 mission project risks identified through IV&V, leading to increased quality and improved insight.

IV&V had a significant impact on the community, providing more than 300 jobs and supporting internships, robotics initiatives, and educational outreach across West Virginia to prepare the next generation of space science professionals.

Industry-Leading Technology.

IV&V continued to develop unique spacecraft digital twins: software-only simulations that fully replicate spacecraft hardware and the space environment. As an example of a tangible contribution to reduce mission risk, IV&V utilized a purpose-built digital twin for Artemis to successfully execute a series of ascent phase abort test cases that will assure the safety of our astronauts and the success of Artemis II and subsequent Artemis missions.

IV&V developed and continues to utilize similar capabilities for NASA's science missions. For Psyche, the IV&V team used our unique testbed to perform specific independent testing requested by the Jet Propulsion Laboratory (JPL). JPL asked for this support because their current testbeds could not be used to perform the same tests.

IV&V's development of industry-leading software analysis tools also included collaboration with OSMA on the development of the Code Analysis Pipeline (CAP), a unique capability for using multiple tools to analyze the software on NASA's highest-profile missions.

NASA's IV&V Program provided Software Safety and Mission Assurance (SMA) services contributing to the safe and successful launch, docking, and return of SpaceX Crew-5 and Crew-6 missions and safe and successful launch and docking of the Crew-7 mission to the International Space Station. The program's SMA services include software safety and quality analysis covering such areas as hazard reports and software audits.

Successful Software. Safer Missions.

JPSS-2 launched November 1, 2022 after over seven years of support from IV&V. The program identified 449 software defects, which were accepted and corrected by the development teams and resulted in improved safety and reliability of the JPSS-2 mission software.

On November 16, 2022, over a decade's worth of IV&V support across various programs, centers, and stakeholders led to the successful launch of the Artemis I Mission. The Orion Spacecraft traveled 1.4 million miles, splashing down in the Pacific Ocean on December 11, 2022, completing the 25-day journey. All critical Artemis software performed nominally, in part to over 18,500 system and software-related issues previously identified by IV&V, which could have negatively impacted the software execution in the Artemis mission timeline.

Working closely with Agency leadership and Mission Directorate stakeholders, the IV&V Mission Protection Services (MPS) initiative continued to advance its complementary approach to NASA mission security. MPS provides a mission-focused view of cybersecurity that leverages and builds on IV&V's existing capabilities to improve NASA's understanding of software security risks and potential mitigations. This past year, the MPS team worked collaboratively with the Orion project to improve the mission's overall security posture.
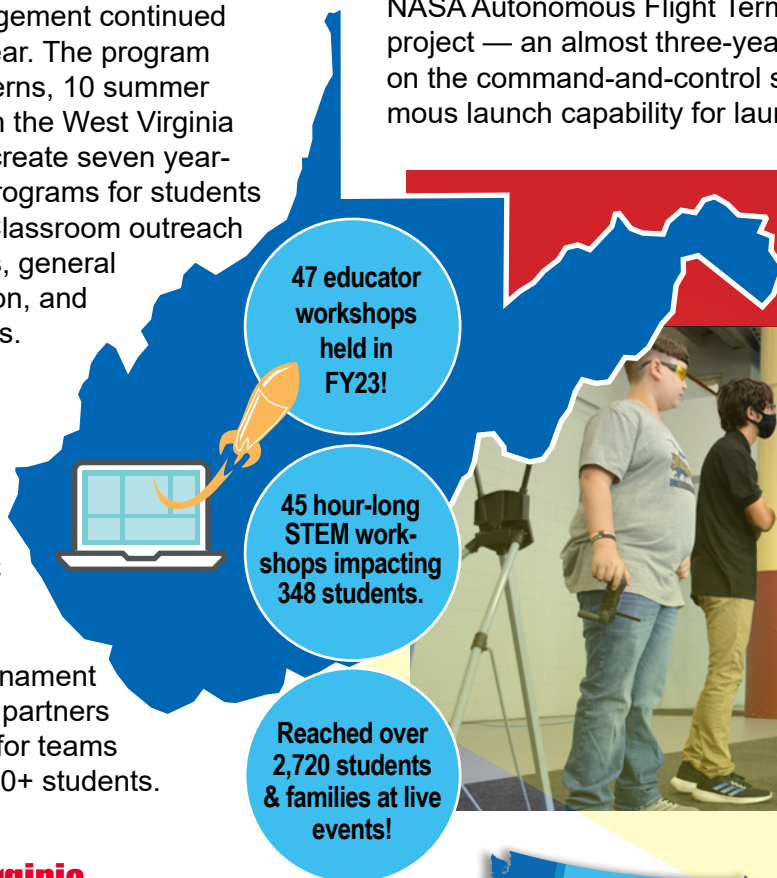
Risk Reduction for Mission Success.

The SMA Support Office (SSO) Outreach Team adapted a code quality assessment capability to make it more applicable to NASA missions with more automation. NASA's version, the Code Quality Risk Assessment (CQRA) capability, is easier to execute and comprehend, and it has been shown to provide significant value.

The team also provided Software Assurance (SA) reach back support to the Volatiles Investigating Polar Exploration Rover (VIPER)/Near Infrared Volatile Spectrometer Subsystem (NIRVSS) Project at Ames, where they were challenged to mitigate the overall SA project risk for this upcoming Artemis moon mission. Team members also completed SA support of a Wallops Flight Facility (WFF) NASA Autonomous Flight Termination Unit (NAFTU) project — an almost three-year effort to assure software on the command-and-control system enabling an autonomous launch capability for launch vehicle providers.

IV&V's focus on STEM engagement continued to be a major success this year. The program supported three yearlong interns, 10 summer interns, and collaborated with the West Virginia Space Grant Consortium to create seven yearlong fellowships and many programs for students across the Mountain State. Classroom outreach included sessions on Artemis, general rocketry, internship information, and career opportunity showcases.

Our Education Resource Center (ERC), a partnership with Fairmont State University, had a 95% satisfaction rate for educator workshops. In FY23 the ERC coordinated and hosted the second annual WVSSAC Robotics Championship Tournament and supported our statewide partners with over 30 robotics events for teams from WV which engaged 6000+ students.

47 educator workshops held in FY23!

45 hour-long STEM workshops impacting 348 students.

**Reached over 2,720 students & families at live events!**

A strong foundation produces results.

IV&V Impact on West Virginia.

Economic impact in WV can be attributed to labor income and tax revenue. Results from these activities, when multipliers are applied, are estimated to account for $47.8M in labor income and $139.2M in economic output.

280 Contractors   **51** Civil Servants
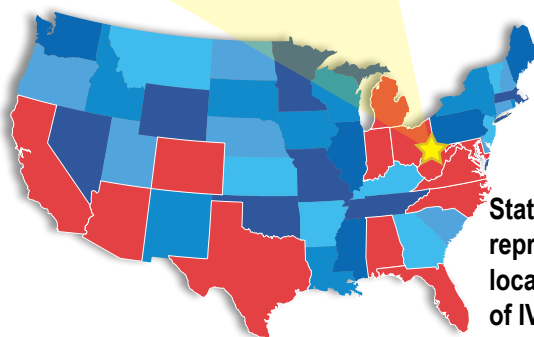
States in red represent the local presence of IV&V staff.

Find us online for more details:
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IV&V Support Across the U.S.

Our national footprint supports an agency-wide scope that provides subject matter experts in a variety of disciplines, domains, processes, and tools wherever they are needed.