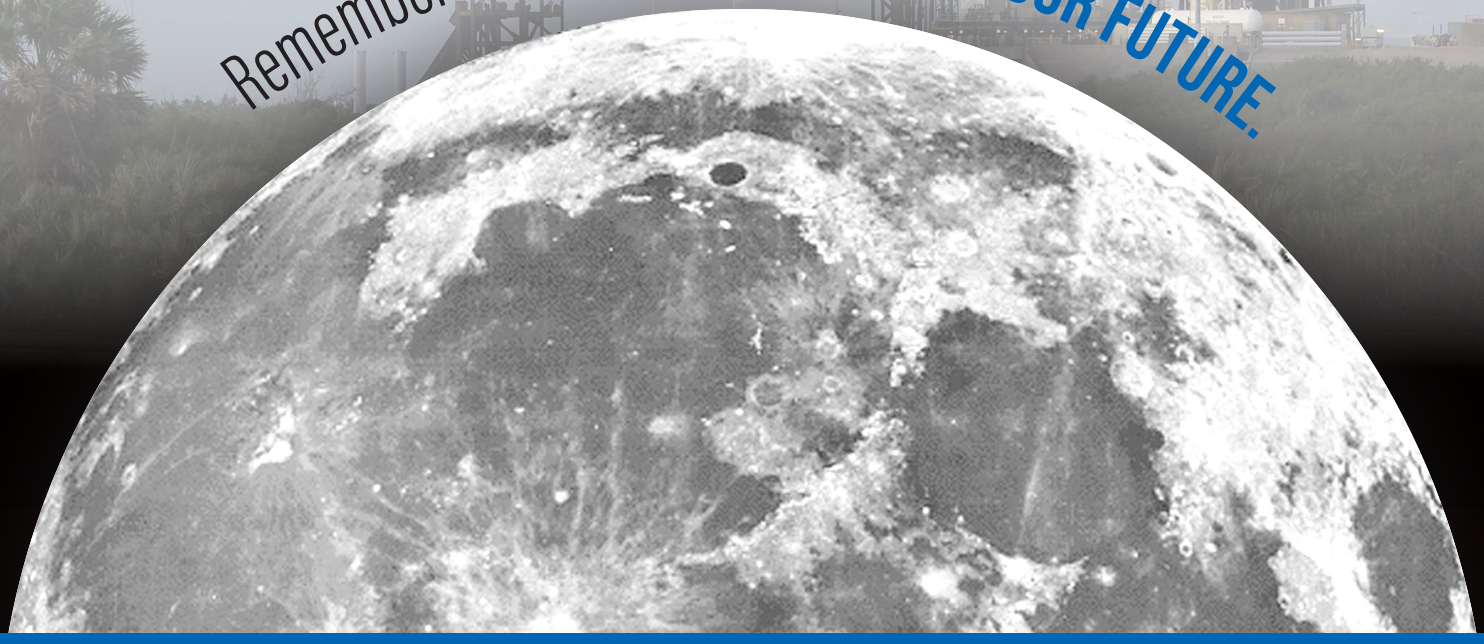
National Aeronautics and
Space Administration

CHALLENGER
35 YEARS
Jan. 28, 1986

Remembering our past, **TO ASSURE OUR FUTURE.**



www.nasa.gov

NASA'S Independent Verification & Validation Program

IV&V ANNUAL REPORT FY2021

MISSIONS THAT GET THE BENEFIT OF IV&V INPUT HAVE A 99.53% TRACK RECORD OF SUCCESS.

NASA's IV&V Program was established in 1993 as a direct result of recommendations made by the National Research Council (NRC) and the Report of the Presidential Commission on the Space Shuttle Challenger Accident.

Since inception, NASA's IV&V Program has had input to 212 individual missions including 183 entrusted with human lives (78 Shuttle and 65 ISS). Of these missions, there has only been one mission or major capability failure on record due to software on a mission where IV&V was performed: the Demonstration of Autonomous Rendezvous Technology (DART) in 2005.*

MISSIONS SINCE IV&V INCEPTION:

	Shuttle	ISS	Science	TOTAL
Completed Successfully	78	65	38	181
Currently Operational			30	30
SW Mishap			1	1

Total Missions: 212 Success: 211

Success %: 99.53%

From the cover:
A photo of the Challenger crew.
A photo of the pre-flight setup of the Commercial Crew Program (CCP) Crew 2 launch. A view of the moon ready for its next bootprints.

*For more information visit https://www.nasa.gov/mission_pages/dart/main/.

A message from the DIRECTOR:

The last year has been one of challenge, change, advancement, and success. Through it all, NASA's Independent Verification and Validation (IV&V) Program has continued to provide value-added services to NASA's most critical missions. In true NASA fashion we saw beyond the challenges by using the necessary changes brought on by the pandemic as fuel for the future. And in the midst of so much transformation, one thing remained constant: The IV&V Program's commitment to mission success with a high quality of service when it comes to assuring mission-critical systems and software.

IV&V Program management's focus and objectives were to continue providing value added services to our customers while adding new mission protection services, adopting and integrating new and ever-evolving IT capabilities and requirements, and adjusting to changes coming from every direction. And we've seen tangible success throughout that journey. IV&V maintained high customer satisfaction marks in internal and external surveys. In addition, we saw milestones such as the Perseverance Rover landing on Mars, several Ingenuity helicopter flights, progress on Artemis missions, and launches of Commercial Crew-2 and Landsat-9 just to name a few. And we saw all of this while navigating COVID-19 and moving forward into the Future of Work with flexibility and adaptation — using our program values of innovation and excellence in real time.

Multiple Agency and Administration changes have been significant along with many Program adjustments, including my own decision to retire. After many years dedicated to NASA and the IV&V Program, I believe we cannot truly appreciate present achievements without acknowledging the past that built them. This year marked the 35th anniversary of the Challenger Disaster. It is a tragedy I remember firsthand as I was working on console when it happened, and I'll never forget how devastating it was to see lives lost and families in such pain. The IV&V Program was born from this disaster to add a pivotal step in safety and security of our missions. My goal here at the IV&V Program has always been to never let software cause a tragedy like Challenger again. As I prepare to retire, I look back over this last year and all those that came before proud that we have risen to the occasion providing excellent and value-added services to NASA.

Thank you for your dedication and excellent contributions to NASA!
Gregory Blaney

Contents:

STRATEGIC ALIGNMENT

As indicated by the graphic on the right, NASA's Independent Verification & Validation (IV&V) Program supports all NASA Strategic Goals. IV&V is an agency-level function which supports our highest priority missions. The IV&V Program is implemented through a series of policies grounded in ensuring the safety and quality of mission critical software. We do this by leveraging services that assess risk, fine tune standards, and expand capabilities in support of each NASA facility.

This is our mission. Our vision is to be the very best.

Our values and beliefs are shaped by our experience, driven by our mission, and underpin our culture. At the core of our organization are our people, our processes, and our tools. These make us the best in the world. The services we provide are how we deliver for our stakeholders.

300+ Employees providing the gold standard of safety services to NASA's most significant endeavors:

18
High Priority Missions

3237
Severity 1, 2, and 3 issues submitted during FY 2021

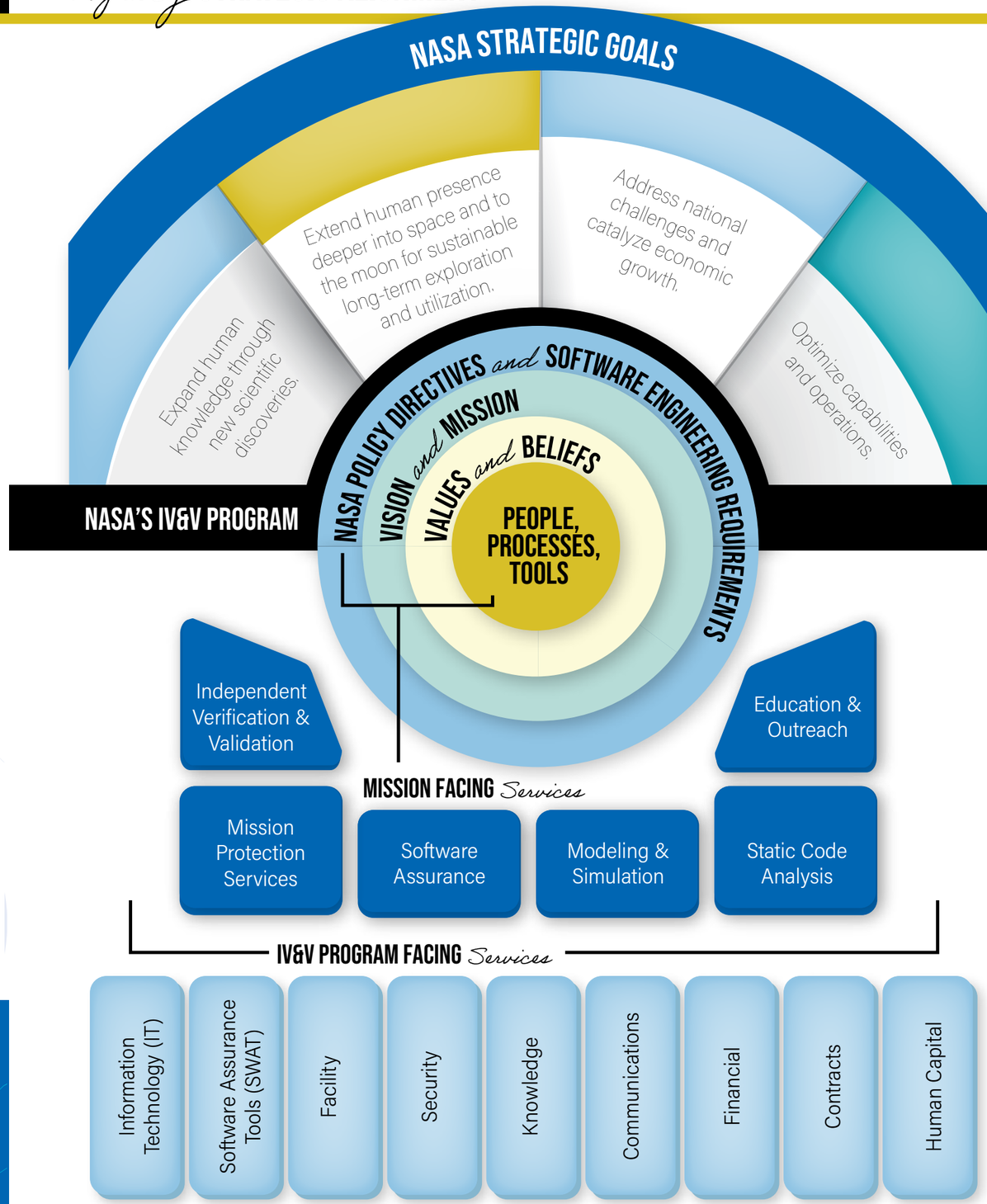
97.1%
IV&V Issue Acceptance

94.7%
In-Phase with Project

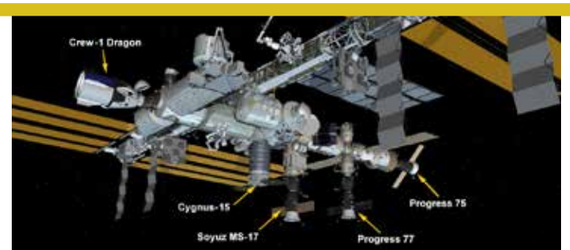
99.7%
Customer Satisfaction for IV&V Services

100%
Customer Satisfaction for Software Assurance Services

Agency STRATEGIC ALIGNMENT



INDEPENDENT VERIFICATION & VALIDATION (IV&V) *Services*



International Space Station (ISS)

Support for ISS ensures that software continues to meet safety and mission needs. The ISS IV&V team adds assurance to software release development efforts and software transition readiness assessments, which reduces risk to astronauts and ISS operations.

A quote from ISS Flight Software (FSW) Development Manager: ***"[ISS IV&V team] has provided a much needed knowledge injection and assurance service..."***

IV&V started 1/1/1993
FY21 Issue Acceptance Rate: 95.2%
FY21 Issue Phase Containment: 98.9%

Human Landing System (HLS)

Analysis of HLS Program documents helped improve the quality of the documents and ensure IV&V interests are represented within the HLS Program's activities. Working with three HLS providers, IV&V analysts developed an understanding of three distinct solutions.

IV&V started 2020
FY21 Issue Acceptance Rate: N/A
FY21 Issue Phase Containment: N/A

Artemis

In FY21, the Artemis IV&V Program made outstanding progress, completing Artemis I IV&V assurance activities, closing Artemis I IV&V issues and risks, ramping up assurance activities for Artemis II, and staying in phase with Artemis III and IV development work. Our Program also made outstanding progress in continuing to enhance coordination and collaboration among the Artemis IV&V projects and teams and advancing Artemis IV&V capabilities. We teamed up to assure cross-program integrated software behaviors and to enhance the efficiency and effectiveness of all the Artemis IV&V work.

IV&V started 10/1/2014
FY21 Issue Acceptance Rate: 94.4%
FY21 Issue Phase Containment: 87.8%

Exploration Ground System (EGS)

Since 2014, the EGS IV&V Team has performed analysis in support of the Launch Accessories (LACC) software, resulting in the resolution of 877 high severity TIMs, including 12 Severity 1 and 19 Severity 2. IV&V's ongoing LACC analysis over the past seven years has helped ensure the LACC software operates correctly and safely, and more specifically the winches/swing arms retract in an integrated and simultaneous manner at the time of launch.

Accurate and Complete Data Monitoring and Command Execution through Resolution of EGS IV&V Issues

IV&V started 7/1/2010
FY21 Issue Acceptance Rate: 91.9%
FY21 Issue Phase Containment: 83.3%

Mission Control Center (MCC)

Fifty-three assurance goals and analysis activities have been completed to date along with two formal risks that have been identified and documented.

Responding to the IV&V MCC Team's ability to work with the MCC Project and achieve six Severity 1 Technical Issue Memorandum (TIM) closures, IV&V senior leadership responses included words such as: Awesome, Great Work, Outstanding and Well done.

IV&V started 8/1/2019
FY21 Issue Acceptance Rate: 100%
FY21 Issue Phase Containment: 95%

Gateway

Gateway IV&V is providing value through timely identification of software requirements issues and is saving time and money by providing these issues to the development team early in the software development cycle.

The Habitation And Logistics (HALO) module lead said ***"Good Catch"*** after reviewing a list of issues sent via email with the Software Requirements Document (SRD), indicating these issues would not have been identified in the existing review process.

This year the IV&V team began collaboration with the International IV&V Working Group to plan assurance activities for critical Gateway interfaces with I-Hab.

IV&V started 6/1/2019
FY21 Issue Acceptance Rate: 94.7%
FY21 Issue Phase Containment: 100%

Orion/MPCV (Multi-Purpose Crew Vehicle)

In FY21 the IV&V Orion team worked closely with mission point-of-contact's (POC's) to move FSW issues to a closed state. This closure represents work that resulted in over 2200 Artemis I Orion TIMs, of which almost 200 were Severity 1 or 2 concerns.

Kevin Jackson, an Orion POC for IV&V and the Orion FSW Production System Manager, stated: ***"(NASA IV&V) is a key resource in helping us keeping the project on task. Over and over again, the IV&V team demonstrated the value to the project management. HQ investigators came asking about IV&V and NASA safety and the project was very adamant that IV&V is doing a great job and are a necessary part of the project. Many used to think that IV&V came in late and wanted fixes done after the fact, but Orion IV&V has done a tremendous job in making sure they are involved in the day-to-day happenings of the project and that issues are turned in to the developer in-phase."***

IV&V started 10/1/2014
FY21 Issue Acceptance Rate: 86.8%
FY21 Issue Phase Containment: 80%

Space Launch System (SLS)

IV&V has supported the development of SLS software for over 10 years providing significant value in improving the software products as well as the reliability, safety, and success of the Artemis mission. Collaboration with the development and test teams resulted in the resolution of over 3,000 IV&V-identified higher severity issues that were found in phase with the software development lifecycle - ultimately contributing to the Project's flight readiness for Artemis I.

IV&V started 6/1/2011
FY21 Issue Acceptance Rate: 100%
FY21 Issue Phase Containment: 94.4%

INDEPENDENT VERIFICATION & VALIDATION (IV&V) *Services*

LandSat 9 (L9)

The L9 IV&V Team was extraordinarily successful posting a >97% issue acceptance rate and completing 101 assurance objectives during the development lifecycle. During the lead up to launch, the team helped close 21 issues, 1 formal project risk, and 16 assurance activities. In a follow-up to the successful launch, separation, and deployment of L9, the L9 Goddard Space Flight Center (GSFC) Project Software Manager stated,

"IV&V provided significant support to L9 software by performing analysis of all software development artifacts, including test procedures and source code, etc. IV&V's participation in L9 peer and project presentations provided an independent assurance to NASA/USGS of L9 observatory software verification and validation."

IV&V started 2/1/2017
FY21 Issue Acceptance Rate: 80%
FY21 Issue Phase Containment: 80%

Dragonfly

IV&V planning and scoping efforts are underway. IV&V participated in-phase with the development effort to review Level 3 and 4 system requirements while working on planning and scoping for the entire IV&V effort. The ability to review these L4 requirements not only contributed to the project's requirements quality, but also increased IV&V's domain knowledge, yielding more accurate planning and scoping outcomes.

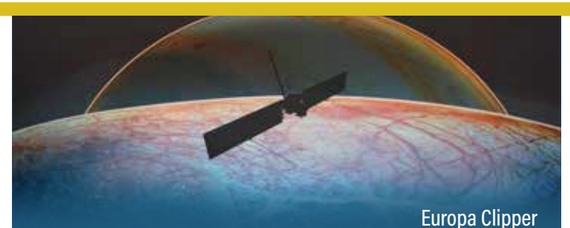
IV&V started 4/13/2020
FY21 Issue Acceptance Rate: 100%
FY21 Issue Phase Containment: 100%

JPSS-2 (Joint Polar Satellite System-2)

The JPSS-2 Flight IV&V team worked closely with the Northrop Grumman FSW developers through the FSW Qualification Testing to fully assess what is the almost-final FSW build for the JPSS-2 mission. In doing so, IV&V has been able to fully close all Severity 1-3 Technical Issue Memorandums (TIMs) for the JPSS-2 effort. This resulted in a glowing response from the IV&V point of contact on the JPSS-2 Flight Project Team, who is also the JPSS Flight Software System Engineer:

"What can I say but, WOW! I cannot overstate the significant contribution you have all made to the J2 Spacecraft Flight SW development, helping to ensure that JPSS Flight Project would realize/receive a high quality product that not only met our requirements, but will also be sustainable going forward into flight and for both J3/J4 spacecrafts. Much gratitude to you all!"

IV&V started 6/1/2015
FY21 Issue Acceptance Rate: 76.5%
FY21 Issue Phase Containment: 100%



Europa Clipper

The Europa IV&V team provided the Project, stakeholders and users with an overall "Medium-High" confidence that the Europa Compute Element (ECE) FSW was ready to proceed cautiously with system integration. IV&V's FSW analysis results presented at the Europa System Integration Review (SIR) revealed that the Project is 75% complete with implementation; however, the test verification was only 40% complete.

One of the SIR Board Members commented that IV&V provided a very good presentation at the SIR and that IV&V is doing very important work, which it is necessary that IV&V has the staff and support to do this work in a timely manner until the end of FSW development.

IV&V started 4/1/2016
FY21 Issue Acceptance Rate: 99%
FY21 Issue Phase Containment: 93%

Lucy

IV&V completed Software Item Qualification Test analysis for all in-focus software, and provided all planned assurance conclusions to the project with high confidence in the software's ability to meet the needs of the mission. The IV&V Program has improved quality and confidence in Guidance Navigation & Control and science operations throughout development, integration, and testing phases. The IV&V team received significant praise from the Project and Development teams for our contributions to the mission. Lucy successfully launched on 10/16/2021.

IV&V started 1/1/2017
FY21 Issue Acceptance Rate: 99.7%
FY21 Issue Phase Containment: 99.7%

James Webb Space Telescope (JWST)

Following nearly 20 years supporting JWST, closing all formal risks, and resolving over 1,500 Severity 1 -3 TIMs, IV&V reported high confidence in the mission software at the JWST Safety and Mission Success Review prior to launch.

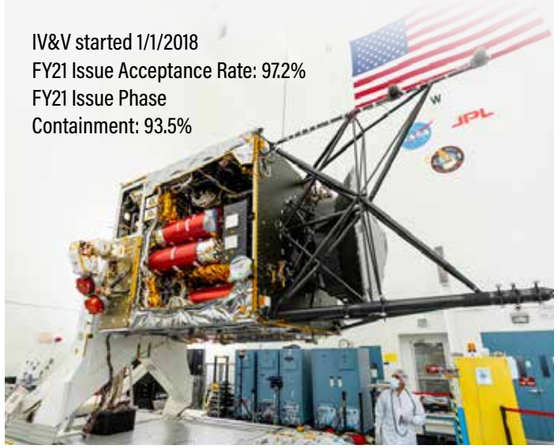
IV&V started 4/1/2002
FY21 Issue Acceptance Rate: 100%

FY21 Issue Phase Containment: 100%

Psyche

IV&V continued to provide valuable results to the project, increasing reliability and confidence in the flight software. As result of a static code analysis activity, IV&V identified a severity 2 TIM where a buffer overflow was causing a subtle memory corruption error. The developer was very appreciative and indicated they never would have caught it.

IV&V started 1/1/2018
FY21 Issue Acceptance Rate: 97.2%
FY21 Issue Phase Containment: 93.5%



Nancy Grace Roman Space Telescope (RST)

The IV&V RST team has analyzed the Roman Instrument Command & Data Handling Software and Test Procedures and created a Technical Reference for the Fine Guidance Sensor Algorithm FSW to assure this software is at peak performance. IV&V continues to be an active participant in FSW Requirement and Test Reviews and Advanced Camera for Surveys requirements, design, code, and test reviews.

The matured development of our WISP simulator, our Roman Space Telescope Digital Twin, now includes early builds of spacecraft and instrument flight software.

IV&V started 5/1/2017
FY21 Issue Acceptance Rate: 100%
FY21 Issue Phase Containment: 99.8%

MISSION PROTECTION SERVICES

Mission Protection Services (MPS)

MPS takes a threat-informed and consequence-driven approach to provide independent assessment of mission security risk, with a focus on system and operational security risk factors.

MPS conducts security engineering analysis on NASA missions from an end-to-end context and throughout the mission lifecycle.

MPS protects missions from malicious acts, security exploitation, and/or security engineering and design risk that can result in mission failure by identifying, communicating, tracking, and advising on mission risk.

237 Findings that enabled missions the opportunity to address vulnerabilities which could have security impacts up to mission failure.

Benefits:

- Action is taken to reduce mission security risk to acceptable levels.
- Enable teams to consciously accept risk where appropriate.
- Built-in security removes vulnerabilities or reduces their impact for mission systems in development and maintenance.
- Enhanced operations planning with insight into security monitoring capabilities and response readiness that will enhance mission success.
- Inform other mission, engineering, and acquisition organizations about factors that affect the security-resiliency of their mission systems.
- Enhance policy, direction, and guidance to mission directorates, mission projects, and their support organizations.

NASA IV&V'S *Newest Challenge*

END-TO-END MISSION SECURITY... TO ENABLE MISSION SUCCESS.

GROUND SYSTEMS

DEVELOPMENT

POLICY & PROCEDURES

FLIGHT SYSTEMS

COMMUNICATIONS

MISSION OPERATIONS

SOFTWARE ASSURANCE *for the* COMMERICAL CREW PROGRAM (CCP)

- Increasing the likelihood of CCP achieving safe, reliable, and cost-effective access to and return from the International Space Station (ISS) through analyses relating to software safety and software quality.
- Two safe launches and two safe returns of three different crews in 2021.
- Analysis identified 489 Findings and Recommendations in 2021.
- Supported 68 Safety Technical Review Boards and 21 Technical Interchange Meetings.

ENGINEERING AND OUTREACH

- Software Architecture Review Board (SARB) support to reduce flight software complexity to reduce risk and save costs.
- Space Trusted Autonomy Partnership support to examine the issues surrounding trusted autonomy in space systems including NASA and other federal partners.
- Improved Cybersecurity through updates to the Software Engineering Handbook (NASA-HDBK-2203).
- Delivered autogenerated Software Assurance tasking checklists to save time and money.
- Provided technical expertise to Wallops projects – Advanced Command Destruct System (ACDS), and NASA Autonomous Flight Termination Unit (NAFTU).
- Supported a key Department of Energy Software Assurance and Cybersecurity initiative.

CLOUD SECURITY ASSESSMENTS

- Advancing the proliferation of cloud systems through penetration testing to identify critical vulnerabilities in NASA cloud systems. Our team has helped protect these missions from compromises which, if exploited, have the potential to cause loss of the mission or significant impacts to security of our data.

JON MCBRIDE SOFTWARE TESTING AND RESEARCH (JSTAR)

Developed a custom ERAD750 flight computer model in Simics.

Completed a Modified Condition/ Decision Coverage analysis of open-source Core Flight System software.

Development and deployment of Roman Space Telescope Digital Twin (WISP) for spacecraft and instrument flight software testing capabilities. Initial setup of Roman Hardware-in-the-Loop testing capability.

Maturation of a Psyche simulation environment (PHASE) to support independent testing.

Multiple updates to Software-only Simulator to remain in-phase with SLS flight software development and V&V.

Assists GSFC Small-Sat development efforts by enabling development and testing of flight software in a virtual environment when lab time is more constrained than ever before.

Simulation to Flight 1 (STF-1), West Virginia's first Cube-Sat, surpassed 1,000 days of operation in-orbit.

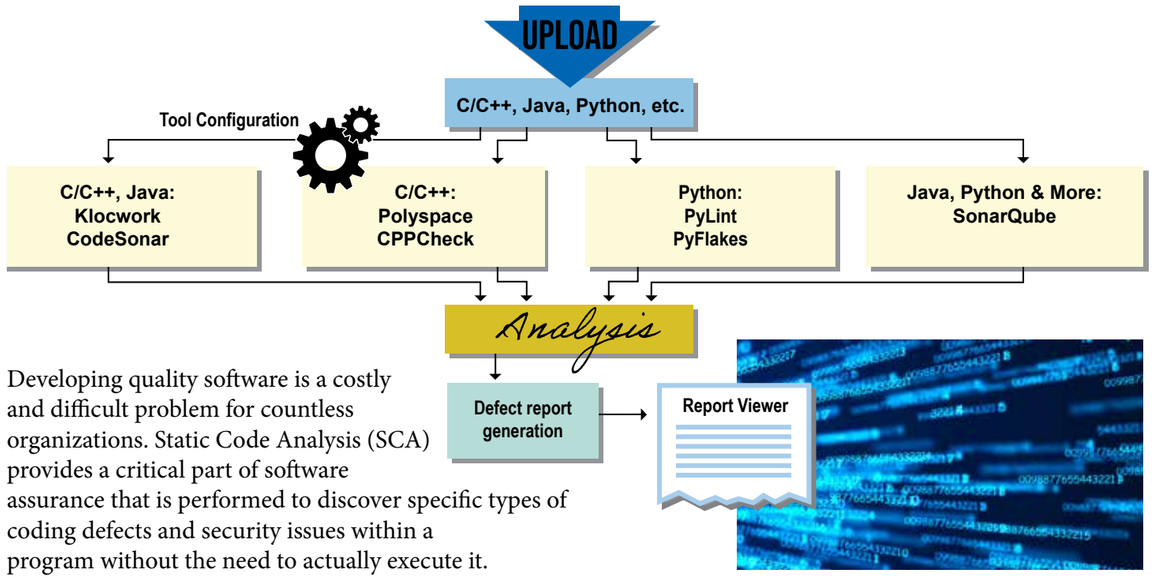
Advanced Risk Reduction Integrated Software Test and Operations Tri-program Lightweight Environment (ARRISTOTLE)

ARRISTOTLE enables evaluation of Artemis missions from an end-to-end perspective in which we have multiple system's software executing in a simulated environment. The ability to execute all systems in one simulation allows us to evaluate the integrated nominal and off-nominal behaviors of systems working together in order to accomplish the mission.

MODEL BASED MISSION ASSURANCE (MBMA)

MBMA leverages modeling to perform a variety of assurance analyses earlier in the lifecycle, reducing the occurrence of costly changes after the system design hardens. The MBMA team has developed capabilities to perform requirement and design verification as early as project preliminary design review (PDR). By using the MBMA capabilities, IV&V can utilize near real time simulation capability that, in some cases, incorporates environmental simulators such as GSFC 42 Sim and others to aid in the Command & Data-Handling Systems / Guidance, Navigation & Control verification early in the lifecycle. In addition to being timelier, this approach is more flexible, cost-effective, and comprehensive. MBMA has been leveraged by external organizations such as the GSFC Space Communications and Navigation (SCaN) Program. MBMA aided the SCaN program in developing their current and to-be network architectures which will support future Human Exploration and Operations (HEO) Missions such as Artemis, Gateway, and Mars missions. MBMA has also aided the MPS efforts in identifying high severity security vulnerabilities through its modeling activities.

STATIC CODE ANALYSIS *Services*



Developing quality software is a costly and difficult problem for countless organizations. Static Code Analysis (SCA) provides a critical part of software assurance that is performed to discover specific types of coding defects and security issues within a program without the need to actually execute it.

Though the benefits of program analysis are obvious, building a cost-effective program analysis is not trivial since computer programs are complex and often very large. The number of inputs, not to mention the number of program states, that can arise in all possible use cases is so huge that software developers are likely to fail to handle some corner cases. The number can easily be greater than the number of atoms in the universe, for example.*

CAN SCA HELP YOUR ORGANIZATION AVOID COSTLY SOFTWARE QUALITY ISSUES? *Yes!*

285 Findings that enabled missions to address defects which increases mission assurance.

HERE ARE SOME *Key Benefits* OF SCA:

- SCA can identify potential code defects missed during testing or code reviews.
- SCA excels at identifying errors that elude the most experienced and skilled developers.
- SCA can identify maintainability concerns that can negatively affect code quality.
- SCA tools can analyze large code bases in a short amount of time.
- Performing SCA early in the lifecycle can identify issues that are most cost-effective to solve versus later in the lifecycle.
- SCA tools readily support numerous safety-critical coding standards, best practices, defect taxonomies, and security standards.

* Rival,X. & Yi,K. [2020] *Introduction To Static Analysis: An Abstract Interpretation Perspective*
Massachusetts Institute of Technology

EDUCATION & OUTREACH *Services*

EDUCATION RESOURCE CENTER

NASA IV&V's Education Resource Center (ERC) continued to provide STEM engagement to students and educators across the state through hands-on workshops, webinars, STEM events, summer camps, and robotics competitions. The ERC's "Loan and Learn Program" provides training for educators, which certifies them to borrow one of 55 STEM classroom kits to inspire and engage their learners. ERC staff added a third educator professional development course, offered through Fairmont State. Collaborating with our Strategic Communications Office (SCO) and NASA IV&V Project Managers, the ERC hosted a virtual workshop and celebration for the Perseverance Landing. The ERC also hosted and live-streamed dozens of remote robotics competitions with teams attending from West Virginia and across the world and hosted our first ever in-person aerial drone tournament. A pilot event for WVSSAC Robotics was held in Charleston in May, with 19 schools participating. Each robotics summer camp offered across the state ran at maximum capacity and was led by college interns sponsored by the WV Space Grant Consortium. Through a collaboration with Destination SPACE, we provided a week-long residential space camp at Fairmont State University for 24 high school scholars. We hosted our first residential robotics boot camp for new coaches, which provided free robots to participants thanks to the support of NASA IV&V Director Greg Blaney.

INTERNSHIPS

In FY21, the IV&V internship program consisted of yearlong and summer positions that let students work on projects including: Orion, Gateway, Artemis, simulations and modeling, and education. We welcomed 20 diverse students from New York, Connecticut, California, West Virginia, Indiana, and Texas. And as our IV&V Program officially made "inclusion" one of its program values in 2021, we saw diversity and inclusion come to life with our internships:

- 17% Disability Claimed
- 6% Military Service
- 39% Female
- 5% Asian
- 6% Native American or Alaska Native

These students had the opportunity to showcase their project efforts at an annual capstone presentation, which highlights the projects, the mentors who serve, and the students' skills. It was a chance, even in a virtual environment, to come together and celebrate the benefits of our internship program. And it doesn't end with the internship program, which often leads to future opportunities. Our IV&V interns have gone on to fill roles at IV&V and other NASA locations as Pathways interns and as full time employees in the space industry, automotive industry, medical industry, and banking industry. We hope to welcome many more interns in the years to come!

IV&V PROGRAM FACING *Services*

Program Facing Services enable efficient and effective delivery of IV&V business functions in the form of Mission Facing Services. These value-added activities are required for timely, reliable, and quality services which promote and enhance mission assurance and the Agency's achievement of our strategic objectives.

FACILITIES are making our workplace smarter. We have incorporated lessons learned from being apart to begin building for the Future of Work to save time and money:

- Zero Safety Incidents in FY21
- Completed Construction of "Hoteling" seating area
- Touchless Entry Doors installed for Safety and Accessibility
- PLC/Breaker Decommission addressed an emergent Safety Issue

INFORMATION TECHNOLOGY (IT)

is the backbone of our enterprise. In FY21, IT completed initiatives which enabled remote access, increased security, and assured business continuity while maintaining standards for performance in customer service as demonstrated by:

- 1,300+ Service Requests Supported
- Achieving 100% Customer Satisfaction
- Achieving 100% Services Uptime

SOFTWARE ASSURANCE TOOLS (SWAT)

enable repeatability and performance. SWAT's commitment to continuous improvement and efficiency and effectiveness helped maintain mission assurance standards:

- 54 Tools Supported
- 40 Production Releases including 75 Change Requests
- 1,006 Mission Artifacts Analyzed including 157,468 Requirement Assessments

SECURITY protects our people, facilities, information, and other assets. Security implemented new controls for access and in-processing to protect our assets in the face of an evolving threat landscape and accredited space for more sensitive work.

- Nearly 15K patrols and 1,900 calls processed
- 211 Badging Items Completed
- 710 Visitors Processed

COMMUNICATIONS

activities are used to motivate our workforce, drive success, and connect the public with stories about the amazing work we get to support.

- 10 Awards, Launch or Education Events Hosted
- 14 External Articles to Inform the Public
- 50 Newsletters to Engage our Team

KNOWLEDGE MANAGEMENT (KM)

increases our return on investment. Focus has been on advancing Mission Assurance by fostering and promoting a Learning Organization — one where knowledge is captured, preserved, shared, and applied.

- 74 Technical Methods and 27 System Level Procedures
- 240+ Lessons Learned
- 1,400+ Current Risk Assessments
- 54K+ Issues Documented (Current Data Store)

BEST PLACE TO WORK IN THE FEDERAL GOVERNMENT *2021*

PROGRAM FINANCIAL MANAGEMENT

sustains capabilities and operations. Supported recommendations and approved changes to the IV&V Program Governance and Funding Model to promote increased alignment with the PPBE process and greater engagement of mission assurance personnel in the development of the annual IV&V plans.

- >$50M Budget
- 340 Requisitions Processed

PROCUREMENT AND CONTRACTS MANAGEMENT

engages our partners. NASA's IV&V Program relies on our partners to achieve and maintain our standards of performance and excellence.

- 11 Contracts, Grants and Agreements Maintained (Six with WV organizations)
- Two new services procurement acquisitions in FY21

HUMAN CAPITAL

invests in our people. Our people make us the best in the world!

- Over 4,000 Training Sessions Completed
- >15K training Courses Available
- 40 Active Mentor-Protégé Engagements
- NASA rated as the Best Place to Work in Federal Government

OUR PEOPLE PROVIDE *the Services*

THAT MAKE MISSIONS SAFER.

NASA civil service employees residing in West Virginia earned $8.4 million per year in labor income according to a recent study.

These economic activities generate $4.3 million in tax revenues for the state and local governments in West Virginia, according to the report.

The total economic impact resulting from these activities when multipliers are applied is estimated to account for:

$48.1 MILLION IN LABOR INCOME

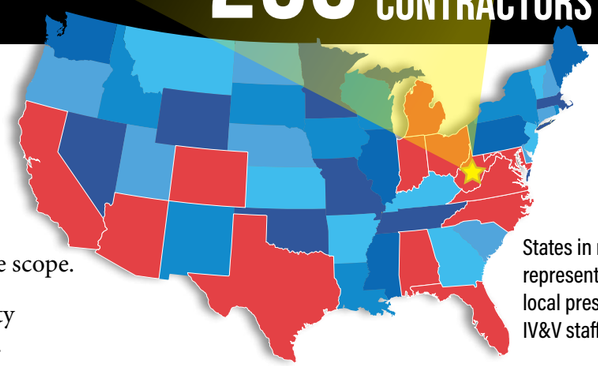
$137.5 MILLION IN ECONOMIC OUTPUT

53 CIVIL SERVANTS

250 CONTRACTORS

NATIONAL FOOTPRINT, NATIONAL CAPABILITY

- Supported 18 missions across 7 centers.
- Our national footprint supports agency-wide scope.
- We provide subject matter experts in a variety of disciplines, domains, processes, and tools.



States in red represent the local presence of IV&V staff.

Recognition:

SPACE FLIGHT AWARENESS AWARDS

2021 Trailblazers:
Gage Mazurowski & Gerek Whitman

2020 Silver Snoopy:
Nicholas Guerra

2020 ROBERT H. GODDARD AWARDS

Customer Service:
IV&V Program's SCO Educator Resource Team

Mission and Enabling Support:
IV&V Program's COVID-19 Response Team

DIRECTOR GREG BLANEY *Retiring:*

Gregory Blaney has served as the Director of NASA's Independent Verification and Validation (IV&V) Program, located in Fairmont, West Virginia for more than a decade providing leadership and technical direction. His leadership has set a lasting example that will surely remain within the IV&V Program as Mr. Blaney retires this year.

Born in Morgantown, West Virginia, Mr. Blaney worked at the Goddard Space Flight Center in Maryland as a Network Director providing services for NASA missions such as the Space Shuttle, the Hubble Space Telescope, and classified operations before transferring to NASA's IV&V Program in West Virginia. Mr. Blaney has been with NASA through the pivotal events – like Challenger and Columbia – that led to the creation of the IV&V Program and has never allowed those tragedies to be forgotten as the program strives for safety and assurance. Since his arrival at IV&V, he has held many positions within the IV&V Program including Supervisor, Operations and Maintenance Manager, Acting Deputy Director, and Associate Director of Operations before transitioning into the Program Director role.

In his nearly 40 years with NASA, Mr. Blaney has earned several prestigious awards including the Manned Space Flight Awareness Award, the Silver Snoopy Award presented by the NASA astronaut corps, NASA Headquarters Honor Award for Leadership, the Agency Outstanding Leadership Medal and the Presidential Rank Award of Meritorious Executive given by the Office of the President.

As Mr. Blaney prepares to retire and surely spend more time with his family, the IV&V Program wishes him well and hopes to continue shooting for the stars as Mr. Blaney has all these years.

Wes Deadrick is the new IV&V Program Director. He began his NASA career in 2002 as an intern, and has since gained experience as the IV&V Project Manager on a variety of NASA missions and programs; as the Lead for the IV&V Program Safety and Mission Assurance (SMA) Support Office (SSO); and most recently as the Lead for the program's IV&V Office.

Mr. Deadrick also serves as a senior staff member for the Goddard Space Flight Center and the Office of Safety and Mission Assurance at NASA Headquarters.

More information on Mr. Deadrick can be found at www.nasa.gov/centers/ivv/about/directorsbio.html.

IV&V'S MISSION

To provide our customers assurance that their safety and mission critical systems and software will operate reliably, safely and securely, and to advance the systems and software engineering disciplines. In doing so, we work to standards of excellence, focus on customer satisfaction, inspire and advance the next generation, and adhere to and demonstrate our core set of values: safety, integrity, respect, inclusion, teamwork, balance, innovation and excellence.

IV&V'S VISION

To be a world leader in systems and software engineering that enables our customers' success.

IV&V'S VALUES

The NASA IV&V organization embraces these values in words and deeds, as they collectively shape behaviors, guide services to customers, and establish the NASA IV&V organization's culture.

Safety • Integrity • Respect • Inclusion • Teamwork •

Balance • Innovation • Excellence

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