

NASA Independent Verification and Validation (IV&V) Program



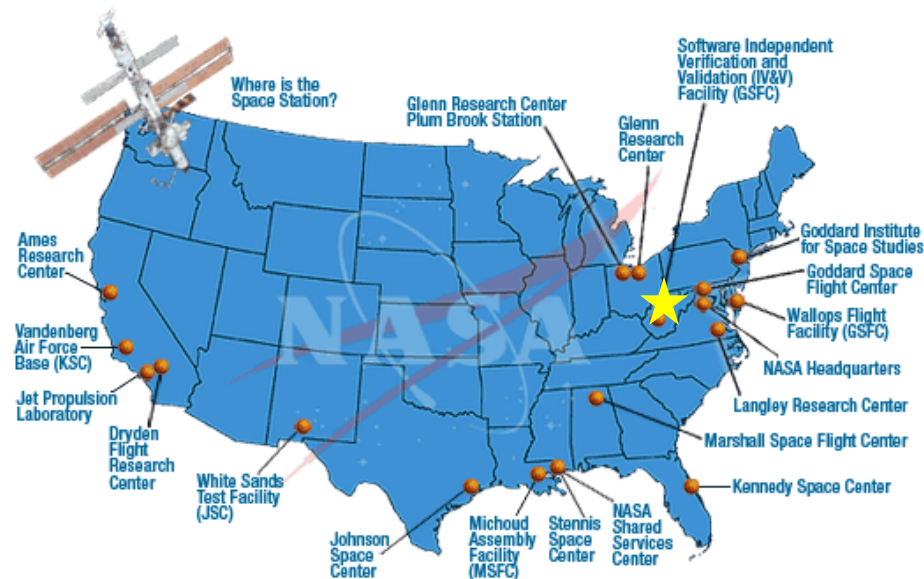
NASA IV&V Program, Fairmont WV

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NASA IV&V Program

- Independent Verification and Validation (IV&V) is a NASA Program located in Fairmont West Virginia
 - IV&V Program's technical work is directed by the Office of Safety and Mission Assurance (OSMA) at NASA Headquarters
 - IV&V Program's administrative functions are handled through Goddard Space Flight Center (GSFC).



GSFC field center located in Fairmont West Virginia

NASA IV&V Program (cont)

- The NASA IV&V Program analyzes mission and safety critical system software on NASA's development efforts to ensure mission software will operate reliably and safely.
 - Basically → ensure that system software will not fail and will do what it needs to do!
- Throughout the development life-cycle, IV&V utilizes subject matter experts (SMEs), engineering tools, independent testing, and engineering rigor to conduct its analyses
 - IV&V generates objective evidence regarding whether or not engineering artifacts adequately address what software needs to do, doesn't need to do, and what software needs to do in the presence of failures

Example Projects @ IV&V

Space Shuttle (just retired it)	International Space Station (ISS)	James Webb Space Telescope (JWST)
Multipurpose Crew Vehicle (MPCV)	Mars Science Laboratory (MSL)	Gravity Recovery and Interior Laboratory (GRAIL)
Juno	Global Precipitation Measurement (GPM)	Magnetospheric MultiScale (MMS)
Mars Atmosphere and Volatile Evolution (MAVEN)	Soil Moisture Active Passive (SMAP)	Autonomous Flight Safety System (AFSS)

NASA IV&V Program (cont)

- Some Approaches in our IV&V “Tool box”
 - Requirements, Design, Implementation, and Test Analysis
 - Independent Testing
 - Reusable emulated components, common user interfaces and APIs for simulation development enabling IV&V teams to fully analyze the software in an executable environment.
 - Software Assurance Tools
 - NASA IV&V maintains a laboratory of commonly used software engineering tools that enables all IV&V missions to share engineering tools & best practices
 - IV&V Expert Systems
 - NASA IV&V knowledge base consists of ALL software errors that IV&V has discovered in the 17 years of existence.
 - IV&V’ s Jon McBride Software Testing and Research (JSTAR) Laboratory
 - Capability development to research and advance analytical approaches
 - Advance IV&V’ s Independent Testing Capabilities
 - Rigorous training initiatives to maintain proficiencies of workforce & engage public
 - Rotating employees through mission development efforts
 - IV&V microsatellite missions (NASA IV&V Space Flight Design Challenge)

Capabilities within JSTAR

- Capability Development Initiatives (aka R&D)
 - Advancing testing techniques and developing infrastructure for the analysis of complex systems and robotic/intelligent systems
 - Exploring static and dynamic analysis techniques on software models
 - Advancing software test coverage techniques (e.g. combinatorial testing technique, branch/path coverage testing)



- Current Testing and Simulation Projects
 - ISS, JWST, GPM, AFSS, ~MMS, MPCV
 - Central computing platform for commonly used engineering tools
 - 2 laboratories outfitted with various computing platforms
 - Various robotic/autonomy platforms
 - Rovers, Manipulators, quadcopters, spacecrafts

Areas of Collaboration (i.e. WV Space Grant Consortium) → Professors working real problems / Students getting hands on experience / NASA getting practical solutions

Capabilities within JSTAR (cont)

- Training and education for IV&V workforce, public and students
 - Robotics 101 – offered across NASA
 - Annual Verification and Validation Workshop (Sept. 11- 13, 2012) WVU campus
 - Engaging students & involving them in NASA IV&V initiatives (e.g. Internships and COOP opportunities)
 - Robotics, intelligent systems, capability development, testing AND microsatellite development initiatives at NASA IV&V
 - NASA IV&V Space Flight Design Challenge (see next slide)

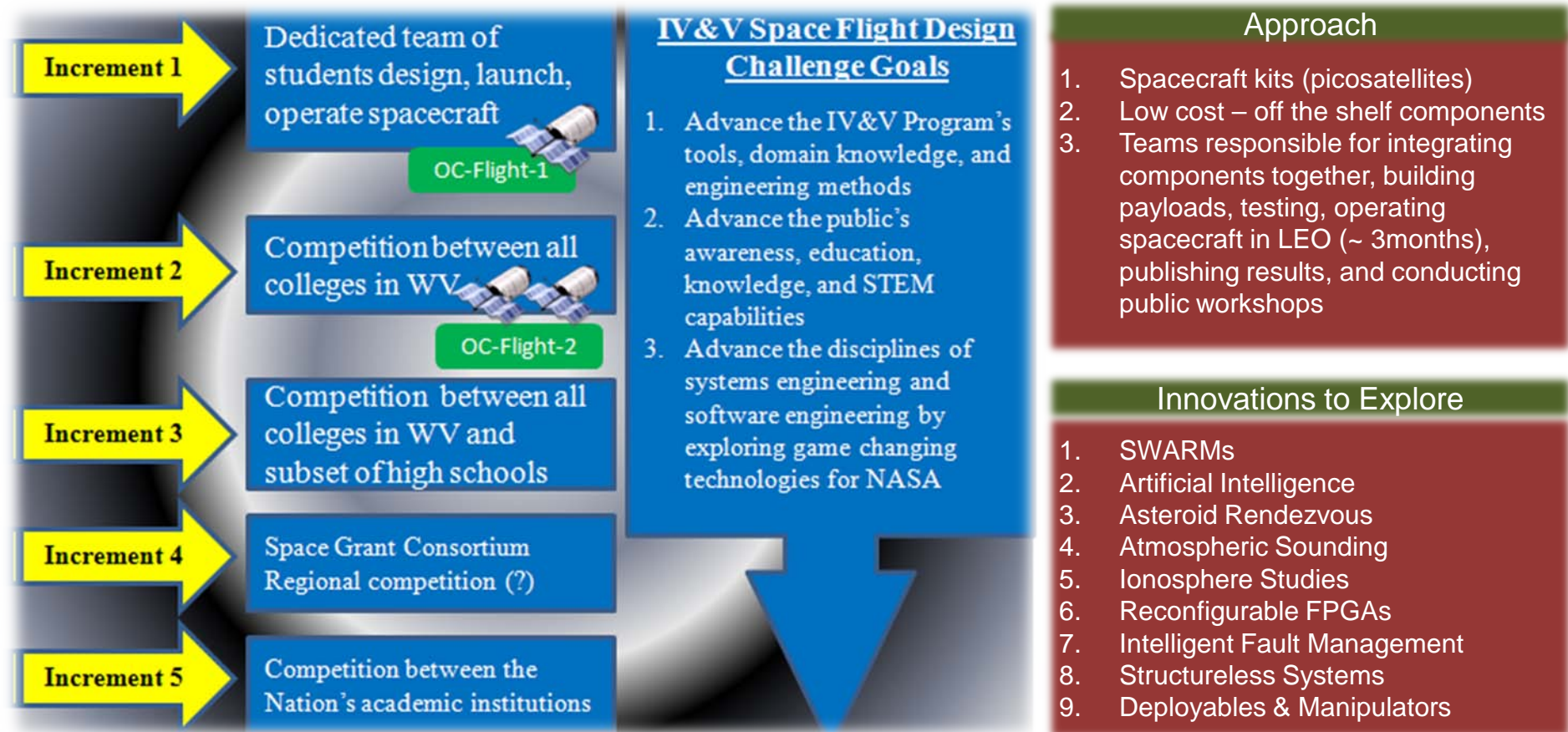
**NASA IV&V Planetary Surface Simulation
located behind Tower 2 at the NASA IV&V
Facility in WV**

Provides an environment for the testing and evaluation of robotic and autonomous applications. It is intended to inspire and engage students and the public in the advancement of Science, Technology, Engineering and Math (STEM), while enhancing knowledge and contributing to the IV&V goal of assuring mission and safety critical software systems.



NASA IV&V Space Flight Design Challenge

- The NASA IV&V Program teaming with WV Space Grant Consortium where academic institutions develop knowledge and gain practical experience in designing, building, launching, and operating space-based vehicles.



First Mission = OC-Flight-1
Launch = Summer of 2012

NASA IV&V & West Virginia Space Grant Consortium

To Collaborate with us is easy ... take the initiative ... Let's invent the future together

*To inspire the next
generation ...*

*as only
NASA
can.*



Independent Verification and
Validation Facility
Fairmont, WV