NASA IV&V Program

NASA's Independent Verification and Validation Program

April 2014 IV&V Boot Camp

History of NASA's IV&V Program

1990

1991 - Grant to WVU to build IV&V Facility. Program assigned to HQ-OSMA

1994 - Space Station Program Implements IV&V through NASA's IV&V Program

1996 - Program assigned to AMES Research Center
Focus = Research

1996 - Facility Omnibus contract: Enabled IV&V across all NASA Projects

1999 - Senior Management Council: IV&V mandate for all NASA software

2000

2000 – Program transitioned to Goddard Space Flight Center
Focus = Applied

2003 - IV&V Funding changed to Corporate G&A

2003 – IV&V Program is functionally assigned to OSMA

2004 - IV&V Board of Advisors formed

2009 - IV&V added to NPR 7150.2A

2010

2010 - Program reorganization to current org structure

2011 - Instantiation of JSTAR & Independent Test Capability

2011 - Consolidated Workforce into one physical location

2012

2012 - ISC Contract award – Single IV&V Service provider

2012 - IV&V Completed 22+ years of Space Shuttle IV&V

2012 - GO-SIM Software of the Year - Honorable Mention

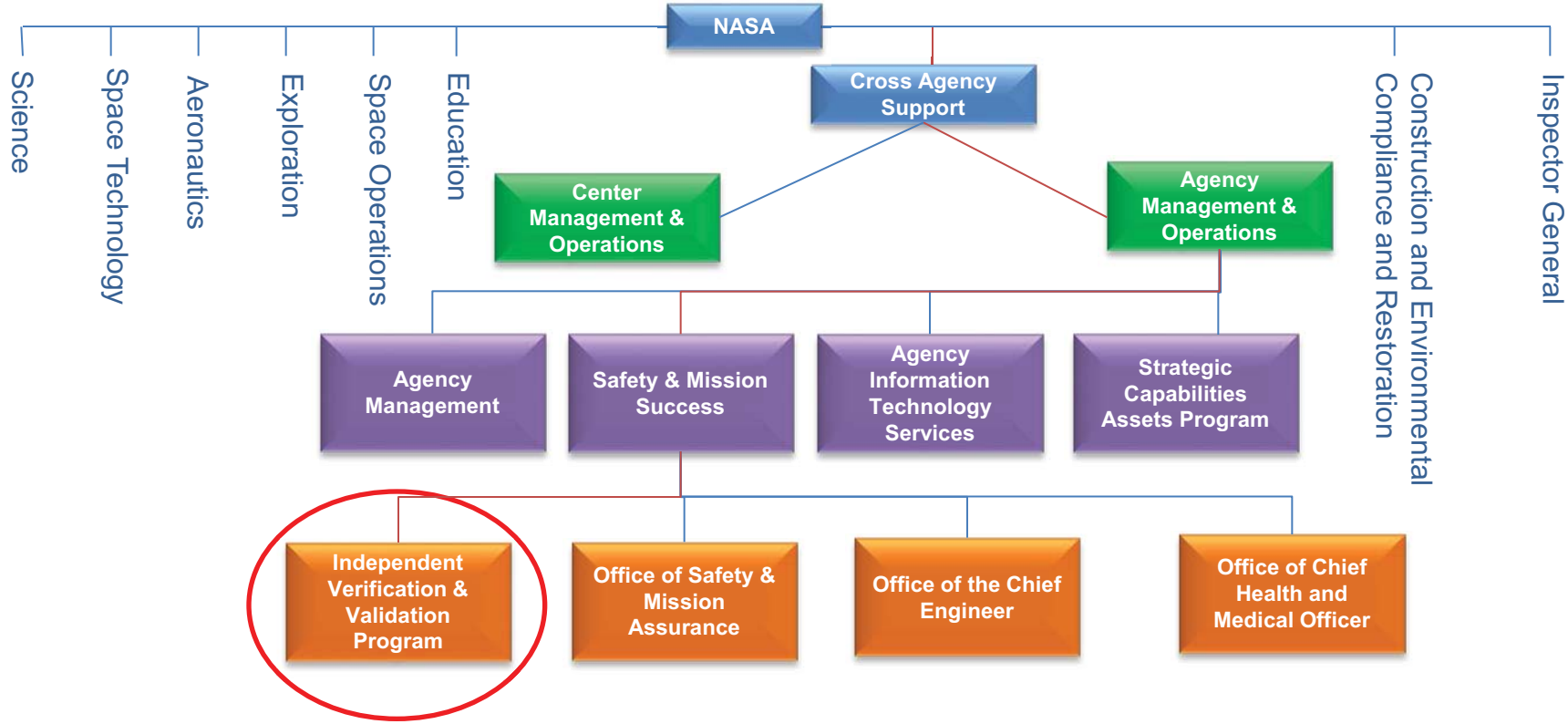
2012 - IV&V Program Strategic Plan completed

2012 - ECTP Work began

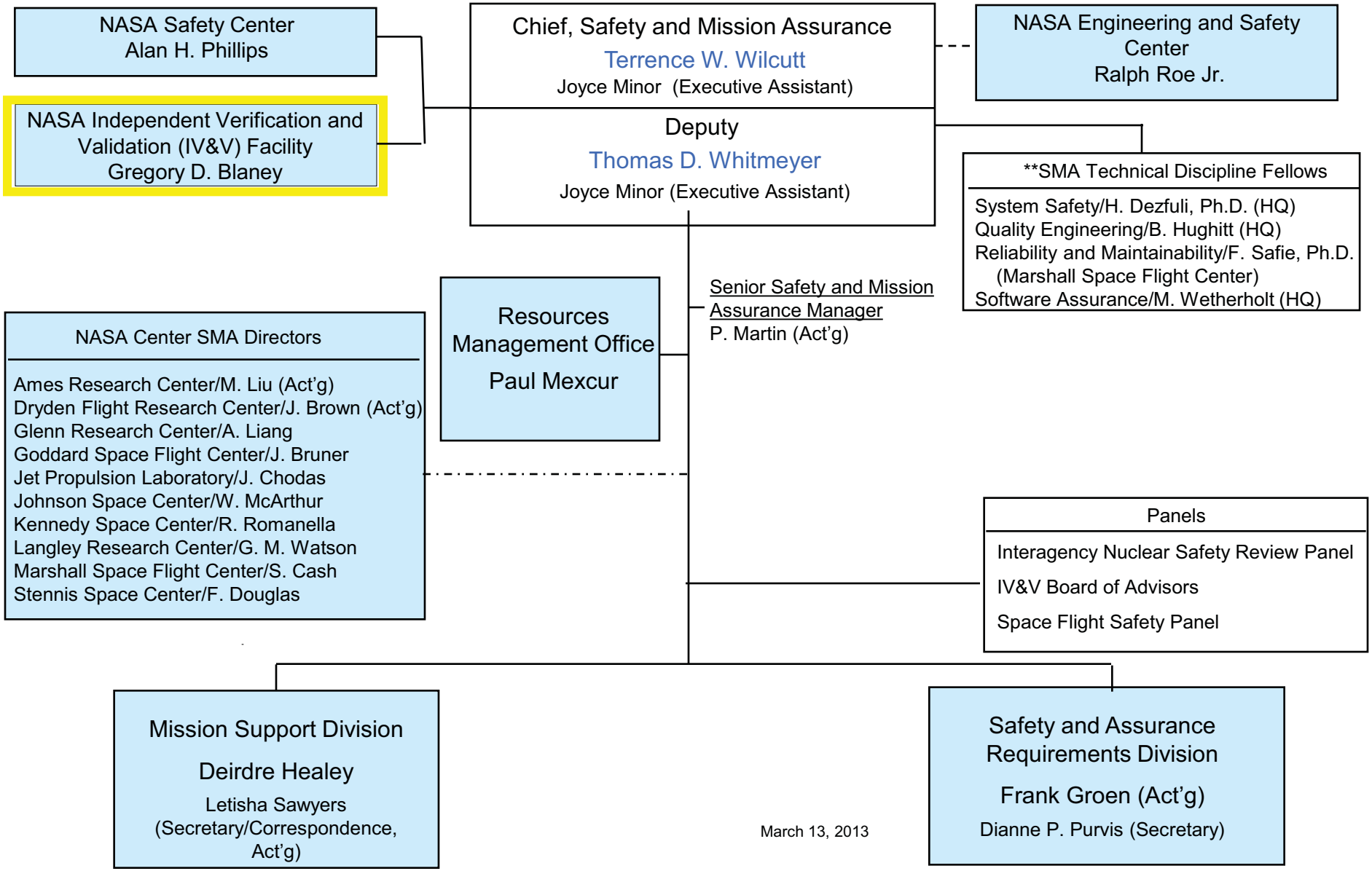
2013 - Work with Commercial Crew partners began

IV&V Program Affiliations

Agency Budget Structure

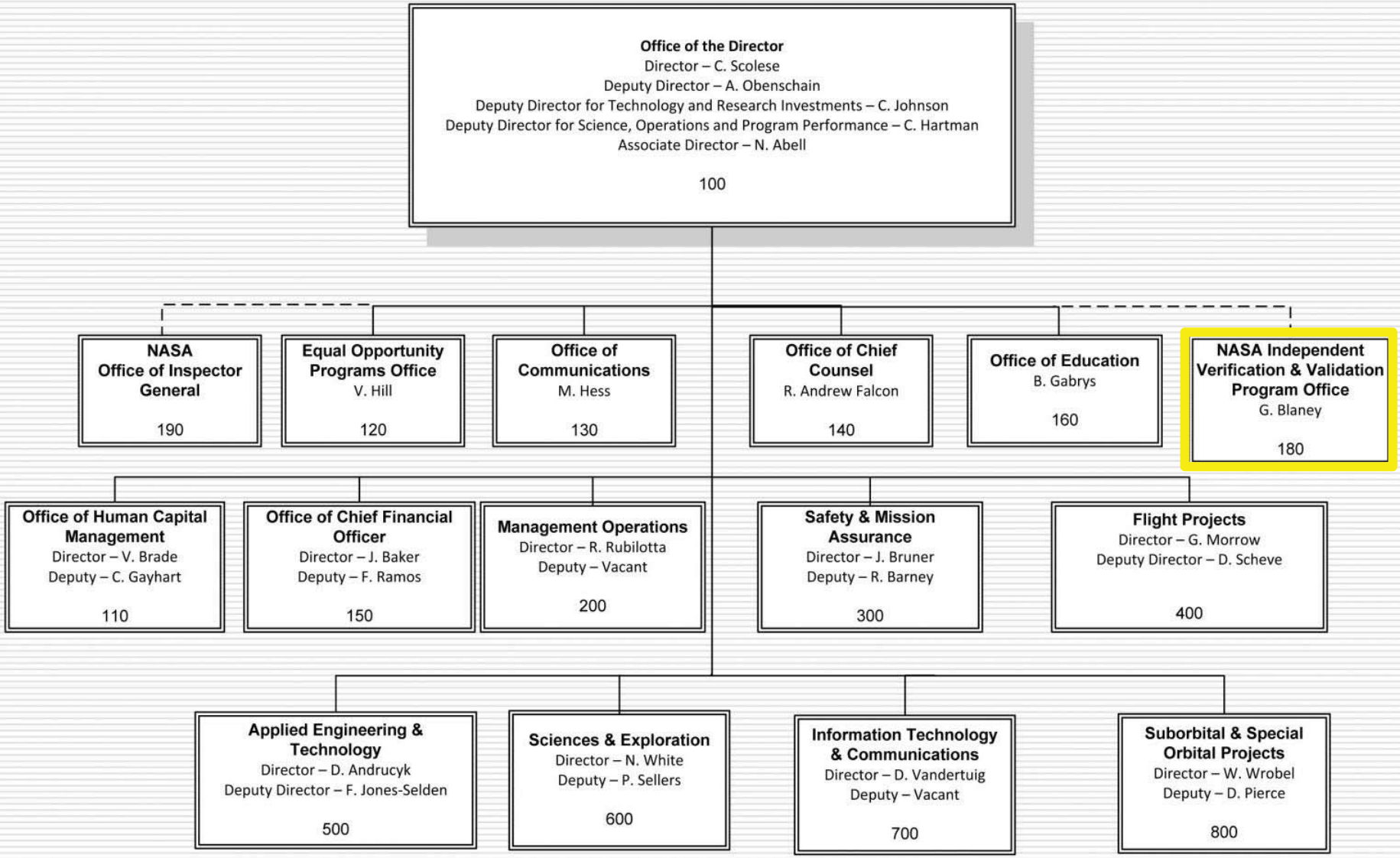


Office of Safety and Mission Assurance



March 13, 2013

Goddard Space Flight Center - Center Org Chart



Updated: February 2014

IV&V Program Information

- FY14: $39.1M NASA funding, $50M total funding
- 45 Civil Servant personnel
- 220 Contractor personnel
- ~25 interns (College and High School)
- IV&V Program trivia:
  - First building in Tech. Park
  - Brought NOAA to the Park: now leases Research building
  - IV&V Program benchmarked by GAO
  - Leases floor space to NOAA and the Army
  - Building #1 owned by WVU Research Corporation
  - Leasing space in building #2 from WVHTCF
  - ISO 9001:2008 certified
  - International IV&V Working Group member
  - VPP certified
  - Led NASA's presence at the 2013 National Scout Jamboree
  - Recognized as a national leader in STEM outreach to students and educators

The Need for IV&V

NASA Decides That A Software Error Doomed The Mars Global Surveyor Spacecraft

By Keith Cowing Posted Wednesday, January 10, 2007

During a meeting of the Mars Explorat
Group Meeting in Washington Dc, yest
McNamee, Mars Exploration Program
the recent failure of the Mars Global Surveyor (MG
spacecraft.

Software Glitch Blamed for Turning Satellite Into Space Zombie

Peter B. de S

Software Glitch Means Loss of NASA's De Comet Probe

timothy posted about 4 months ago | from Taco Cowboy

Taco Cowboy writes "'NASA is ca
comet probe after a suspected so

Office of the Chief Engineer

Reports

Text Size

Technical Excellence Initiative

NASA Study on Flight Software Complexity

In 2007 the NASA Office of Chief Engineer commissioned a multi-Center study of the growth in flight software size and complexity in NASA space missions. The

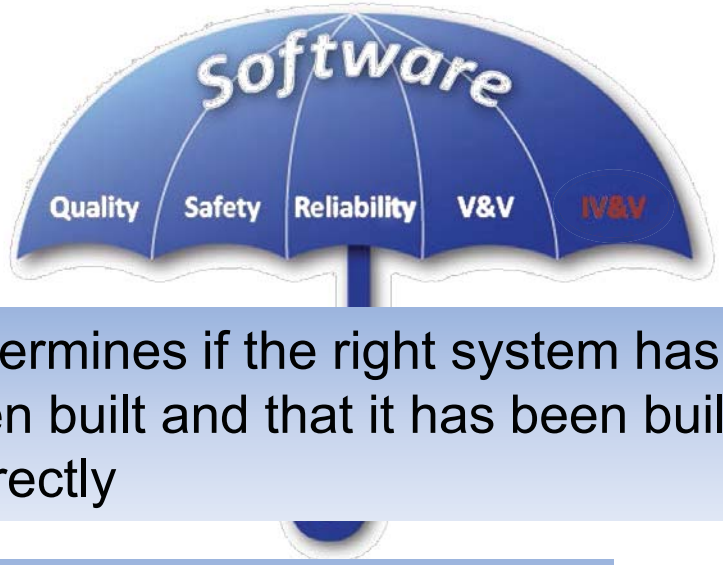
Inquiry Board Traces Ariane 5 Failure to Overflow Error

Readers of *SIAM News* may remember that on June 4, less than a minute into its first flight, the French rocket Ariane 5 self-
des études spatiales) and ESA (the European Space Agency) to investigate the failure was chaired by applied mathematician

Developing complex, safety and mission-critical software systems is inherently challenging, and that creates risk.

What is IV&V?

Independent Verification and Validation (IV&V) is an objective examination of safety and mission critical software processes and products



Independence: 3 key parameters:
- Technical Independence
- Managerial Independence
- Financial Independence

Determines if the right system has been built and that it has been built correctly

NASA IV&V perspectives:
- Will the system's software do what it is supposed to do?
- Will the system's software not do what it is not supposed to do?
- Will the system's software respond as expected under adverse conditions?

IV&V, as a part of Software Assurance, plays a role in the overall NASA software risk mitigation strategy applied throughout the lifecycle, to improve the safety and quality of software systems.

Benefits of IV&V

- Yields higher confidence that delivered products are error free and meet the user needs.
- Increases likelihood of uncovering high-risk errors early in the development lifecycle.
  - Allows time for the design team to evolve a comprehensive solution rather than forcing them into a makeshift fix to accommodate deadlines
- Delivers ongoing status indicators and performance reporting to decision makers (e.g. program managers).
  - The customer is provided an incremental preview of system performance with the chance to make early adjustments.
- Reduces the need for rework from the developing contractor thereby reducing total costs to programs and projects.
- Facilitates the transfer of system and software engineering best practices.

IV&V leads to higher quality products, reduced risk, greater insight, reduced cost, and knowledge transfer.

IV&V Program Value

- Space Shuttle Program: 22 years; over 100 Severity* 1 and 2 issues
- International Space Station: continue to find Severity 1 and 2 issues
- MSL: 952 issues over 6.5 years; 21 severity 1 and 60 severity 2 issues
- Consistently find issues in-phase (90+%)
- Consistently have a very high issue acceptance rate (90+%)
- Developers are improving their processes based on our findings, reducing future errors
- Voice of the customer (2 examples of many):
  - IV&V's "impact on accessing and evaluating the system requirements, Interface Control Documents and software requirements has had an immense payoff as mistakes were caught early on." – Armstrong POC
  - "You guys saved our Program, so thank you very much." – New York City Deputy Mayor Holloway comments on NASA IV&V contributions to NYC Emergency Communications Transformation Program (ECTP)

IV&V results, customer survey metrics, and customer feedback are indicators of high value.

IV&V Services

CCP

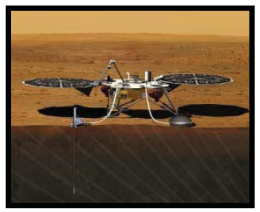

DSCOVR

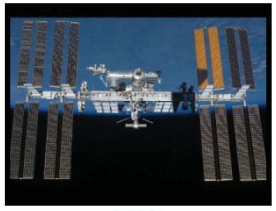

ECTP


GPM


GOES-R


GSDO


InSight

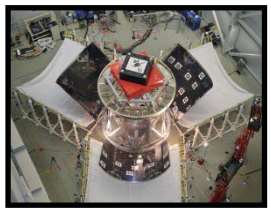

ISS

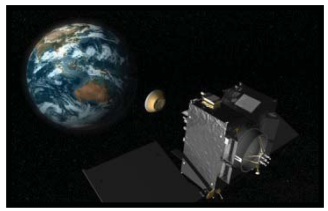

JWST

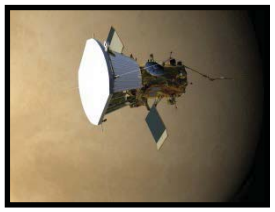

JPSS

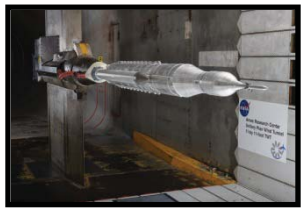

MAVEN

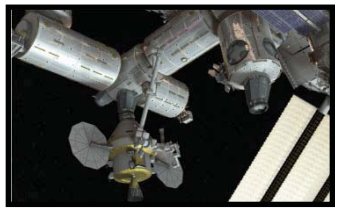

MMS


MPCV


OSIRIS-REx


SPP


SLS


SGSS

IV&V plays a key role in a number of high-profile NASA and non-NASA missions.

NASA IV&V Program Strategic Plan

Vision and Mission

Vision - Be a world leader in systems and software engineering that enables our customers' success.

Mission - To provide our customers assurance that their safety and mission-critical software will operate reliably and safely and to advance the systems and software engineering disciplines. In doing so, we work to standards of excellence, provide professional engineers, provide national and global leadership, focus on customer satisfaction, and adhere to and demonstrate our core set of values: safety, integrity, respect, teamwork, balance, innovation, and excellence.

NASA IV&V Program Strategic Plan

Vision and Mission

Strategic Goal 1: Maintain and develop effective and efficient system and software assurance related services provided to NASA, other government agencies and organizations globally, that field safety and mission critical systems.

Strategic Goal 2: Create and institutionalize innovative technologies and capabilities required for providing evidence that safety and mission critical systems and software will operate reliably and safely.

Strategic Goal 3: Advance the systems and software engineering discipline for the benefit of the Nation and Federal Government.

Strategic Goal 4: Ensure IV&V program capabilities and services are state-of-the-practice and represent standards of excellence for enabling NASA and IV&V program activities.

Strategic Goal 5: Share NASA and the IV&V program with the public, educators and students to provide opportunities to participate in our mission, foster innovation and contribute to a strong national and state economy.

NASA IV&V Program Strategic Plan

Vision and Mission

- Open, honest, transparent, and inclusive communications
- Values based
  - Safety
  - Integrity
  - Respect
  - Teamwork
  - Balance
  - Innovation
  - Excellence

Each of us has a role and responsibility in the pursuit of excellence!