National Aeronautics and Space Administration

Promoting Innovation at America's Spaceport

Siemens IT Innovation Day

David J. Miranda

GSDO Operations Analysis Lead

May 17, 2017

SPACEPORT INNOVATORS

THE JOURNEY TO MARS BEGINS HERE

Outline

- Kennedy Space Center
- NASA's Journey to Mars
- Birth of Spaceport Innovators
- Spaceport Innovators Activities
- Agency Impact


Kennedy Space Center

Kennedy Space Center Past

- Supporting NASA's programs since 1962

1962-1975: Mission to the Moon

1973-2020?: Space Operations

Kennedy Space Center Today

Multiple Partners

Government

Non-Government

1998-2033?: Exploration

2008-∞: Multi-User Spaceport

Multiple Partners

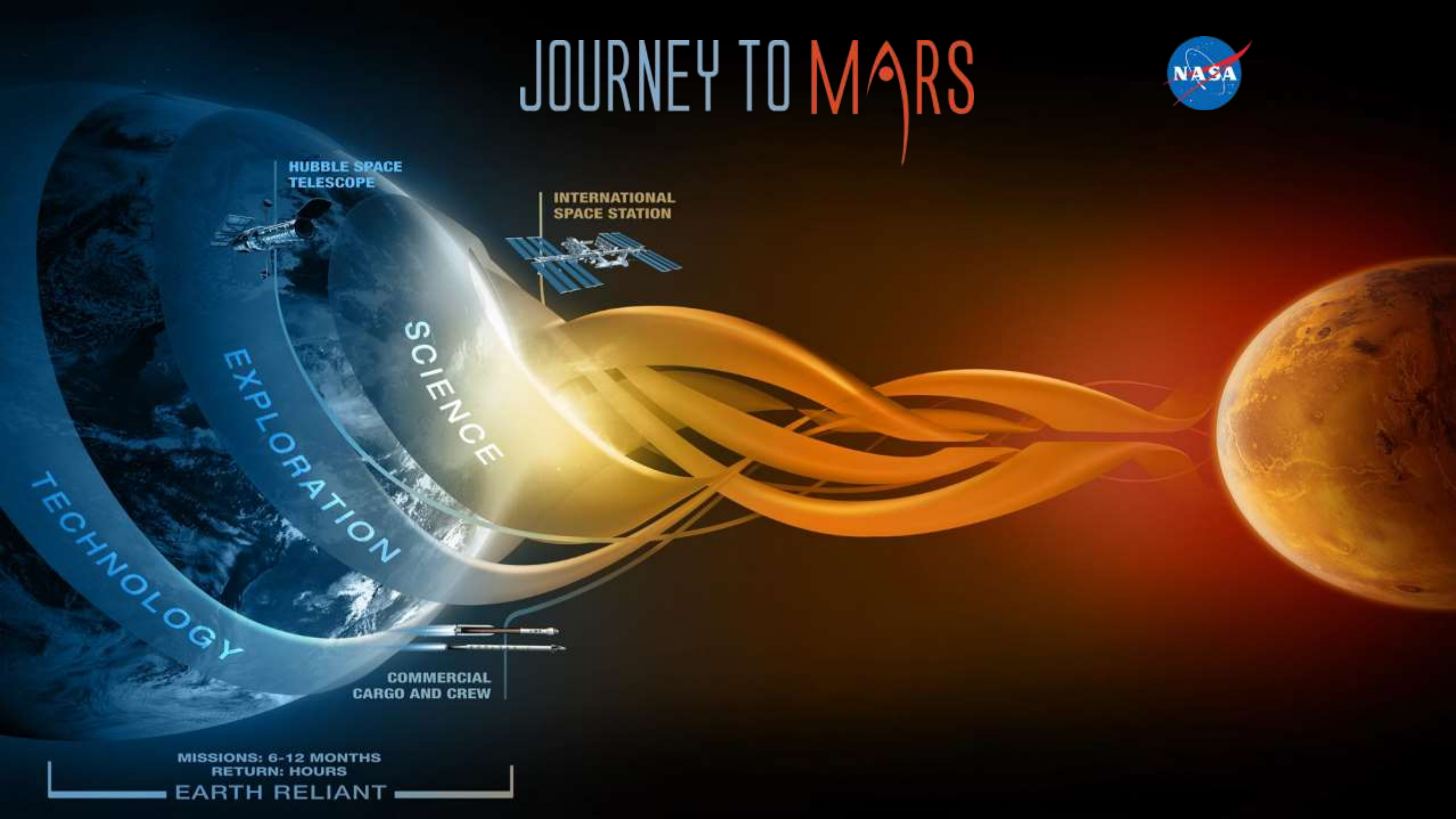
Past

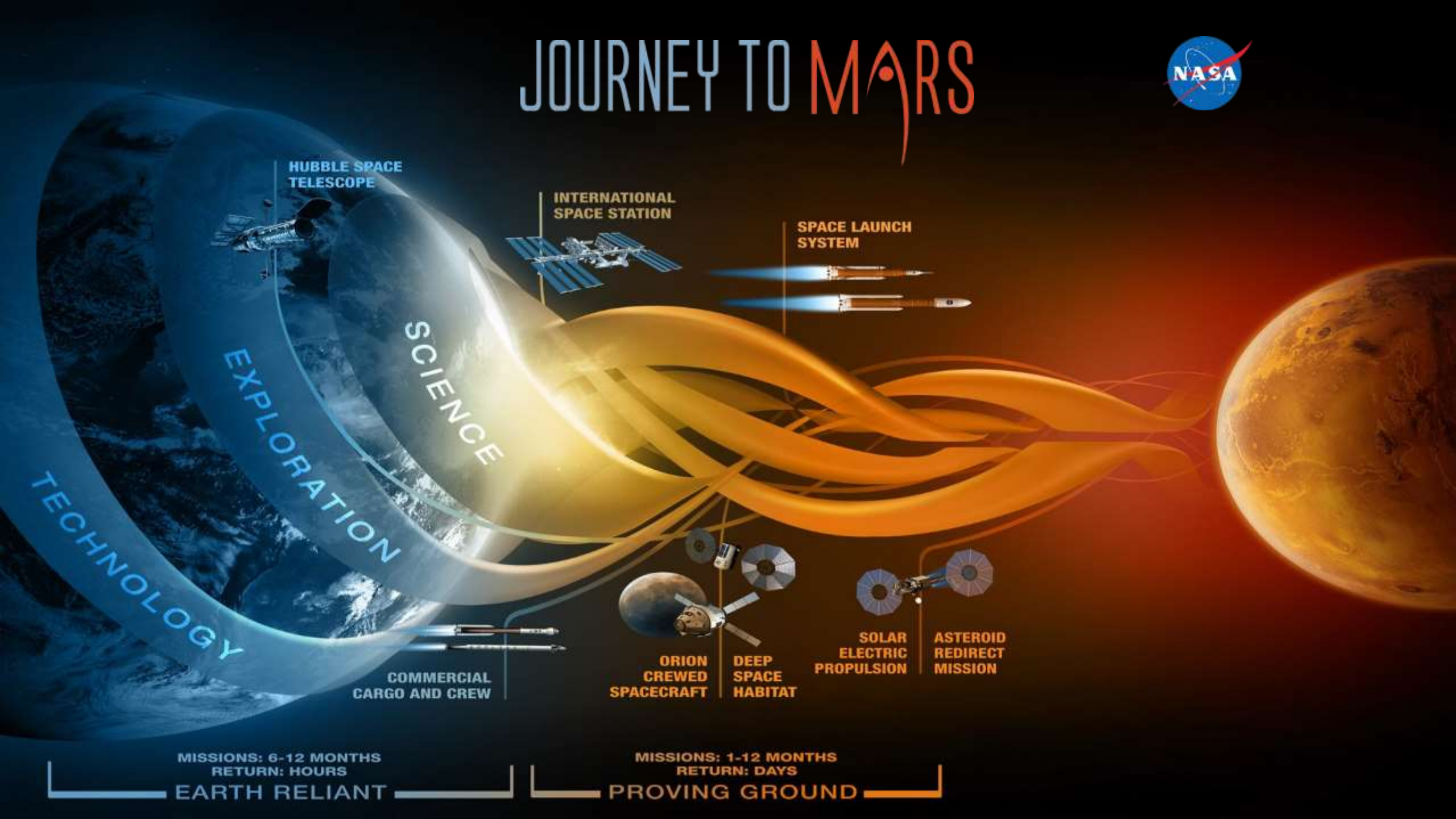
Transition

Government

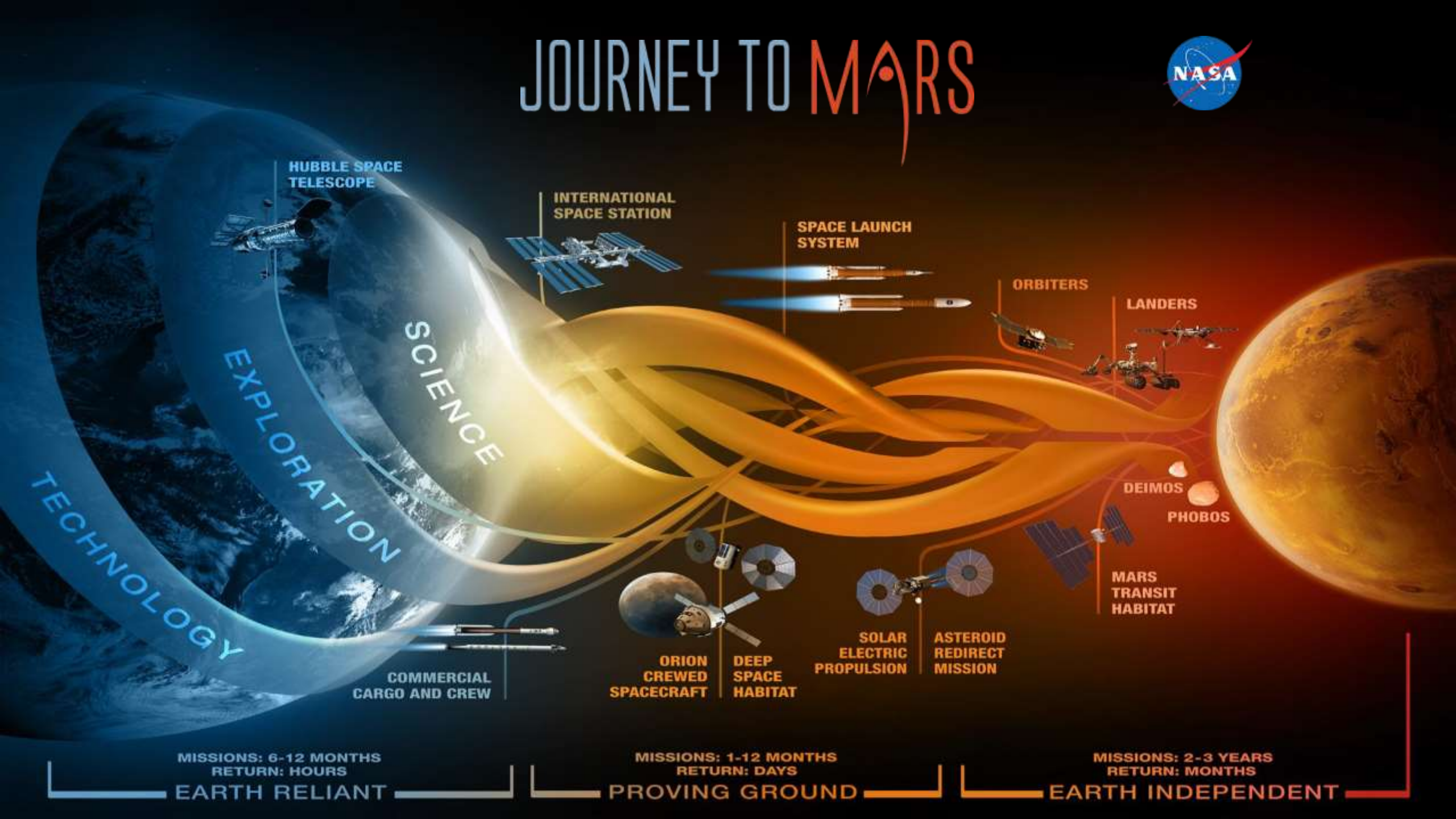
Non-Government


JOURNEY TO MARS
NASA
SCIENCE
EXPLORATION
TECHNOLOGY


JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SCIENCE
EXPLORATION
TECHNOLOGY
COMMERCIAL CARGO AND CREW
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT


JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM
SCIENCE
EXPLORATION
TECHNOLOGY
COMMERCIAL CARGO AND CREW
ORION CREWED SPACECRAFT
DEEP SPACE HABITAT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND

JOURNEY TO MARS



MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT

MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND

MISSIONS: 2-3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

Birth of Spaceport Innovators

- **2010**: Space Shuttle program was ending and KSC was entering new era
- **New Era**: Transition from government spaceport to a multi-user spaceport

- Management tasked a group of KSC civil servants with the challenge to brainstorm new and different ways to think about the Center
  - Everything was on the table: facilities, organizations, partnerships, geography, launch vehicles, and market competition.
  - How could we make the best space center today, for the next 50 years?
- On October 18, 2010 the group met

The First Year of Spaceport Innovators

- Focus turned to the culture needed for this new era
- Started meeting twice a month
- Discussed variety of innovation topics
- Soon, we became involved with an Agency-wide study: Barriers to Innovation

Barriers to Innovation (2011-2012)

7 Themes

- Risk-averse culture
- Lack of opportunity
- Organizational Inertia
- Communication Challenges
- Short-Term focus
- Process Overload
- Instability

5 Recommendations

- Corporate time for creative thinking
- Innovation labs & creative spaces
- Process streamlining
- Innovation investments
- R&D Radical Innovation Labs

KSC Innovation Expo (2012-Present)

- After the Barriers to Innovation study, Spaceport Innovators put itself to work
- In two months a small team created and organized the first KSC Innovation Expo
- **Goal**: Open up the workforce to the world outside our cubicle walls
  - Attack head on the barriers of “Communication Challenges” and “Lack of opportunity”
- Innovation Expo 2012:
  - Exhibits from every KSC organization
  - Tours of KSC labs and facilities
  - Employee networking activities
  - Short talks by NASA innovators and diverse outsiders (U.S. Navy, Publix, Universal Orlando)
  - KickStart: “Shark-tank”-like project funding competition

Kennedy KickStart (2012-Present)

- **Goal**: Remove barriers to innovation
- First – Identify the Barriers
  - Time, Labs, SMEs, Stuff, Permission, Top Cover?
  - Biggest was Stuff, followed by Permission
- Then – Remove the Barriers
  - Stuff
    - $5K of Stuff goes a long way when you have the lab and skills
  - Permission
    - Propose to Kennedy leadership, they pick the ideas
    - Bonus - reduced barriers between senior leaders and folks
- Finally – Publish Results
  - In the Forum, for all to see, comment and learn. Forever.

International Space Apps Challenge (2012-Present)

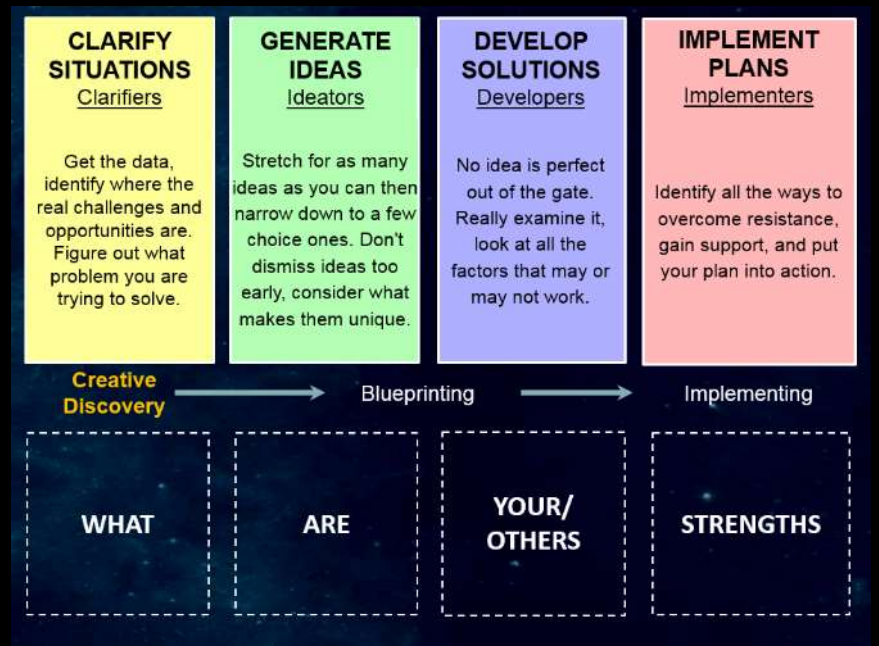
- International hackathon begun in 2012 with the goal of creating solutions of global importance related to spaceflight
- In 2013 Spaceport Innovators hosted the first event at a NASA center
- In 2017 over 25,000 participants in 69 countries participated in the latest Space Apps Challenge

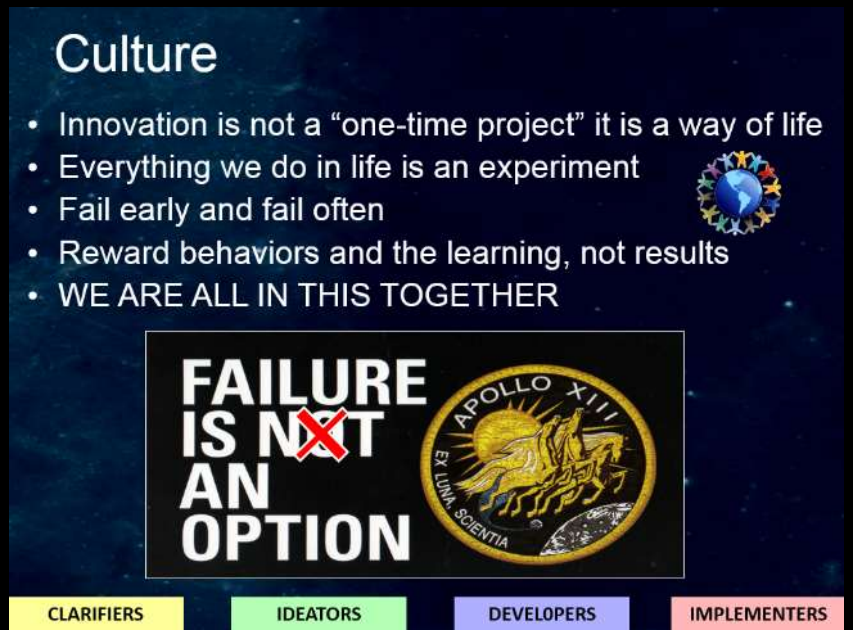
The Employee's Guide on How to Be Innovative at KSC (2014)

The 5 C's of Innovation

- **Creativity**: Conceive of new ideas
- **Communicate**: Articulate the meaningfulness of your ideas
- **Collaborate**: Strengthen your idea through teamwork
- **Culture**: Change your organization so that it embraces new ideas

Human Innovation Training (2015)





Others Define

Innovation: Something different that has impact

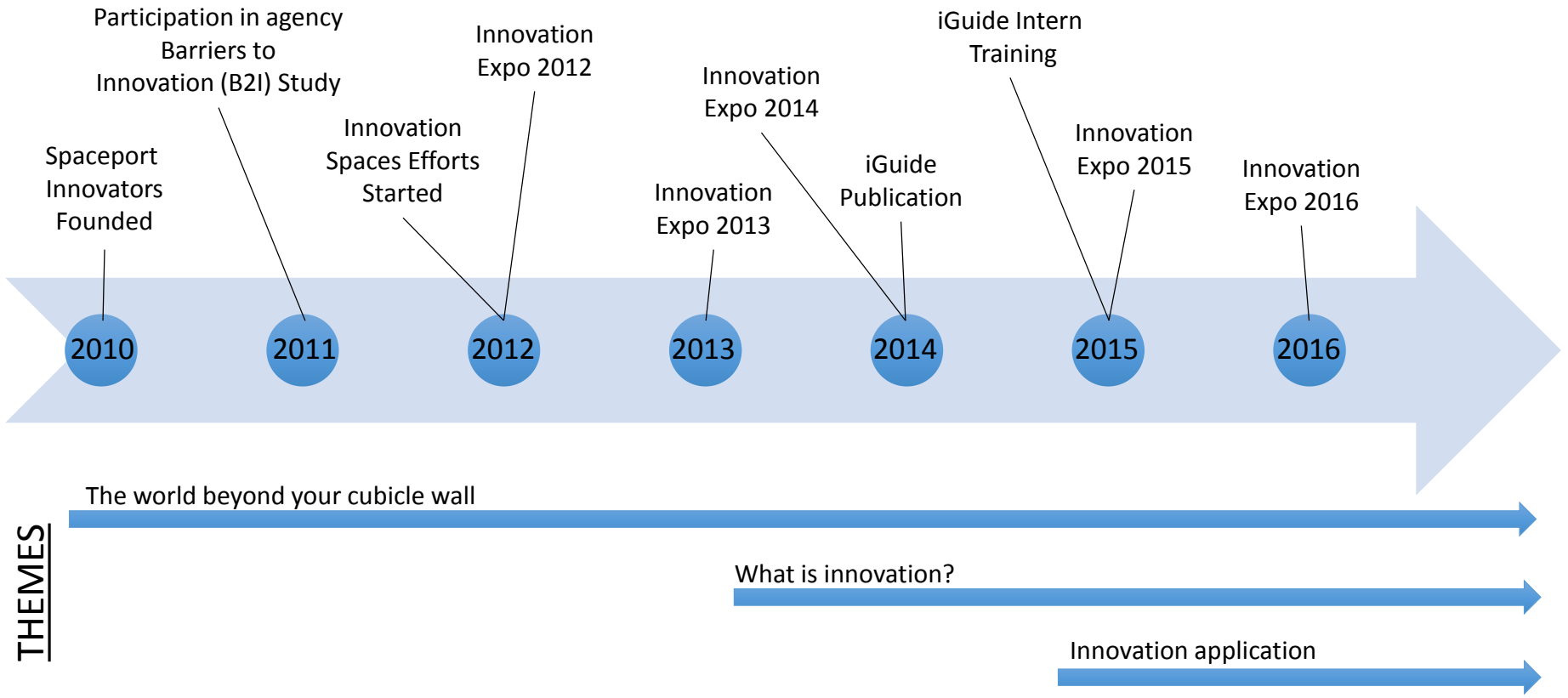
Creative Discovery → Blueprinting → Implementing → Measurable Results

The Creative-Impact Gap

is ...

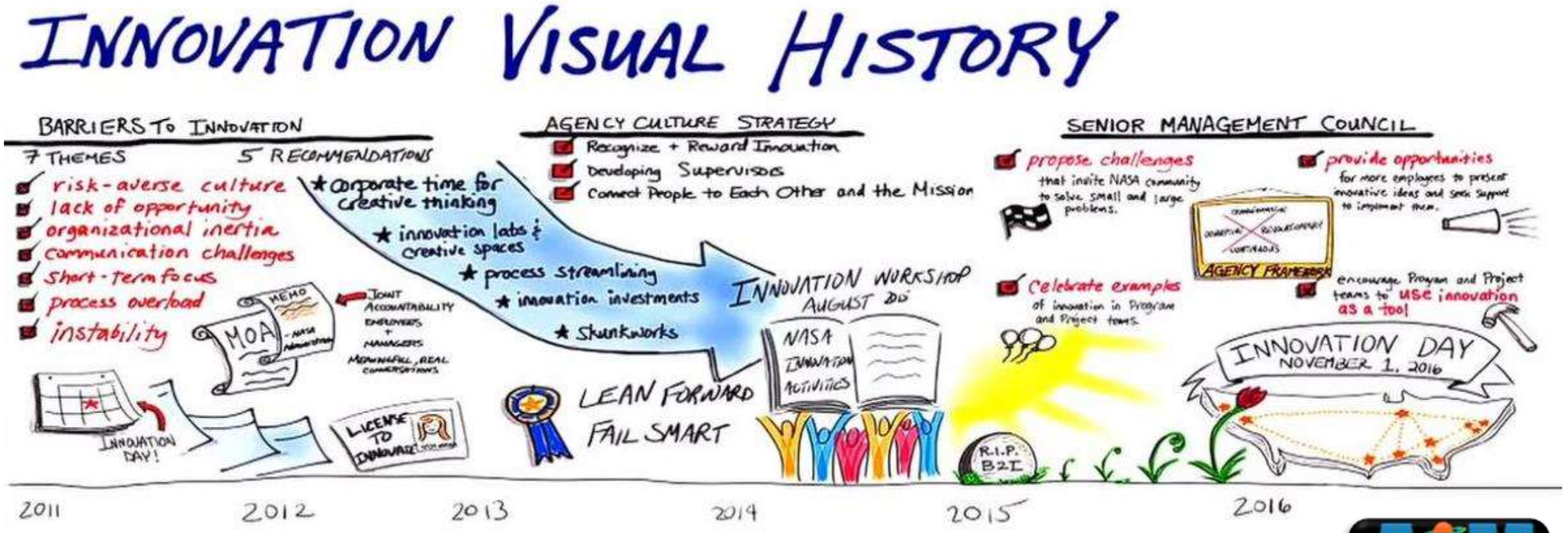
Innovation

Spaceport Innovators Impact



Long term goal: Develop a culture of innovation in every KSC organization

Impact at an Agency level



Summary

- Over the past 7-years Spaceport Innovators has:
  - Participated in Agency Barriers to Innovation study
  - Created KSC's Innovation Expo
  - Participated in NASA's International Space Apps Challenge
  - Developed KSC's iGuide
  - Developed NASA's Human Innovation Training
  - Major influence to NASA Innovation activities
  - Continued to meet on a regular basis to discuss innovation
- Have we achieved our goal?
  - No, and we never will
  - An innovative culture must always be continuously sustained

Siemens IT Innovation

The Innovation Playground
And What Info Tech Brings to the Game

MIKE.CONROY@NASA.GOV

Background – Mike Conroy

- 25 Years of Modeling, Simulation, Visualization, Info Tech
  - These are grand, challenging, disruptive, ever changing and incredibly powerful tools
  - Like any sharp tool, they have sharp edges

- My Goals:
  - Capability in the hands of as many People as possible
  - Minimal use of the First Aid Kit
  - Share all Outcomes, Good or Bad

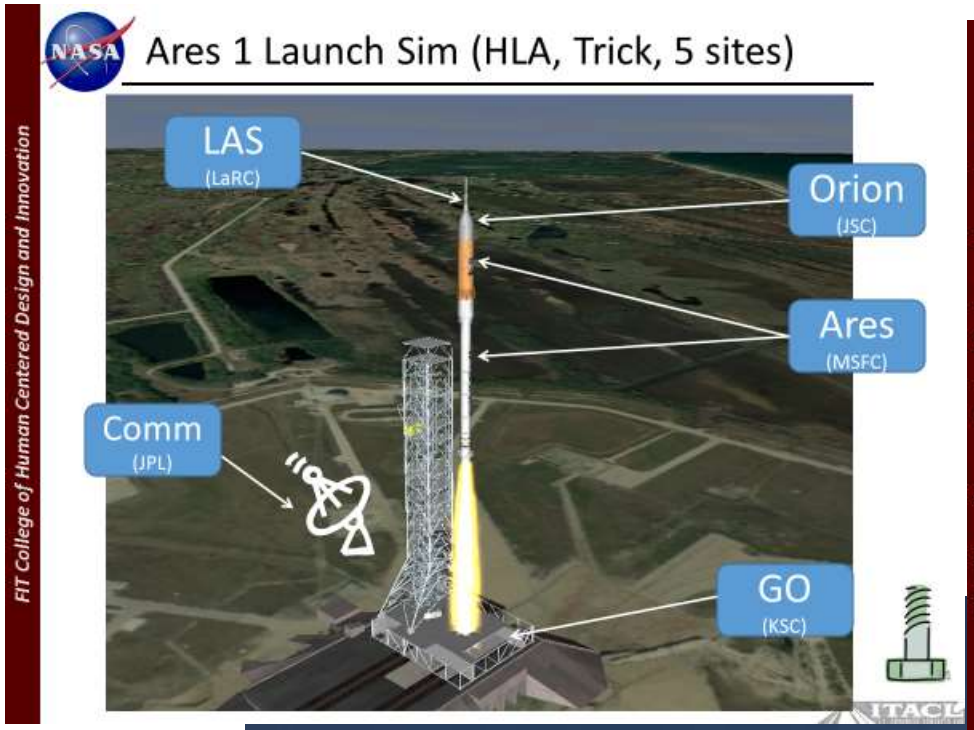
Simulation

- Until recently 3D Sim was and IT Lab
  - It is now imbedded in Engineering (mainstreamed)

- Simulation Helps:
  - Inform Design – this is what it will look like, how it will behave
  - Share Ideas – is much richer than documents or pictures
  - Speeds Communication – unambiguous, stay in same argument
  - Drive Understanding – hard to simulate what is not understood

- Goals Were:
  - Make Sim accessible – contracts and support teams, DON
  - Make Sim affordable – right tools, right people, shared costs
  - Make Sim useful – get right capability applied to right problems

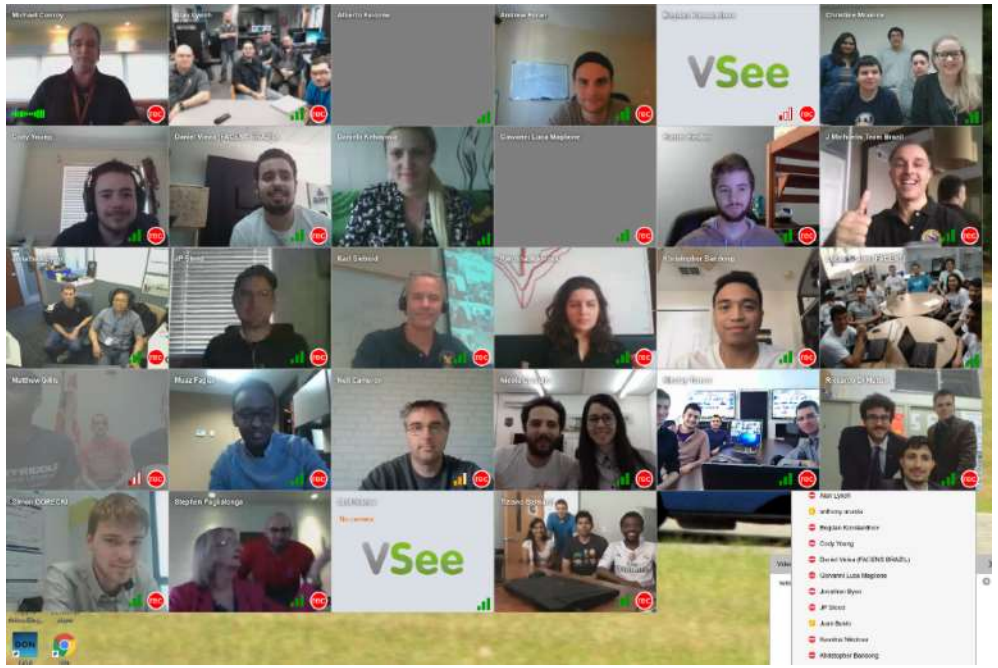
Communication / Understanding



SSPF Orion
Fuel Ops

SEE 2017 (Sim Exploration Experience)

- Cooperative Student Event *(7 years, 65+ students this year)*
  - US, Canada, Europe, South America
- Simulate Lunar and Mars Bases with Industry and NASA Tools
  - HLA (MAK, Pitch, Forward Sim), SISO Space Reference FOM
  - Trick (NASA Open Source), SEE Starter Kit (Calabria)
  - Federations (rovers, flyers, facilities, greenhouses, terrain)
  - DON, Distributed Observer Network (Game Based Visualizer, FREE)
  - Model Process Control data, creates persistent simulations
- Add
  - 3D models for understanding
  - Discrete Event and Process Simulation results
    - Not typical, inventing methods



Siemens IT Innovation

Game Tech

- Started as “Could we use Game Tech to do Simulation?”
  - We could show the data, but the physics were pretty useless
- Then “Could we show Simulation Results in the Game?”
  - Yes we can! Use the game for what it is good at. Use Simulator for what it is good at.

Just needed:
An Interface (MPC)
A Game (Unity) and
An Architecture

Then:
Make it sustainable (DON) and
Give it away (NASA Software Store)

3D Printing

- Prices are dropping, capability is increasing
  - The cheap ones ($1K to $3K) require some expertise to use
  - The expensive one ($25K +) are expensive
  - $200 ones are emerging

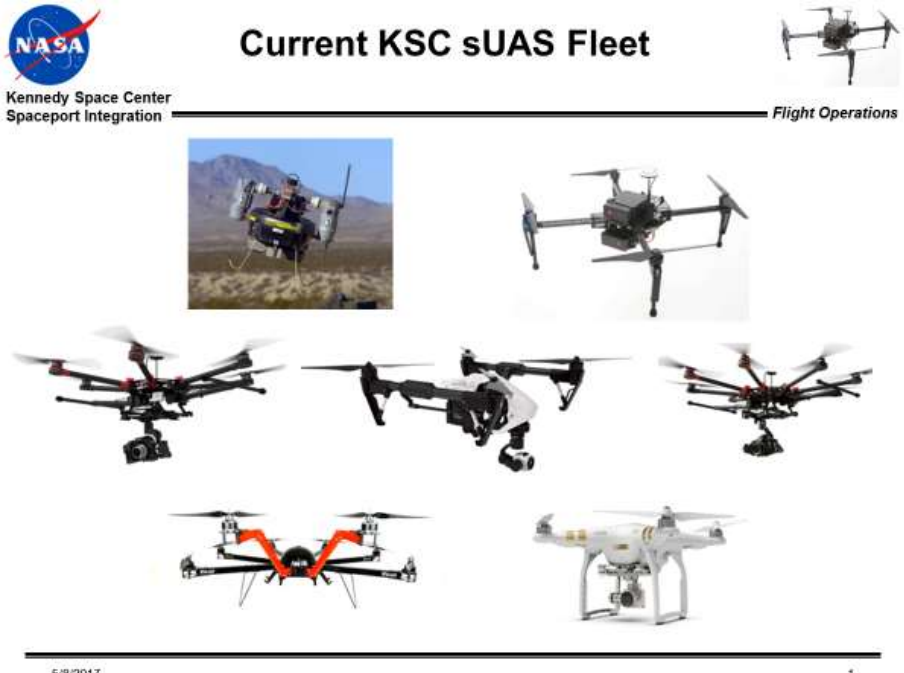
- IT had experience with the cheap ones
  - Created a class:
    - Model libraries, Web Based modeling tools
    - Taught language, printer tech, let everyone print something
    - Made class resources available to anyone who took the course
  - Classes keep filling up, room had to be expanded, 150+ trained
  - A spin-off project may solve some ISS challenges

UAV - Drones

- Started as a way to survey field antenna sites for Analogs
  - Arizona Desert is big, drone beats walking or driving
  - Canadian wilderness is even more difficult to traverse
  - Best way possible to delivery tools and batteries

- Then mobile communications relays
  - Hang an antenna on a large one for difficult to reach areas

- Now a business line for 3 NASA centers
  - Worked through Air Readiness Boards, Ground School, Processes, Flight Reviews



What's Next

- Info Tech is the ultimate innovation enabler
  - Nothing can go from "never existed" to "done" faster than IT
  - It can remove time and space barriers (see-bb)
    - AWS server, free PHPBB AWS widget, Backup/Restore, done(?)
  - Software enables rapid innovation in the "real" world
  - The job is to both use it, and help it to be used by others

- 3D Printers to "Classroom" to ISS concept
  - Concept – a better way to grow plants in space with a dramatic up-mass and up-volume reduction
  - No 3D model or printer work until I took the class
  - It took about 2 weeks and I used TinkerCad, version 2 in 2 hours

Advice?

- Recognize that Info Tech is a Super Power
  - Figure out how to teach and share that power
  - Fill a need, Release it, Share it with everyone
  - Then you will have time to create the next super power
    - Or, you will be doing the same thing forever

- Recognize that humans will do the cool and unexpected
  - 3D Printing Class to ISS Study
  - Antenna Survey to Space X Landing
  - SSPF Ammonia Operations, that is what it says, but not what it means

Siemens IT Innovation

Thank You