

# NASA In-Space Inspection Technology Workshop (ISIW 2014)

Jul 15 – 16, 2014

at JSC Gilruth Center, Houston, TX

**Register** at ISIW 2014 Website: <http://www.nasa.gov/offices/nesc/workshops/ISIW2014.html>

**Technical Sponsor:** NASA Engineering and Safety Center(NESC) – NDE TDT - Bill Prosser

**Chair:** Mr. George Studor, NESC NDE TDT member

**JSC Facility Sponsor:** NASA JSC/KA – Greg Byrne, KX Image Science and Analysis - Randy Moore

**Coordination Team:** Sponsors(above), JSC/Ajay Koshti, LaRC/Eric Madaras

**Support Team:** NESC TDT Staff, KSC/Miles Skow

**Purpose:** Promote inspection **technology development** for In-Space/**similar needs** through identifying mutual interests/potential points of co-operation in multi-agency, industry and academic groups.

## 2014 In-Space Inspection Workshop Sessions

7/15	a - Alamo East(100)	b - Alamo West(50)	c - Discovery(40)	d - Coronado(40)
1	Introduction, Challenges, Vision – Including Wayne Hale – Former Shuttle Program Manager			
2	ISS Risks/Extend Life	Spacecraft Inspection	Future Space Vehicles	Software Enhancement
Lunch Speaker – Robonaut 2 NASA Dextrous Robot in Space – Ron Diftler – NASA JSC				
3	Oil/Gas Industry	Air Force & Navy	NASA Insp Operations	SBIR/STTR Topics
4	Miniature Backscatter Xray	Fully Controllable Video scopes	3D Surface Characterization	ISS Module Wall Leak Detection & Repair
7/16	a - Alamo East(100)	b - Alamo West(50)	c - Brazos (18)	d - Coronado(40)
5	Miniature Free-Flyers - Flight Systems -	ISS External Inspection - Improvements -	Hands-free Ops in ZeroG - Gecko Materials -	Triggered Inspections - Add-on Sensors -
6	Miniature Free-Flyers - Test Capabilities -	Difficult to Access Areas - new tools -	Hands-free Ops in ZeroG - Electro Adhesion -	Triggered Inspections - Designed-In Sensors -
Lunch Speaker – Spatial Phase 3D Imaging - Blair Barbour – Photon-X				
7	One-on-One Sessions – Technology Developers Sign-up for 15 minute private sessions with Users - Demonstration Tables remain up to the extent practical -			
8	Forward Planning Splinter Sessions – Reports prior to Wrap-up			

**Note:** Rio Grande Room (Conf Rm holds 8) available to schedule small sessions – see reception desk

- All Presentations will be Publicly Available and Webex - Telecom will be attempted
- Displays & Demonstration Tables in Alamo Ballroom – 16 to 18 Tables (1/2 table each)
- Food: Order Lunch(Buffet) by Jul 5 – Pay at Workshop - Will include cost of beverage/snacks
- Registration: Free
- 2012 In-Space Inspection Workshop website (previous brochure, presentations, summary):

[http://www.nasa.gov/offices/nesc/workshops/in\\_space\\_non\\_destructive.html](http://www.nasa.gov/offices/nesc/workshops/in_space_non_destructive.html)

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Please note that all NASA civil servants and NASA contractors are required to register their conference attendance at <https://ncts.nasa.gov/index.cfm> in addition to registering here on the In-Space Inspection web site. **Some centers (e.g. JSC) have their own procedure for registering on NCTS via designated organizational representatives.** The conference code is 18920-14. Failure to register at the NCTS site can result in a denial to attend the conference.



## ISIW 2014 Agenda (as of June 23)

### ISIW 2014 Day 1: July 15th AM - Session 1 - Introduction and Session 2 - User Needs

**\*\*SORRY, ABSOLUTELY NO OUTSIDE FOOD OR BEVERAGES ALLOWED IN THE GILRUTH CENTER\*\***

	Start	Stop	Last	First	Organization	Topic of Talk - > Title of Presentation
<b>Session 1</b>	<b>Alamo Ballroom - East End</b>					
1-1	8:30	8:35	Byrne	Greg	JSC/KA	Welcome/Logistics/Vision
1-2	8:35	8:45	Prosser	Bill	NASA/LaRC/NESC	NESC-TDT Intro, Previous Workshop, 2014 Workshop Plan
1-3	8:45	9:00	Hale	Wayne	Special Aerospace Services	In Space Inspection - Shuttle Program and Mission Ops Experience
1-4	9:00	9:15	Studor	George	NASA/JSC/KX - Jacobs-LZ Tech	Workshop Overview: In-Space Inspection Needs & Technologies
<b>Break</b>	<b>9:15</b>	<b>9:30</b>	<b>15 minutes</b>	<b>Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos</b>		
<b>Session 2a</b>	<b>Alamo Ballroom - East End(100)</b>					
<b>ISS Risks and Life Extension to 2024 and beyond</b>						
2a-1	9:30	10:00	Christiansen	Eric	NASA/JSC/KX- Jacobs-LZ Tech	Current Micro-Meteoroid and Orbital Debris Risks
2a-2	10:00	10:30	Dempsey	Phil	NASA/JSC/OB	Inspection Considerations from the ISS Program
2a-3	10:30	11:00	Moore	Randy	NASA/JSC/KX	ISS Inspection Capabilities and Challenges
2a-4	11:00	11:30	Rollins	Michael	JSC/KX-Jacobs	Orion Inspection Planning - Lessons Learned
<b>Session 2b</b>	<b>Alamo Ballroom - West End (50)</b>					
<b>Spacecraft Inspection and Re-entry TPS</b>						
2b-1	9:30	10:00	Roesler	Gordon	DARPA	High resolution inspection as part of DARPA mission for GEO servicing
2b-2	10:00	10:30	McGuire	Jill	GSFC/SSCO	Satellite Servicing Mission - Inspection Needs
2b-3	10:30	11:00	Henshaw	Glen	NRL	NRL Spacecraft Engineering - Robotic Satellite Repair
2b-4	11:00	11:30	Gard	Joe	JSC/EA4	Asteroid Crewed Segment Mission
<b>Session 2c</b>	<b>Discovery Room (40 persons)</b>					
<b>Future Space Vehicles and Satellite Repair</b>						
2c-1	9:30	10:00	Vos	Gordon	NASA/JSC/SF - Wylie Labs	Human -System Integration Needs for InSpace Inspection
2c-2	10:00	10:30		TBD - in work	NASA/JSC/DX	ISS - OSO - Crew Ops
2c-3	10:30	11:00		TBD	TBD	TBD
2c-4	11:00	11:30	Frank	Jeremy	NASA/Ames	Autonomous Mission Operaitons
<b>Session 2d:</b>	<b>Coronado Room(40 persons)</b>					
<b>Opportunities with Sensor Software Enhancement</b>						
2d-1	9:30	10:00	Lecky	Cara	NASA/LaRC	Software Improvements for In Space Inspection
2d-2	10:00	10:30	Turner	James	Texas A&M	Computational Vision Technology & TAMU's LASR Lab
2d-3/4	10:30	11:30	Nellums	Robert	Independent Consultant	Space-Based Sensor Enhancement By Signal Processing
<b>Session 2e</b>	<b>Rio Grande(8) Conference Room</b>					
<b>Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk</b>						

### ISIW 2014 Day 1: July 15th PM - Session 3 - User Needs

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<b>Lunch</b>	<b>11:30</b>	<b>12:30</b>	<b>Pickup Food - Visit Demonstrations - Schedule One-on-One Sessions - Return to tables/seats for Keynote Presentation</b>			
	<b>12:00</b>	<b>12:30</b>	Differ	Ron	NASA/JSC/ER	Robonaut2 in Space - JSC Dexterous Robotics Laboratory
<b>BREAK</b>	<b>12:30</b>	<b>12:45</b>	<b>Coffee/Snacks - Prepare for One-on-One Sessions, Visit Displays/Demos</b>			
<b>3a</b>	<b>Alamo Ballroom - East End (100)</b>					
<b>Oil/Gas Industry Needs</b>						
3a-1	12:45	1:15	Rogers	Jon	BP	BP Grand Challenge and other Inspection needs
3a-2	1:15	1:45	Kapusta	Sergio	Shell - SIEP-PTI/TP	Shell International E&P Inc
3a-3	1:45	2:15	Brower	Dave	Astrotechnology Inc.	Under-water Inspection Mini-ROV Tech Needs
3a-4	2:15	2:45		TBD	TBD	Oil and Gas/Energy Industry
<b>3b</b>	<b>Alamo Ballroom - West End(50)</b>					
<b>Air Force and Navy</b>						
3b-1	12:30	1:00	Russ	Stephan	USAF - AFRLRLX - NDE	USAF Aircraft Inspection Needs
3b-2	1:00	1:30	Floyd	Tim	WR-ALC/GRBEB	C130 Maintenance and Inspection
3b-3	1:30	2:00	Trepal	Nathan	NAVAIR-Tech Insertion	Inspection Needs - Fleet Readiness Center Southwest
3b-4	2:00	2:30	Lockhart	Patric	NAVSEA	USN/Coast - Underwater Inspection Needs
<b>3c</b>	<b>Discovery Room(40)</b>					
<b>NASA Inspection Operations</b>						
3c-1	12:30	1:00	Skow	Miles	NASA KSC/NEL40 - NDE	Contamination Control Inspections of Crewed Vehicles
3c-2	1:00	1:30	Griffith	Jon	Virgin Galactic	Spacecraft Inspection needs
3c-3	1:30	2:00		TBD	TBD	TBD
3c-4a	2:00	2:30	GoForth	Monte	NASA/JSC/EV	Avionics Inspection Needs
3c-4b	2:00	2:30	Grygier	Michael	NASA/JSC/ES	Structural Dyanamics to trigger Inspection
<b>3d</b>	<b>Coronado Room (40)</b>					
<b>SBIR/STTR Discussion - WEBEX Telecon Primary</b>						
<b>3e</b>	<b>Rio Grand (8 Person Conf Room)</b>					
<b>Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk</b>						



<b>ISIW 2014 Day 1: July 15th PM - Sessions 4 - Technologies</b>						
<b>BREAK</b>	<b>2:45</b>	<b>3:00</b>		<b>Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos</b>		
<b>Session 1</b>	<b>Start</b>	<b>Stop</b>	<b>Last</b>	<b>First</b>	<b>Organization</b>	<b>Topic of Talk -&gt; Title of Presentation</b>
<b>4a</b>	<b>Alamo Ballroom - East End(100)</b>			<b>Miniature Backscatter Xray</b>		
4a-1	3:00	3:30	Snell	Mike	AS&E Technologies	3D Backscatter Xray
4a-2	3:30	4:00	Garber	Wayne	Nucsafe	2D Backscatter Xray - with Boeing for Navy Chris Root
4a-3	4:00	4:30	Grubsky	Victor	Physical Optics Corp	3D Backscatter Xray - Navy Phase 2 and NASA delivery this year
4a-4	4:30	5:00	Turner	Clark	Turner Innovations	3D Backscatter Xray
4a-5	5:00	5:30	Murali	S. Krupakar	Multiversal Technologies	IEC - Inertial Electrostatic Confinement for Xray source
<b>4b</b>	<b>Alamo Ballroom - West End(50)</b>			<b>Controllable Snake-arm Inspection Systems</b>		
4b-1	3:00	3:30	LaFleur	Frank	Olympus	Videoscopes/Boscopes - Remote Visual Inspection Systems
4b-2	3:30	4:00	Pairazaman	Carlos	Uniwest	Controllable videoscope/sensors
4b-3	4:00	4:30	Mallion	Adam	OC Robotics	Snakearm Technology and NDI
4b-4	4:30	5:00	Baybutt	Mark	SRI	Controllable Dexterous Video Inspection Device
			Low	Tom	SRI - co-presenter	Controllable Dexterous Video Inspection Device
4b-5	5:00	5:30	Tongue	Alex	4DSP	Shape Sensing Utilizing c-OFDR
<b>4c</b>	<b>Discovery Room (45)</b>			<b>Minature 3D Surface Profile and Damage Characterization</b>		
4b-1	3:00	3:30	Sallee	Brad	SPEC - Systems & Pocesces Eng	Micro-LADAR and Ramen Spectral LADAR
4b-2	3:30	4:00	Greaves	Tom	Panoscan powered by Dotprodu	Panoscan PointGun handheld 3D scanner
			Coss	Casey	Panoscan	3D Industrial Management Solutions applied to Aerospace
4b-3	4:00	4:30	Kim	Catherine	Capture3D	3D Image Capture
4b-4	4:30	5:00	Turner	James	Texas A&M	Computational (3D) Vision Technology and TAMU
4b-5	5:00	5:30	Hagen	Nathan	Rebellion Photonics	Hyper-spectral Imaging for Detecting and Locating Gas Leaks
<b>4d</b>	<b>Coronado Room (40)</b>			<b>ISS Module Pressure Wall Inspection Operations Tools</b>		
4d-1	3:00	3:30	Madaras	Eric	NASA/LARC	Leak Location System - Reducing Inspection Timelines
4d-2	3:30	4:00	Koshti	Ajay	NASA/JSC/ES4	Considerations for IVA NDE Instrumentation for ISS On-Orbit NDE
4d-3	4:00	4:30	Cabral	Ed	Sonatest	Sonatest NDE Equipment
4d-4	4:30	5:00	Tang	Kevin	Cybernet	Wireless Encoder for NDE Sensor tracking
4d-5	5:00	5:30	Kessler	Seth	Metis	Condition-based Inspection - Damage-change Triggered Inspections
<b>4e</b>	<b>Rio Grand (8 Person Conf Room)</b>			<b>Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk</b>		
<b>ISIW 2014 Day 2: Jul 16th - AM - Session 5 &amp; 6 - Technologies</b>						
<b>**SORRY, ABSOLUTELY NO OUTSIDE FOOD OR BEVERAGES ALLOWED IN THE GILRUTH CENTER**</b>						
<b>Session 5a</b>	<b>Alamo Ballroom East End (100)</b>			<b>Miniature Free-Flying Platforms for Inspection - Part 1 - Flight Systems</b>		
5a-1	8:30	9:00	Hinkley	David	Aerospace Corp	Aerospace PICOSAT Capability Status 2014
5a-2	9:00	9:30	Villa	Marco	Tyvak	Inspection during a 3u Cubesat rendezous mission
5a-3	9:30	10:00	Johnson	Mike	Nanoracks	NanoRacks ISS Operations
<b>Session 5b</b>	<b>Alamo Ballroom - West End (50)</b>			<b>Robotic Inspection - Part 1 - ISS External Inspection Improvements</b>		
5b-1	8:30	9:00	Studer	Victor	NASA/JSC/EV	HD Cameras for ISS - What it means, What it's not.
5b-2	9:00	9:30	Gonthier	Yves	CSA	Dextre-Deployable Vision System(DDVS)
			Gemme	Sebastien	CSA	Dextre-Deployable Vision System(DDVS)
5b-3	9:30	10:00	Callen	Phillip	JSC/ER	Automation of SSRMS/DEXTER operations
<b>Session 5c</b>	<b>Brazos Room (18) - Upstairs</b>			<b>Hand's Free Operations in Zero-G - Part 1 - Temporary Adhesion with Gecko-Materials</b>		
5c-1	8:30	9:00	Glass	Paul	Nanogripteck	Gecko-Tape
5c-2	9:00	9:30	Gupta	Rana	Felsuma	Think Like Geckskin
5c-3	9:30	10:00	Parness	Aaron	NASA/JPL/82-105	Gecko grippers
<b>Session 5d</b>	<b>Coronado Room (40)</b>			<b>Autonomy Improvements - Part 1 - Condition/Event - Triggered Inspections with Add-on Sensors</b>		
5d-1	8:30	9:00	Trott	Aaron	Invocon	Impact-Event Triggered Inspections:Acceleration/Ultrasound/ Plasma
5d-2	9:00	9:30	Bowman	Christopher	DF & NN	Data Fusion & Neural Networks applied to C5 monitoring
5d-2	9:30	10:00	Goodman	Doug	Ridgetop Group	Smart Sensors for Distributed Event-Triggered System Health
			Ferrio	Kyle	Ridgetop Group	Monitoring
<b>Session 5e</b>	<b>Rio Grand (8 Person Conf Room)</b>			<b>Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk</b>		
<b>BREAK</b>	<b>10:30</b>	<b>11:00</b>		<b>Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos</b>		
<b>Session 6a</b>	<b>Alamo Ballroom East End (100)</b>			<b>Miniature Free-Flying Platforms for Inspection - Part 2 - Test Capabilities</b>		
6a-1	10:30	11:00	Saenz-Otero	Alavar	MIT - Space Science Lab	MIT Space Science Lab, ExoSPHERES and other projects
6a-2	11:00	11:30	Martinez	Andres	NASA/AMES	SPHERES - a free-flying testbed inside the ISS
6a-3	11:30	12:00	Magruder	Darby	NASA/JSC/ER4	Remote Underwater Robotic Inspection
<b>Session 6b</b>	<b>Alamo Ballroom - West End (50)</b>			<b>Robotic Inspection - Part 2 - Difficult to Access Areas</b>		
6b-1	10:30	11:00	Jaskolski	Cory	Hydrotech	Hot-Spots for Comm & Power with no penetration of metal barriers
6b-2	11:00	11:30	Baybutt	Mark	SRI	Taurus robot from DHS, underwater and In Space Inspection
6b-3	11:30	12:00	Quinn	Roger	Case Western Reserve Univ	Climbing robots with gecko inspired adhesive feet for inspecting ISS int
<b>Session 6c</b>	<b>Brazos Room (18) - Upstairs</b>			<b>Hand's Free Operations in Zero-G - Part 2 - Temporary Adhesion with Electro-Adhesion</b>		
6c-1	10:30	11:00	Aguero	Victor	SRI	Electro-adhesion R & D
6c-2	11:00	11:30	Spenko	Matt	Illinois Institute of Tech	Electro-Adhesive Gripping and Hybrids with Aaron Parness
6c-3	11:30	12:00	Ferreira	Gerhard	Justik	Electro-adhesion products for space
<b>Session 6d</b>	<b>Coronado (40) - Upstairs</b>			<b>Autonomy Improvements - Part 2 - Triggered Inspections with Designed-In Sensors</b>		
6d-1	10:30	11:00	Rummel	Ward	D&W Enterprises, LTD	New Penetrant Overlay Inspection for Life-Cycle Inspection
6d-2	11:00	11:30	Richards	Lance	NASA/DFRC	Fiber-Optic sensing
6d-3	11:30	12:00	Djordjevic	Boro	Materials & Sensors Tech, Inc.	In-situ Versus Imbedded Sensing - How Health Monitoring effects Inspection Needs
<b>Session 6e</b>	<b>Rio Grand (8 Person Conf Room)</b>			<b>Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk</b>		
<b>Lunch</b>	<b>12:00</b>	<b>12:30</b>	<b>Pickup Food - Visit Demonstrations - Schedule One-on-One Sessions - Return to tables/seats for Keynote Presentation</b>			
<b>Speaker</b>	<b>12:30</b>	<b>1:00</b>	<b>Barbour</b>	<b>Blair</b>	<b>Photon-X</b>	<b>Spacial Phase Imaging Capabilities</b>

**ISIW 2014 Day 2: Jul 16th - PM - Session 7 & 8 - One-on-One & Forward Planning Sessions**

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<b>BREAK</b>	1:00	1:15	<b>Coffee/Snacks - Prepare for One-on-One Sessions, Visit Displays/Demos</b>		
<b>Session 7</b>	1:15	3:30	All rooms	<b>One on One Sessions -15 minute periods - See Schedule for Sign-up at the Reception Desk</b>	
				<b>Ten Sessions of One-on-One Sessions - 15 minute intervals - Sign-up beforehand</b>	
				27 Tables x 10 slots = 270 slots; 45 Tech Developers => ~ 6 slots/TD	
<b>Session 8</b>	3:30	4:30	All rooms	<b>Forward Planning Splinter Sessions - Rooms to be assigned</b>	
<b>Locations</b>	<b>Potential Forward Planning Session</b>		<b>Spokesperson - Need Volunteers before/during the workshop - topics will depend on volunteers</b>		
Alamo East	ISS Inspection		TBD		
Alamo Central	Future Space Vehicles		TBD		
Alamo West	Sensors and Lighting		TBD		
Coronado	Autonomous Inspection and Robotics		TBD		
Rio Grande	Future Workshops		TBD		
<b>Summary</b>	4:30	5:00	Splinter Spokesperson provides	<b>5 minute Report from Each of the Splinter Groups</b>	
<b>Close</b>	5:25	5:30	Studor	George	

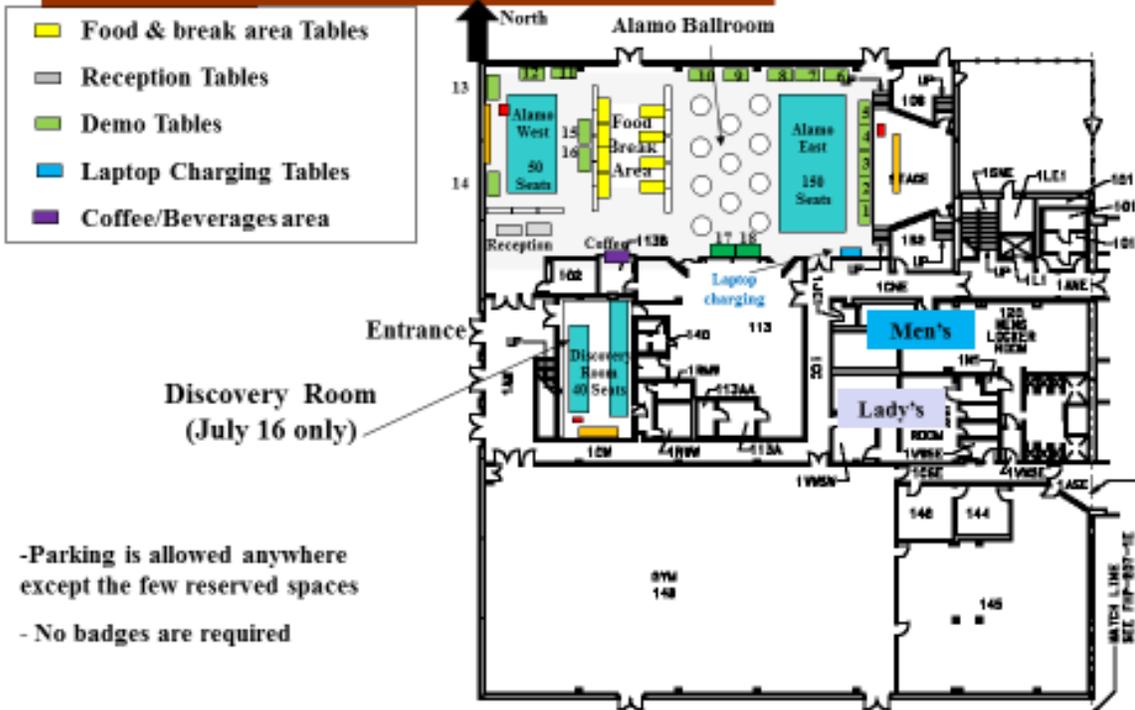
**ISIW 2014 Technology Needs used to create the agenda**

**\*Common Goals:** Low Size, Weight & Power; Minimize On-orbit crew time to address risks; Locally Derived Information to minimize data transfer; Less than 2 years to flight; Multiple NASA Aerospace program applicability – supporting recent roadmaps, Broad use case for other than Space industries and Government Agencies; take advantage of other investments to sustain maturity/long term improvements.

<b>Technology Area</b>	<b>Spaceflight Need</b>	<b>Characteristics*</b>
<b>3D Surface Imagers and Profiling</b>	- Surface Damage - Configuration	Range: 2 in – 120 ft, Insensitive to lighting, high resolution, dynamic (frame-by-frame)
<b>3D Penetrating Imagers</b>	- Damage+Configuration under non-conductive & conductive	Range: 2 in – 1 foot, high resolution, low SWaP, safety and reliability,
<b>Liquid and Gas Leak Sensors</b>	- Remote detection and location of leaks to vacuum	Range: 2 in – 120 ft, high sensitivity, reliability of detection & identification
<b>COTS NDE, Sensors, Cameras</b>	- Out of configuration, Damage Detection & Characterization	Cost, reliability, minimum operations and integration, improved performance
<b>Difficult to Access Areas</b>	- Small gaps, out of reach, EVA, blind spots, noise, rel. motion	Size, mobility, location, Safety/Hazard mitigation, min crew operations.
<b>Robotic Inspection Platforms</b>	- Decrease blind areas & EVAs - Increase direct access to site	Cost, min operations and planning, mobility, stability, size, safety/hazards
<b>Snake-like Inspection Scopes</b>	- Highly controlled, min hazard - 3D ops/sensing, mapping	Cross-section size, controllability, hazards, 3D mapping & head following, location
<b>Free-Flying Inspection Platforms</b>	- Flexibility of sensor location - Reduce manipulator ops	SWaP, Safety/Hazards, Re-use & throw-away, autonomy, sensor modularity
<b>Efficiency</b>		
<b>Temporary Adhesion</b>	- Hands Free Crew Operations - Velcro replacement - Secure equipment, sensors - On-Off grip for robotic ops	Easy-peel replacement of glues with temporary adhesion, quick on-off grip, no or low power, compliant to surfaces, IVA then EVA(extreme environment) capability
<b>Materials/Mfging To Enhance Inspection</b>	- Properties enhance damage - Properties for pass-through	Doping of embedded materials Coatings and etchings of surfaces
<b>Event-Triggered Inspection</b>	- Reduce scheduled inspection - Enable inspection on demand	Monitor environment, structure or system to detect threshold requiring inspection
<b>Autonomous Inspection</b>	- Reduce human ops (flt & grd) - Reduce data transfer needs	Command and Data handling minimized for robotic platforms and sensors Information & Answers with minimum data
<b>SBIR/STTR Requested Technologies</b>	- Fund sources, interests and contacts outside NASA - Technologies developed or being developed by others	Solicitation wording and past contracts are relevant to InSpace Inspection Workshop TRL possibly above NASA's in some areas Future interagency cooperation potential
<b>Miscellaneous Technologies</b>	- Catch all – not in above list - Last minute or Inspirational	Fewer, possibly higher risk applications Ground-breaking and possibly emerging

# Gilruth Center First Floor

In Space Inspection  
Workshop  
June 15-16, 2014



# Gilruth Center Second Floor

Inspection  
Workshop  
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Schedule your meeting in the Rio Grand at the reception desks available on July 15 & 16

# ISIW 2014 Location: NASA Johnson Space Center

## Gilruth Center – Outside the Gate – no NASA Badging Needed

