NASA Engineering & Safety Center

In-Space Inspection Workshop

July 15 - 16, 2014

Gilruth Center
Johnson Space Center

http://www.nasa.gov/offices/nesc/workshops/ISIW2014.html

Michael Prosser/NASA
Sponsor (S1-P2)

George Studor/NASA
Sponsor (S1-P1)

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NASA (s2-p1)

Phil Dempsey
NASA (S2A-P2)

Randy Moore
NASA (S2A-P3)

J. Michael Rollins
JSC (S2A-P4)

Gordon Soesler
DARPA (S2B-P1)

Gordon Vos
Wyle (S2C-P1)

Tina Holden
JSC SHFE (2S2C-P1)

Daniel Perri
NASA (S2C-P2)

Cara Leckey
NASA/LARC (S2D-P1

Bob Nellums
)Nellums (S2D-P3/4)

Sergio Kapusta
BP CTO (S3B-P2)

David Brower
Shell (S3A-P2)

Stephan Russ
US AF (S3B-P1)

Timothy Floyd
AFLCMC/WLNEB (S3B-P2)

Nathan Trepal
US Navy (S3B-P3)

Patric Lockhart
NAVSEA (S3B-P4)

Michael Grygier
NASA JSC (S3C-P3B)

R. Zoughi
Schlumberger (S3C-P4)

M. Tayeb Ghasr
AMNTL (S3C-P4)

Seth Van Liew
AS&E (S4A-P1)

Wayne Garber
Nucsafe (S4A-P2)

Victor Grubsky
POC (S4A-P3)

D. Clark Turner
Turner Inn. (S4A-P4)

Adam Mallion
OC Robotics (S4B-P3)

Mark Baybutt
SRI (S4B-P4)

Thomas Low
SRI (S4B-P4)

Alex Tongue
NASA (S5B-P5)

Bradley Sallee
SPEC (S4C-P1)

Casey Coss
Panoscan (S4C-P2)

Nathan Hagen
Rebellion Photonics (S4C-P5)

Ajay Koshti
NASA (S4D-P2)

Kevin Tang
Cybernet Sys (S4D-P4)

Douglas Haanpaa
Cybernet Sys (S4D-P4)

Seth S. Kessler
Metis Des Corp(S4D-P5)

David A. Hinkley
Aerospace Corp (S5A-P1

Austin Williams
Tyvak NSSI (S5A-P2)

Al Tsuda
Tyvak NSSI (S5A-P2)

Michael D. Johnson
NanoRacks, LLC (S5A-P3)

Victor J. Studer
NASA (S5B-P1)

Yves Gonthier
CSA (S5B-P2)

NASA In-Space Inspection Technology Workshop (ISIW 2014)

Jul 15 – 16, 2014

at JSC Gilruth Center, Houston, TX

ISIW 2014 Website: http://www.nasa.gov/offices/nesc/workshops/ISIW2014.html

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.

Technical Sponsor: NASA Engineering and Safety Center(NESC) – NDE TDT - Bill Prosser
JSC Facility Sponsor: NASA JSC/KA – Greg Byrne, KX Image Science and Analysis - Randy Moore
Chair: Mr. George Studor, NESC NDE TDT member
Coordination Team: Sponsors(above), KSC/Miles Skow, JSC/Ajay Koshti, LaRC/Eric Madaras
On-Site Support Team: NESC TDT Staff: LaRC/Carol Castle, Katie McCarty, Sheri Hagood

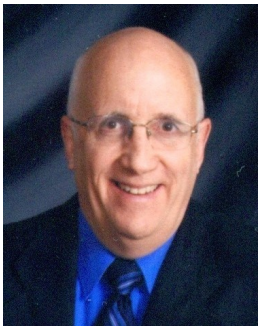
2014 In-Space Inspection Workshop Sessions				
7/15	A - Alamo East(100)	B - Alamo West(50)	C - Discovery(40)	D - Coronado(40)
1	Introduction, Challenges, Vision – Including Wayne Hale – Former Shuttle Program Manager			
2	ISS Risks/Extend Life	Spacecraft Inspection	Future Space Vehicles	Software Enhancement
	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 -	Temporary Adhesion - Gecko Materials -	Triggered Inspections - Add-on Sensors -
6	Miniature Free-Flyers - Test Capabilities -	Difficult to Access Areas – new tools -	Temporary Adhesion - Electro Adhesion -	Triggered Inspections - Designed-In Sensors -
	Lunch Speaker – Spatial Phase 3D Imaging – Preston Bornman/Blair Barbour – Photon-X - SPAR3D 2015 Conference - Chris Zmijewski – Haag3D			
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	Feedback - Forward Planning Session - Alamo East			
Note: Rio Grande Room (Conf Rm holds 8) available to schedule small sessions – see reception desk				

- **All Presentations must be Publicly Released – Presenters will sign/show that this is completed.**
- **Registration is Closed – Webex/Telecom Available (page 7)**
- **170 participants, 80+ speakers**
- **Displays & Demonstration Tables in Alamo Ballroom ~ 36 displays (1/2 of 6' table each)**
- **Food: Order Lunch(Buffet) by Jul 5 – Pay at Workshop - $30/day**
  - Will cover cost of continental breakfast, lunch buffet, afternoon snack, coffee, tax & gratuity.

2012 In-Space Inspection Workshop website (previous brochure, presentations, summary):
http://www.nasa.gov/offices/nesc/workshops/in_space_non_destructive.html

Workshop Coordinators:

On-site coordination—at the Gilruth



George Studor
Workshop Chairman
NESC NDE Technology Staff

Miles Skow
Presentation Integrity
NASA Kennedy Space Center/M&P Eng.

Carol Castle
Registration and Food Orders
Secretary, NESC
NASA Langley Research Center

Sheri Hagood
Registration
NESC Chief Eng Office Staff
NASA Johnson Space Center

Katie McCarty
Registration, Brochure & Publishing
NESC Chief Eng Office, Secretary
NASA Johnson Space Center

Off-site coordination—Langley Research Center

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NASA Langley Research Center

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IT Support, NESC ISIW Website
LITES Contract
NASA Langley Research Center

Hope Venus
IT Support Team Integration
NASA Engineering and Safety Center
NASA Langley Research Center

ISIW 2014 Agenda

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	Title of Presentation
Session 1	Alamo Ballroom - East End			Vision - Motivation - Organization - ISIW Plan		
1-1	8:30	8:35	Byrne	Greg	NASA/JSC/KA	Welcome/Logistics/Vision
1-2	8:35	8:45	Prosser	Bill	NASA/LaRC/NESC	NESC-TDT Intro, Interest in In-Space Inspection
1-3	8:45	9:00	Hale	Wayne	Special Aerospace Services	Why are we here? - Shuttle Program/Mission Ops Experience
1-4	9:00	9:15	Studor	George	NASA/JSC/KX - Jacobs-LZ Tech	Workshop Overview: In-Space Inspection Needs & Technologies
Break	9:15	9:30	15 minutes	Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos		
Session 2a	Alamo Ballroom - East End(100)			ISS Risks and Life Extension to 2024 and beyond		
2a-1	9:30	10:00	Christiansen	Eric	NASA/JSC/KX- Jacobs-LZ Tech	Micro-Meteoroid and Orbital Debris Risk Overview
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	NASA/JSC/KX-Jacobs	Orion Inspection Planning - Lessons Learned
Session 2b	Alamo Ballroom - West End (50)			Spacecraft Inspection and Re-entry TPS		
2b-1	9:30	10:00	Roesler	Gordon	DARPA	Inspection of GEO Spacecraft for Commercial & Military Customers
2b-2	10:00	10:30	Mcguire	Jill	NASA/GSFC/SSCO	Satellite Servicing Mission - Inspection Needs
2b-3	10:30	11:00	Henshaw	Glen	NRL	Overview of NRL Advances in Orbital Inspection
2b-4	11:00	11:30	Gard	Joe	NASA/JSC/EA4 - Systems Eng	Asteroid Crewed Segment Mission
Session 2c	Discovery Room (40 persons)			Future Space Vehicles and Satellite Repair		
2c-1	9:30	10:00	Vos	Gordon	NASA/JSC/SF - Wylie Labs	Technology Needs in Human Factors and Human Systems Integration
			Holden	Kitrina	NASA/JSC/SF - Wylie Labs	Technology Needs in HF and HIS - Co-presenter - One-on-One
2c-2	10:00	10:30	Perri	Dan	NASA/JSC/DX - Mission Ops	OSO In Space Inspection Experience and Needs
2c-3	10:30	11:00	Wright	Michael	NASA/JSC/ER3 - Robotic Ops	Lighting and Robotics Integration
2c-4	11:00	11:30	Frank	Jeremy	NASA/Ames - Roadmap Lead	Autonomous Mission Operaitons
Session 2d: Coronado Room(40 persons)				Opportunities with Sensor Software Enhancement		
2d-1	9:30	10:00	Leckey	Cara	NASA/LaRC	Modeling & Simulation for Enabling In-Space NDE & Health Monitoring
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
Session 2e	Rio Grande(8) Conference Room			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		
ISIW 2014 Day 1: July 15th PM - Session 3 - User Needs						
SORRY, ABSOLUTELY NO OUTSIDE FOOD OR BEVERAGES ALLOWED IN THE GILRUTH CENTER						
Lunch	11:30	12:30	Pickup Food - Visit Demonstrations - Schedule One-on-One Sessions - Return to tables/seats for Keynote Presenation			
	12:00	12:30	Diffler	Ron	NASA/JSC/ER	Robonaut Activites on ISS
BREAK	12:30	12:45	Coffee/Snacks - Prepare for One-on-One Sessions, Visit Displays/Demos			
3a	Alamo Ballroom - East End (100)			Oil/Gas Industry Needs		
3a-1	12:45	1:15	Rogers	Jon	BP	NDT Challenges for the Oil and Gas Industry
3a-2	1:15	1:45	Kapusta	Sergio	Shell - SIEP-PTI/TP	Inspection needs in the Oil and Gas business
3a-3	1:45	2:15	Brower	Dave	Astrotechnology Inc.	Advanced Instrumentation and Inspection for Deepwater Oil and Gas Fields
3a-4	2:15	2:45	Robello	Samuel	Halliburton	Inspection Needs Supporting Increased Well Intergrity
3b	Alamo Ballroom - West End(50)			Air Force and Navy		
3b-1	12:30	1:00	Russ	Stephan	USAF - AFRLRXL - NDE	Overview of USAF NDE R&D Activities
3b-2	1:00	1:30	*Floyd*	*Tim*	WR-ALC/GRBEB	Aging Aircraft Health Monitoring for Condition Based Maintenance
3b-3	1:30	2:00	*Trepal*	*Nathan*	NAVAIR-Tech Insertion	NAVAIR NDI
3b-4	2:00	2:30	Lockhart	Patric	NAVSEA	Navy NDT&E Needs
3c	Discovery Room(40)			NASA Inspection Operations		
3c-1	12:30	1:00	Skow	Miles	NASA KSC/NEL40 - NDE	Contamination Control Inspections of Crewed Vehicles
3c-2	1:00	1:30	GoForth	Monte	NASA/JSC/EV	Potential Avionics Inspection Needs
3c-3	1:30	2:00	Grygier	Michael	NASA/JSC/ES	Structural Monitoring to Minimize Inspections
3c-4	2:00	2:30	Zoughi	Reza	Missouri Univ of S&T	Towards Real-Time and 3D Millimeter Wave Imaging for In-Space Applications
			Ghasr	Mohammad T.	Missouri Univ of S&T	
3d	Coronado Room (40)			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		
3e	Rio Grand (8 Person Conf Room)			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		

ISIW 2014 Day 1: July 15th PM - Sessions 4 - Technologies						
BREAK	2:45	3:00		Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos		
Session 1	Start	Stop	Last	First	Organization	Title of Presentation
4a	Alamo Ballroom - East End(100)			Miniature Backscatter Xray		
4a-1	3:00	3:30	Van Liew	Seth	AS&E Technologies	Handheld Backscatter Scanner Development
4a-2	3:30	4:00	Garber	Wayne	Nucsafe	Recent Backscatter Xray Improvements
4a-3	4:00	4:30	Grubsky	Victor	Physical Optics Corp	Recent Progress on 3D Backscatter X-Ray NDE
4a-4	4:30	5:00	Turner	Clark	Turner Innovations	3D Backscatter Xray
4a-5	5:00	5:30	*Murali*	*S. Krupakar*	Multiversal Technologies	Compact Inertial Electrostatic Confinement (IEC) X-Ray Source
4b	Alamo Ballroom - West End(50)			Controllable Snake-arm Inspection Systems		
4b-1	3:00	3:30	LaFleur	Frank	Olympus	Flexible Videoscopes/Borescopes-Pushing the Limits of Articulation
4b-2	3:30	4:00	Pairazaman	Carlos	Uniwest	Controllable videoscopes/sensors
4b-3	4:00	4:30	Mallion	Adam	OC Robotics	Snakearm Robots 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
4c	Discovery Room (45)			Minature 3D Surface Profile and Damage Characterization		
4c-1	3:00	3:30	Sallee	Brad	SPEC - Systems & Pocesses Eng C	Vehicle Inspection LIDAR
4c-2	3:30	4:00	Greaves	Tom	Dotproduct	Repurposing Game Technology for Real Time, Handheld 3D Data Capture
			Coss	Casey	Panoscan	
4c-3	4:00	4:30	Deremer	Steve	Capture3D	Short Range Full-field Structured Blue Light 3D Scan/Photo-G
4c-4	4:30	5:00	Turner	James	Texas A&M	TAMU's LASR Lab and Computational Vision Technology
4c-5	5:00	5:30	Hagen	Nathan	Rebellion Photonics	Hyper-spectral Imaging for Detecting and Locating Gas Leaks
4d	Coronado Room (40)			ISS Module Pressure Wall Inspection Operations Tools		
4d-1	3:00	3:30	Madaras	Eric	NASA/LaRC	ISS Leak Location System
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	User Friendly NDE Ultrasound and Phased Array
4d-4	4:30	5:00	Tang	Kevin	Cybernet	Optical Tracking for NDE Sensor Scanning
			Haanpaa	Douglas	Cybernet	
4d-5	5:00	5:30	Kessler	Seth	Metis	PZT & CNT Based SHM Systems for Impact Detection & Localization
4e	Rio Grand (8 Person Conf Room)			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		

ISIW 2014 Day 2: Jul 16th - AM - Session 5 & 6 - Technologies						
SORRY, ABSOLUTELY NO OUTSIDE FOOD OR BEVERAGES ALLOWED IN THE GILRUTH CENTER						
Session 5a - Alamo Ballroom East End (100)				Minature Free-Flying Platforms for Inspection - Part 1 - Flight Systems		
5a-1	8:30	9:00	Hinkley	David	Aerospace Corp	Aerospace PICOSAT Capability Status 2014
5a-2	9:00	9:30	Williams	Austin	Tyvak	CubeSat Proximity Operations Demonstration Mission Enabling On-Orbit Inspection
			Tsuda	Al	Tyvak	
5a-3	9:30	10:00	Johnson	Mike	Nanoracks	NanoRacks ISS Operations
Session 5b - Alamo Ballroom -West End (50)				Robotic Inspection - Part 1 - ISS External Inspection Improvements		
5b-1	8:30	9:00	Studer	Victor	NASA/JSC/EV	External High Definition Camera
5b-2	9:00	9:30	Gonthier	Yves	CSA	Dextre-Deployable Vision System(DDVS)
			Gemme	Sebastien	CSA	
5b-3	9:30	10:00	Callen	Phillip	JSC/ER	Enhanced Ground Control for ISS Robotics
Session 5c - Brazos Room (18) - Upstairs				Hand's Free Operations in Zero-G - Part 1 - Temporary Adhesion with Gecko-Materials		
5c-1	8:30	9:00	Glass	Paul	Nanogriptech	Gecko Inspired Adhesive
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 Like Adhesives for InSpace Inspection
Session 5d - Coronado Room (40)				Autonomy Improvements - Part 1 - Condition/Event -Triggered Inspections with Add-on Sensors		
5d-1	8:30	9:00	Trott	Aaron	Invocon	Flight Systems and Technologies for Impact Detection and Location
5d-2	9:00	9:30	Bowman	Christopher	DF & NN	Autonomous Data & Goal Driven Intelligent Inspection for Unknown Precursor Detection
5d-3	9:30	10:00	Goodman	Doug	Ridgetop Group	Smart Sensors for Distributed Event-Triggered System Health Monitoring
Session 5e	Rio Grand (8 Person Conf Room)			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		
BREAK	10:30	11:00		Coffee/Snacks - Schedule One-on-One Sessions, Visit Displays/Demos		
Session 6a - Alamo Ballroom East End (100)				Minature Free-Flying Platforms for Inspection - Part 2 - Test Capabilities		
6a-1	10:30	11:00	Benavides	Jose	NASA/AMES	SPHERES – a Free-Flying Testbed Inside the ISS
6a-2	11:00	11:30	Saenz-Otero	Alavar	MIT Space Systems Laboratory	SPHERES-X - a Proposed Inspection Laborarory Outside ISS
6a-3	11:30	12:00	Magruder	Darby	NASA/JSC/ER4	Remote Underwater Robotic Inspection
Session 6b - Alamo Ballroom - West End (50)				Robotic Inspection - Part 2 - Difficult to Access Areas		
6b-1	10:30	11:00	Knaub	Mitchell	Hydrotech	Enabling Monitoring and Inspection with Wireless Power and Data Hotspots Through Metal Barriers.
			Jaskolski	*Cory*	Hydrotech	
6b-2	11:00	11:30	Baybutt	Mark	SRI	Taurus Robot
			Low	*Tom*	SRI	
6b-3	11:30	12:00	Quinn	Roger	Case Western Reserve Univ	Climbing Robots for Inspecting ISS interior
Session 6c - Brazos Room (18) - Upstairs				Hand's Free Operations in Zero-G - Part 2 - Temporary Adhesion with Electro-Adhesion		
6c-1	10:30	11:00	Aguero	Victor	SRI	Progress Towards Electroadhesion Application in Space
6c-2	11:00	11:30	Spenko	Matt	Illinois Institute of Tech	Hybrid Electrostatic/Gecko-like Adhesives
6c-3	11:30	12:00	Ferreira	Gerhard	Justik	Electro-Adhesion Technology for Space
Session 6d - Coronado (40) - Upstairs				Autonomy Improvements - Part 2 - Triggered Inspections with Designed-In Sensors		
6d-1	10:30	11:00	Rummel	Ward	D&W Enterprises, LTD	A New NDT Tool
6d-2	11:00	11:30	Pena	Francisco	Aero-Institute - NASA/DFRC	Fiber-Optic Sensing Systems for In Space Inspection
6d-3	11:30	12:00	Djordjevic	Boro	Materials & Sensors Tech, Inc.	In-situ Versus Imbedded Sensing - How Health Monitoring effects Inspection Needs
Session 6e	Rio Grand (8 Person Conf Room)			Available to Schedule Side Meetings and Conference Calls - Check with Reception Desk		

ISIW 2014 Day 2: Jul 16th - PM - Session 7 & 8 - One-on-One & Forward Planning Sessions **SORRY, ABSOLUTELY NO OUTSIDE FOOD OR BEVERAGES ALLOWED IN THE GILRUTH CENTER**						
Lunch	12:00	12:30	Pickup Food - Visit Demonstrations - Schedule One-on-One Sessions - Return to tables/seats for Keynote Presenation			
Speaker	12:30	1:00	Bomman	Preston	Photon-X/ RPS	Applications for Spatial Phase Imaging - Capturing and understanding the physical world digitally
			Barbour	*Blair*	*PhotonX- Remote*	
Speaker	1:00	1:15	Zmijewski	Christopher	SPAR-3D - lead Advisory Board	SPAR-3D Conference Overview - 2014 results and 2015 in Houston
Final Speaker	1:15	1:45	TBD			
BREAK	1:45	2:00	Coffee/Snacks - Prepare for One-on-One Sessions, Visit Displays/Demos			
Session 7	2:00	4:30	All rooms	One on One Sessions -15 minute periods - See Schedule for Sign-up at the Reception Desk		
	Ten Sessions of One-on-One Sessions - 15 minute intervals - Sign-up beforehand					26 Tables x 10 slots = 260 slots; 48 Tech Developers => ~ 5 slots/TD
Session 8	4:30	4:55	Alamo East	Feedback Session - All are welcome		
Close	4:55	5:00	Studor	George		

2014 ISIW Webex and Telecom Tie-in Instructions by Room			
Alamo East: "a" sessions – Both Days -	**Alamo West: "b" sessions - Both Days -**	**Day 1: Discovery – "c" Day 2: Brazos – "c"**	**Coronado: "d" sessions - Both Days -**
Webex: 1. Go to: https://nasa.webex.com/nasa/j.php?MTID=mc2bd7a888f5633107091a6e3bb349fa5 2. enter your name, email 3. enter password: **In-space#2014** 4. Click "Join" **Telecom:** **Dial-in # 1-844-467-4685** **Passcode # 5398949869**	**Webex:** 1: Go to https://nasanesc.webex.com/nasanesc/j.php?MTID=m004e574f444dd780ba9413d5a94bacff 2. enter your name, email 3. enter password: **techno2014!** 4. Click "Join" **Telecom:** **Dial-in # 1-844-467-4685** **Passcode #: 639668**	**Webex:** 1. Go to https://nasa.webex.com/nasa/j.php?MTID=m1a4375463b064ca2b5cfcfdaf5d5b71d 2. enter your name, email 3. enter password: **inspect@123** 4. Click "Join" **Telecom:** **Dial-in #: 1-844-467-6272** **Passcode #: 100295**	**Webex:** 1. Go to https://nasanesc.webex.com/nasanesc/j.php?MTID=m5ca0b2e69c6aa1fe9250173ae7b637a9 2. enter your name, email 3. enter password: **workshop!** 4. Click "Join" **Telecom:** **Dial-in #: 1-844-467-6272** **Passcode #: 912592**

Wireless Access at the Workshop

- **Wireless Access should be available in each room.**
- **Capacity will be adequate if attendees connect <u>only 1 device at a time</u>.**
- **Use the Appropriate Network:**

  a. "NASA" – NASA NDC Password & NASA managed/trusted device

  b. "NASAbyod" – NASA NDC Password & personal device

  c. "nasaGuest" – Guest Network Password & personal device

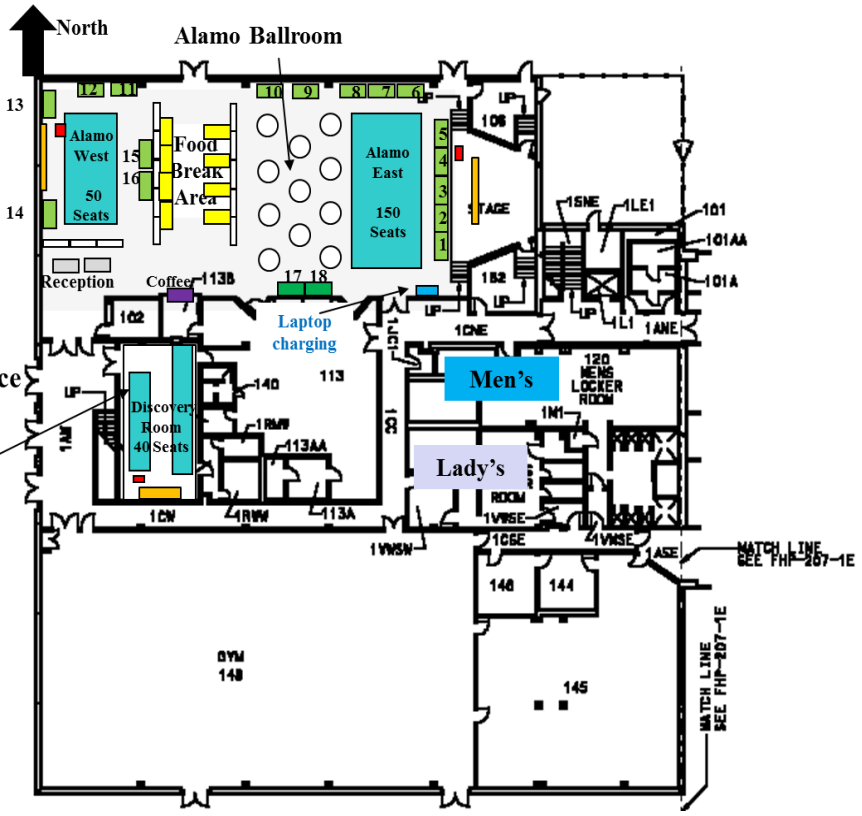
  - for Non-NASA persons – will not work if you have a NDC account

  - Password is available at the ISIW Registration Desk

Gilruth Center First Floor

In Space Inspection Workshop
July 15-16, 2014

- Food & break area Tables
- Reception Tables
- Demo Tables
- Laptop Charging Tables
- Coffee/Beverages area

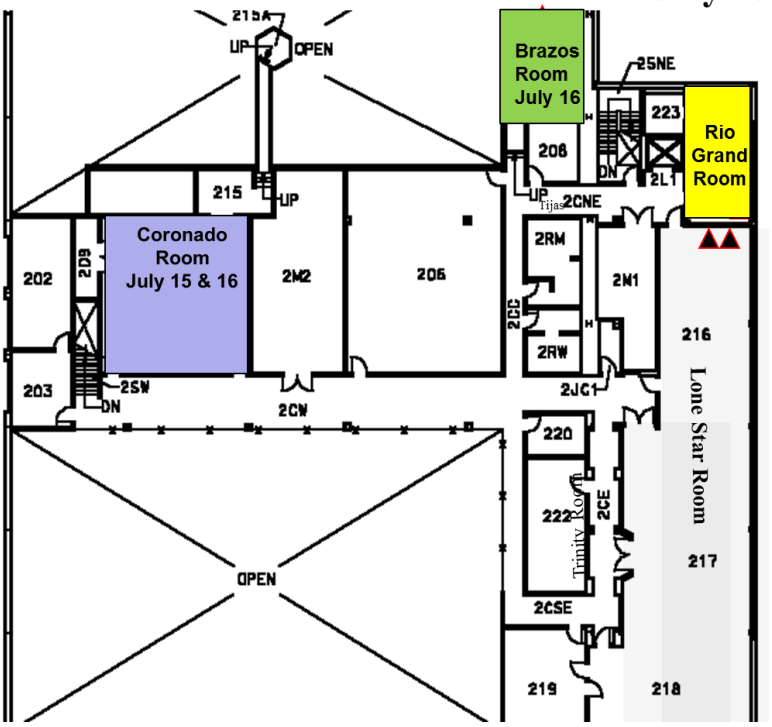


-Parking is allowed anywhere except the few reserved spaces

- No badges are required

Gilruth Center Second Floor

Inspection Workshop
July 15-16, 2014



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

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.

Technology Area	Spaceflight Need	Characteristics*
3D Surface Imagers and Profiling	- Surface Damage - Configuration	Range: 2 in – 120 ft, Insensitive to lighting, high resolution, dynamic (frame-by-frame)
3D Penetrating Imagers	- Damage+Configuration under non-conductive & conductive	Range: 2 in – 1 foot, high resolution, low SWaP, safety and reliability,
Note: In-Space Inspection Sensors Look Through Conductive Material to Target Surface - Friday, 01 July 2011 http://www.techbriefs.com/component/content/article/10507		
Liquid and Gas Leak Sensors	- Remote detection and location of leaks to vacuum	Range: 2 in – 120 ft, high sensitivity, reliability of detection & identification
COTS NDE, Sensors, Cameras	- Out of configuration, Damage Detection & Characterization	Cost, reliability, minimum operations and integration, improved performance
Difficult to Access Areas	- Small gaps, out of reach, EVA, blind spots, noise, rel. motion	Size, mobility, location, Safety/Hazard mitigation, min crew operations.
Robotic Inspection Platforms	- Decrease blind areas & EVAs - Increase direct access to site	Cost, min operations and planning, mobility, stability, size, safety/hazards
Snake-like Inspection Scopes	- Highly controlled, min hazard - 3D ops/sensing, mapping	Cross-section size, controllability, hazards, 3D mapping & head following, location
Free-Flying Inspection Platforms	- Flexibility of sensor location - Reduce manipulator ops	SWaP, Safety/Hazards, Re-use & throw-away, autonomy, sensor modularity
Efficiency		
Temporary Adhesion	- 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
Materials/Mfgring To Enhance Inspection	- Properties enhance damage - Properties for pass-through	Doping of embedded materials Coatings and etchings of surfaces
Event-Triggered Inspection	- Reduce scheduled inspection - Enable inspection on demand	Monitor environment, structure or system to detect threshold requiring inspection
Autonomous Inspection	- Reduce human ops (flt & grd) - Reduce data transfer needs	Command and Data handling minimized for robotic platforms and sensors Information & Answers with minimum data
SBIR/STTR Requested Technologies	- 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
Miscellaneous Technologies	- Catch all – not in above list - Last minute or Inspirational	Fewer, possibly higher risk applications Ground-breaking and possibly emerging

Demo Tables - Locations Assigned at Meeting - see Notice Board/Handout					
Table	**Session**	**Name**	**Org**	**Location**	**Topic**
	Demo	Nichols	RF111	Las Cruces, NM	Comp Pressure Vessel/Rocket Propulsion Inspec-
	2A-1	Christiansen	KA118	Houston, TX	Presenting micrometeoroid and orbital debris risks & inspection needs.
	3C-3	Grygier	ES611	Houston, TX	Structural Monitoring to Minimize Inspections
	4A-1	Van Liew	AS & E	Bellerica, MA	New Developments in Portable Backscatter Scanning
	4A-2	Garber	Nuscafe	Knoxville, TN	Recent Backscatter X-ray Improvements
	4A-3	Grubsky	Physical Optics Corporation	Torrance, CA.	Recent Progress on 3D Backscatter X-Ray NDE
	4B-1	Lafleur	Olympus NDT	Houston, TX	Flexible Videoscopes/Borescopes-Pushing the Limits of Articulated Scopes
	4B-2	Pairazaman	UniWest	Oklahoma City, OK	Controllable videoscopes/sensors
	4B-3	Mallion	OC Robotics	Bristol, UK	Controllable Snake-like Inspection Robots
	4B-4	Baybutt	SRI	Menlo Park, CA	TAURUS robot and 6B-2
	4B-5	Tongue	4DSP	Austin, TX	Shape Sensing Utilizing c-OFDR
	4C-1	Sallee	SPEC Inc.	Austin, TX	Micro LADAR and Raman Spectral LADAR for Inspec-tion
	4C-2	Greaves	DotProduct, LLC	Boston, MA	Repurposing Game Technology for Real Time, Handheld 3D Data Capture
	4C-3	DeRemer	Capture 3D, Inc	Farmington Hills, MI	Short Range Full-field Non-Contact Structured Blue Light 3D Scannaning and Photogrammetry for Rapid and Accurate Inspection Analysis
	4C-5	Hagen	Rebellion Photon-ics	Houston, TX	Hyper-spectral Imaging to Detect/Locate Gas Leaks
	4D-3	Cabral	Sonatest	Toronto, CA	User Friendly NDE Ultrasound and Phased Array
	4D-4	Tang	Cybernet Systems	Ann Arbor, Michigan	Optical Tracking for NDE Sensor Scanning
	5A-1	Hinkley	Aerospace Corp	El Segundo, CA	Aerospace PICOSAT Capability Status 2014
	5A-3	Johnson	NanoRacks, LLC	Houston	NanoRacks ISS Operations
	5C-1	Glass	nanoGriptech, Inc	Pittsburgh, PA	Gecko Inspired Adhesive
	5C-2	Gupta	Felsuma LLC	Boston, MA	Think Like Geckskin
	5C-3	Parness	Jet Propulsion La-boratory	Pasadena, CA	Gecko Like Adhesives for InSpace Inspection
	5D-1	Trott	Invocon, Inc	Conroe, TX	Flight Systems and Technologies for Impact Detection and Location
	6A-1	Benavides	SGT Inc.	NASA ARC, SFO	SPHERES – a free-flying testbed inside the ISS
	6A-3	Magruder	ER411	Houston, TX	Remote Underwater Robotic Inspection
	6B-1	Knaub	Hydro Technolo-gies	Denver, CO	Enabling Monitoring and Inspection with Wireless Power and Data Hotspots Through Barriers
	6B-3	Quinn	Case Western	Cleveland, OH	Climbing robots with gecko inspired adhesive feet for inspecting ISS interior
	6C-1	Aguero	SRI	Menlo Park, CA	Progress Towards Electro-adhesion Application in Space
	6C-2	Spenko	Illinois Institute of Technology	Chicago, IL	Hybrid Electrostatic/Gecko-like adhesives
	6C-3	Ferreira	Justick Internation (Pty) Ltd	South Africa	Electro-Adhesion Technology in Space

One-on-One Tables - Sign-up for 10 Sessions (15 Min each) at Registration Desk					
Table	**Session—Presentatn**	**Name**	**Org**	**Role**	**Topic**
1	2A-1	Christiansen	JSC/KX	Engineer MMOD Prog Office	MMOD risks & inspection needs.
2	2A-2	Dempsey	JSC/OB	Tech Mgr ISS Vehicle Office	Inspection Considerations from the ISS Program
3	2A-3	Moore	JSC/KX	Branch Chief Image Science and Analysis	ISS Inspection Capabilities and Challenges
	2A-4	Rollins	Jacobs Technol-ogy	Image Science & Analysis	Orion Inspection Planning - Lessons Learned
4	2B-1	Roesler	DARPA	Program Manager	Inspection of GEO Spacecraft for Comm&Military
5	2B-3	Henshaw	NRL	Space Systems	Overview of NRL Advances in Orbital Inspection
	2D-2/4C-4	Turner	Texas A&M	Research Professor	TAMU's LASR Lab and Computational Vision
6	2C-1	Vos	JSC/SA - Wyle	Senior Human Factors Eng	Human Systems Integration Technology Needs
7	2C-2	Perri	JSC/DX42 - USA	Instructor, ISS Repair/Mech	OSO In Space Inspection Experience and Needs
8	2C-3	Wright	JSC/DX	SPDM Subsystem Manager	Lighting and Robotics Integration
9	2C-4	Frank	AMES/T1	Autonomous Mission Ops	Autonomous Mission Operations - Roadmap
10	2D-1	Leckey	LaRC/D313	NDE Sciences Branch	Modeling and Simulation for In-Space NDE/HM
11	2D-3/4	Nellums	Nellums Eng	Inspect/imagery processing	Space-Based Sensor Enhancement Signal Prcessing
12	3A-1	Rogers	BP - CTO	Technology Director	NDT Challenges for the Oil and Gas Industry
13	3A-2	Kapusta	Shell Oil Co	Chief Scientist	Inspection needs in the Oil and Gas business
14	3A-3	Brower	Astro Tech	Researcher	Advanced Instrumentation and Inspection for Deepwater Oil and Gas Fields
15	3A-4	Robello	Halliburton	Halliburton Fellow	Inspection Needs Supporting Increased Well Integ-rity
16	3B-1	Russ	USAF - AFRLRXL	Branch Head - NDE	Overview of USAF NDE R&D Activities
17	3B-4	Lockhart	Navy/NUWC	Developmental Systems Eng	Navy NDT&E Needs
18	3C-2	Goforth	JSC/EV	Avionics Engineering & Tech	Possible Avionics Inspection Needs
19	3C-3	Grygier	JSC/ES6	ISS Loads & Dynamics Lead	Structural Monitoring to Minimize Inspections
20	4D-2	Koshti	JSC/ES4	NDE Lead Engineer	Considerations for IVA NDE Instrumentation for ISS On-Orbit NDE Applications
21	5A-1	Hinkley	Aerospace Corp	PICOSAT Program	Aerospace PICOSAT Capability Status 2014
22	5A-3	Johnson	NanoRacks, LLC	CTO NanoRacks, LLC	NanoRacks ISS Operations
23	5B-2	Gonthier	CSA	Space Ex Strategic Planning	Dextre Deployable Vision System
24	5B-3	Callen	JSC/ER	Flight Systems Branch Chief	Enhanced Ground Control for ISS Robotics
25	5C-2	Gupta	Felsuma LLC	CEO	Think Like Geckskin
26	6A-1	Benavides	SGT Inc.	SPHERES Facility Engineering Lead	SPHERES – a free-flying testbed inside the ISS
27	6C-3	Ferreira	Justick	CEO	Electro-Adhesion Technology in Space
28	Day 2 - Lnch	Bornman III	RPS Group Plc	Director of business Devel-opment	Applications for Spatial Phase Imaging - Capturing and understanding the physical world digitally
29	Day 2 - Lnch	Zmijewski	Haag 3D	SPAR Advisory Board	SPAR 3D Conference Overview
30	Demo	Nichols	WSTF/RF	NASA-WSTF MetLab Mgr	Composite Pressure Vessel/Rocket Propulsion

Session 1 Presentation 2
"NESC NDE TDT Overview/Prior In-Space NDE"
Demo: No Poster: No
One-on-One Table: No

Dr. William H. Prosser
NASA Technical Fellow
NASA Langley Research Center
NASA Engineering and Safety Center (NESC)
william.h.prosser@nasa.gov

Abstract: The NASA Engineering and Safety Center (NESC) was charted in the wake of the Space Shuttle Columbia accident to serve as an Agency-wide technical resource focused on engineering excellence. The objective of the NESC is to improve safety by performing in-depth independent engineering assessments, testing, and analysis to uncover technical vulnerabilities and to determine appropriate preventative and corrective actions. Critical to the NESC are teams of experts in a number of core disciplines including nondestructive evaluation (NDE). These teams, designated Technical Discipline Teams (TDTs), draw upon the best engineering expertise from across NASA and also include partnerships with other government agencies, national laboratories, universities and industry. An overview of the NESC NDE TDT will be presented along with a brief review of previous applications of In-Space NDE by NASA.

Background: Dr. Prosser joined NASA Langley Research Center in 1987 as an Aerospace Technologist in the Nondestructive Evaluation Sciences Branch. In 2005, he joined the NASA Engineering and Safety Center as Discipline Expert for Nondestructive Evaluation and in 2007 was named a NASA Technical Fellow. He has served as technical lead and program manager for the research and application of NDE and Structural Health Management (SHM) systems for aerospace vehicles. Dr. Prosser's research has been in the field of ultrasonic and acoustic emission sensing techniques. His work contributed to the successful development and implementation of a system to detect impacts on the Space Shuttle wing leading edge in response to the Shuttle Columbia accident. He has led NASA, industry, university and government agency teams to implement NDE and SHM systems for a variety of NASA programs including the Space Shuttle, International Space Station, X-33, and Aerospace Vehicle Systems Technology Program.

Dr. Prosser was the 1997 recipient of the NASA Floyd Thompson Fellowship, a 2003 recipient of a NASA Superior Accomplishment Award for efforts during the Columbia Accident Investigation, and a 2005 recipient of NASA's Exceptional Achievement Medal. He is past Chair and a Fellow of the Acoustic Emission Working Group and is also the Scientific Editor of Structural Health Monitoring: An International Journal.

Dr. Prosser received his B.S. degree in Math and Physics from the College of William and Mary and his M.S. and Ph.D. degrees in Materials Science and Engineering from Johns Hopkins University.

Session 1 Presentation 3
"Why Are We Here? - In Space Inspection - Shuttle Program and Mission Ops Experience"

Wayne Hale Jr.
Special Aerospace Services, LLS (SAS)
n.w.hale@specialaerospaceservices.com
303-717-6746

Abstract: Mr. Hale will relate his background in Mission Operations and the Post Columbia experiences with the as Space Shuttle Program Manger to the importance of planning and executing Inspections in space.

Background: **Wayne Hale** is currently a consultant for Special Aerospace Services of Boulder, Colorado. In that capacity he provides services in technical consulting, seminars, technical analysis, and speaking engagements with aerospace, energy, and other high reliability organizations on safety, management, culture change, operations in high risk environments.

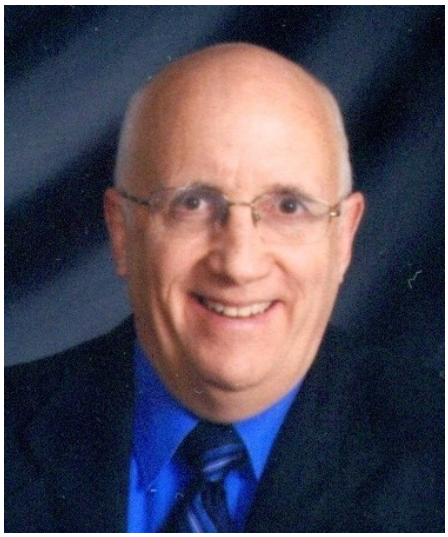
Mr. Hale retired from NASA in 2010 as the Deputy Associate Administrator of Strategic Partnerships at NASA Headquarters in Washington, DC. Mr. Hale served in the senior leadership of NASA's Space Shuttle Program from 2003 to 2008 as Launch Integration Manager at the Kennedy Space Center followed by two years as Deputy Program Manager and finally as **Program Manager all during the post-Columbia return to flight effort.** From 1988 to 2003, he was a **Space Shuttle Flight Director for 40 Space Shuttle flights,** and prior to that as an orbiter systems flight controller in Mission Control for 15 early Space Shuttle flights.

Mr. Hale counts as the capstone achievement of his career the transformation of NASA Space Shuttle management culture to be one that emphasized safety and mission success. His tenure as Program Manager marked seven successful space shuttle flights and set the safety expectations for the fly out of the space shuttle program.

Mr. Hale has received special honors and awards such as: three NASA Outstanding Leadership Medals; the NASA Exceptional Service Medal; Rice University Outstanding Engineering Alumnus; Purdue University Distinguished Engineering Alumnus and numerous other awards..

Mr. Hale holds a Bachelor of Science in Mechanical Engineering from Rice University and a Master of Science in Mechanical Engineering from Purdue University.

Session 1 Presentation 4	**George Studor**
"Workshop Overview:	**ISIW 2014 Workshop Chair**
In-Space Inspection Needs & Technologies"	**NESC NDE TDT—InSpace Inspection Technology**
One-on-One Table: Yes	**george.f.studor@nasa.gov/gmstudor@gmail.com**
	281-415-3986(cell)/763-208-9283



Abstract: George will use the ISIW Pamphlet to overview the workshop purpose, key technologies, method of enabling partnerships, how to use the pamphlet, presentation loading, identify key players in making the workshop a success, address the organization and agenda, location of rooms, use of wireless access and codes, webex/telecom remote access, how to find demo tables, sign-up for one-on-one sessions, food provisions and future planning discussions.

Background: Mr. George Studor is a retired NASA senior project engineer for technology applications and currently supports the NASA Engineering and Safety Center via three technical discipline teams(TDTs): NDE—InSpace Inspection, Avionics—Wireless Community of Practice, and Robotic Spacecraft— adding Natural Systems to Systems Engineering Process. George also works for Jacobs Engineering through LZ Technologies supporting Johnson Space Center Image Science and Analysis branch to address the key issue of inspection capability and implementation of Soyuz Re-Entry Thermal Protection Systems.

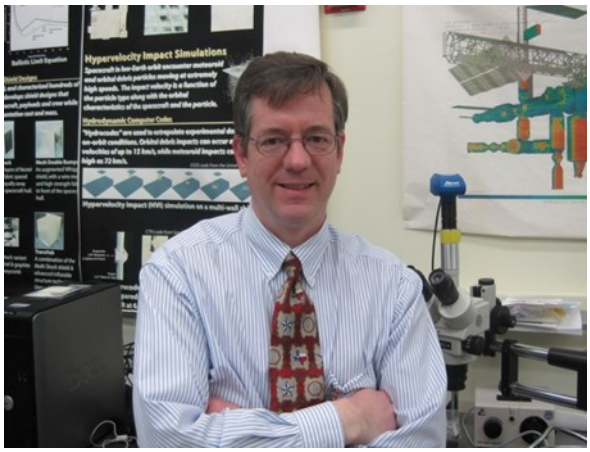
Early in George's career, he guided requirements development and plans for Space Shuttle Orbiter's ground inspections. Then, after leading the Shuttle Program Plan Schedules for return-to-flight after the Challenger accident, he led the Space Station Freedom Verification Program. Prior to the Columbia accident, George managed the Sandia development and flight of LDRI, a 3D LADAR video system for in-space structural dynamics measurements. This system was matured after the Columbia accident to conduct inspections of the wing leading edge in all lighting conditions. In part of the International Space Station Leak Detection and Repair Project, George managed to ISS hand-held leak detection system in orbit. More recently, he has been investigating penetrating imager technologies for characterizing damage in space structures such as re-entry tile, and metallic, composite and fabric walls of manned pressurized modules. His experience also includes a large number of add-on stand-alone wireless instrumentation systems on spaceflight missions and advocates change in aerospace vehicle architectures to enable reduced wires and connectors through a comprehensive approach called "Fly-by-Wireless".

1995-2013 - NASA/JSC: Structures & Avionics Engineering Divisions, Technology Office
1993-1995 - NASA/Montana State University Adjunct Prof.
1990-1993 - NASA/HQ/Reston - Space Station Freedom Verification Program
1983-1990 - NASA/JSC - Space Shuttle Program Office
1987-1999 - AF Reserve AFRL - Retired Major
1972-1987 - Active Duty, USAF C-130 Pilot, USAF Detailee at NASA/JSC,

1981-1982 - MS Astronautical Engineering, USAF AFIT
1972-1976 - BS Astronautical Engineering, USAF Academy

Session 2A Presentation 1
"Micro-Meteoroid and Orbital Debris Risk Overview"
Demo: Yes
Poster: No
One-on-One Table: Yes

Dr. Eric Christiansen
NASA/Johnson Space Center
MMOD Protection Lead
Eric.L.Christiansen@nasa.gov
281-483-5311



Abstract: Micrometeoroid and Orbital Debris (MMOD) impacts represent a significant risk for crews of long-duration space missions for which the spacecraft must perform a safe reentry. In order to protect the crew, the reentry vehicle is covered with one or more forms of thermal protection system (TPS) material able to withstand reentry heating. However, MMOD impacts that leave sufficiently large (i.e. "critical") TPS damage can result in loss of crew or vehicle. In order to mitigate the risk of loss of crew or vehicle, a full-surface image-based inspection or "survey" can be performed. Findings from the survey can lead to a "focused" inspection requiring specialized close-range imaging assets, and possibly to a repair or a safe-haven transfer of the crew. Design of appropriate survey and focused-inspection sensor packages requires prior impact and thermal testing to determine critical damage criteria, and should be guided by standard detection criteria. As-built sensor packages should be verified with subjective screening tests, with the sensors under appropriate environmental conditions. The timing and frequency of in-space inspections should be based on assessment of risk and risk-mitigation (due to inspection), derived from mission-specific MMOD flux and impact modeling.

Background: Dr. Eric Christiansen is the NASA lead for MMOD protection. He has developed and patented low-weight and highly effective MMOD shields used on the International Space Station (ISS), inflatable modules, Stardust and other spacecraft. He is responsible for NASA MMOD risk assessments supported by hypervelocity impact tests that determine high-risk areas of the spacecraft which are then the focus of risk reduction efforts. He has assessed MMOD risk to Shuttle, MPCV/Orion and other NASA reentry vehicles which are covered with TPS materials. His work lead to adopting operational techniques to reduce MMOD risk to NASA spacecraft, such as selecting low-risk attitudes/flight orientations, and using TPS inspection/repair prior to reentry to mitigate MMOD risk. He helped develop MMOD hardened radiator panels for ISS and Shuttle. He is currently working on technologies to integrate impact damage detection and location sensors into NASA MMOD shields, and to incorporate other functions into MMOD shields such as thermal and radiation protection.

1989-Present: NASA Johnson Space Center
1985-1989: Eagle Engineering, Inc., Houston, TX
1982-1985: E.I. du Pont de Nemours & Company, Inc.
Education: 1979 - BS Chemical Engineering, Purdue University

Session 2A Presentation 2
"Inspection Considerations from the ISS Program"
Demo: No Poster: No
One-on-One Table: Yes

Phil Dempsey
NASA, Johnson Space Center
ISS Program Vehicle Office
phil.dempsey@nasa.gov
281-244-8567

Abstract: The International Space Station Program has maintained a permanent human presence in space since November, 2000. Through the assembly of the vehicle, multiple on-orbit anomalies, and now the transition to full utilization many needs for inspection techniques have been identified. Some of these needs have been satisfied and others remain desired capabilities. An overview of the types of inspections needed, such as visual indications, measurement of structural damage, and thermal performance, will be discussed. Key risks that define inspection methods as part of the mitigation plan will be summarized, along with methods we use to demonstrate these techniques both for ISS needs as well as looking forward to Exploration capabilities using the ISS as a demonstration platform.

Background: Mr. Phil Dempsey joined NASA in 1990 as a program analyst for exploration missions. He has since held multiple engineering positions in small and large-scale test as well as various vehicle integration positions within the Space Shuttle Program, the X-38 development project, and the International Space Station Program. Since joining the ISS Program in 2000 he has held increasingly responsible positions in the management of the Vehicle systems, elements, and processes. He is currently the Technical Manager for the ISS Vehicle Office and is also the lead of the Human Exploration and Operations Mission Directorate System Maturation Teams.

1990: B.S. Aerospace Engineering, Boston University

1990-Present: NASA, Johnson Space Center

Session 2A Presentation 3
"ISS Inspection Capabilities and Challenges"
Demo: No Poster: No
One-on-One Table: No
http://imagescience.jsc.nasa.gov

Randy C. Moore
NASA/JSC
Image Science and Analysis/KX
randall.c.moore@nasa.gov
281-244-1079

Abstract: The rationale and strategy for inspection of the International Space Station (ISS) is based largely on lessons learned during the Shuttle/Mir, ISS Phase 1 Program. Experience gained through the survey of Mir established the basis for conducting similar surveys of ISS. Imagery is used today, as it was then, as a means for monitoring the condition of the spacecraft, support problem solving and anomaly investigations, and to provide early detection of changes affecting the long-term health of the aging station. The engineering data derived from imagery validates environment and dynamic models, contributes to spacecraft design measures and supports risk reduction. During the assembly and early utilization phase of ISS, the Space Shuttle provided an excellent platform for the acquisition of ISS surface imagery while docked and during proximity maneuvers, providing 100% coverage. Now, the ISS relies upon its own suite of inspection assets. ISS inspection coverage is constrained by the limits of the procured technology, installation locations, and operational priorities. This presentation will provide an overview of the available ISS inspection assets (primarily regarding external imagery) and summarize the challenges in acquiring a comprehensive survey of the ISS.

Background: Mr. Randy Moore is the NASA manager of the JSC Image Science and Analysis Group. The Image Science and Analysis Group consists of scientists, engineers and specialists providing unique expertise in the planning, acquisition, handling, modification, analysis and interpretation of photo and video imagery. Prior to joining the Image Science and Analysis Group in 2012, Mr. Moore's assignments included Project Manager for the upgrade and sustaining engineering of internal and external camera systems for the Space Shuttle and Project Manager for an external high definition video camera for Space Station.

Session 2A Presentation 4
"Orion Inspection Planning - Lessons Learned"
Demo: No Poster: No
One-on-One Table: Yes

Dr. J. Michael Rollins
Image Analyst
JSC-KX/ESCG
john.m.rollins@nasa.gov
281-483-1262

Abstract: Micrometeoroid and Orbital Debris (MMOD) impacts represent a significant risk for crews of long-duration space missions for which the spacecraft must perform a safe reentry. In order to protect the crew, the reentry vehicle is covered with one or more forms of thermal protection system (TPS) material able to withstand reentry heating. However, MMOD impacts that leave sufficiently large (i.e. "critical") TPS damage can result in loss of crew or vehicle. In order to mitigate the risk of loss of crew or vehicle, a full-surface image-based inspection or "survey" can be performed. Findings from the survey can lead to a "focused" inspection requiring specialized close-range imaging assets, and possibly to a repair or a safe-haven transfer of the crew. Design of appropriate survey and focused-inspection sensor packages requires prior impact and thermal testing to determine critical damage criteria, and should be guided by standard detection criteria. As-built sensor packages should be verified with subjective screening tests, with the sensors under appropriate environmental conditions. The timing and frequency of in-space inspections should be based on assessment of risk and risk-mitigation (due to inspection), derived from mission-specific MMOD flux and impact modeling.

Background: Michael Rollins supports the Image Science and Analysis Laboratory primarily in the field of on-orbit spacecraft inspection. His inspection work has included Space Shuttle mission support, the management of an imagery screening team, anomaly reporting, as well as post-mission assessment of returned vehicle condition. He has been involved in extensive 2D and 3D imagery assessments for current and future on-orbit inspection applications. Michael has worked in image processing for 20 years, with 13 of those at Johnson Space Center. Other work has included correlation-based pattern recognition and imagery application development in support of battlefield smoke/obscurant characterization.

BS in Chemical Engineering
Texas Tech University

MS in Electrical Engineering
University of Texas, El Paso

PhD in Electrical Engineering
New Mexico State University.

Session 2B Presentation 1
"DARPA GEO Robotic Servicing"
Demo: No Poster: No
One-on-One Table: Yes

Dr. Gordon Roesler
DARPA Tactical Technology Office
Gordon.roesler@darpa.mil
703-526-4752

Abstract: Building on the technology innovation and developments of the Phoenix Program and earlier DARPA investments in space robotics, DARPA is developing a GEO Robotic Servicer for launch within the next five years. The servicer will be a multi-mission spacecraft with capabilities including: inspection, including exterior locations difficult to view from standoff ranges; relocation of spacecraft (e.g. moving a retired spacecraft away from active orbital regions); and assisting spacecraft that have suffered mechanism deployment anomalies. These primary mission capabilities serve both strategic and commercial imperatives. Understanding whether a spacecraft malfunction is due to a design flaw, an orbital debris impact, or other cause is of great concern to all spacecraft operators. Providing a relocation service for active spacecraft can conserve their operating fuel. A similar benefit arises for the relocation of a spacecraft compelled to perform unplanned maneuvers. Relocation of uncommandable objects can result in large propellant savings and enhanced safety for satellite fleets. These capabilities, emplaced on a GEO-compatible, long-life spacecraft bus, will provide a dramatic new space fleet management tool for both commercial and government spacecraft. New approaches to GEO systems are expected to emerge following demonstrations of the robotic capabilities and reliability.

Background: Dr. Gordon Roesler is the Program Manager at DARPA for the GEO Robotic Servicing effort. He was Program Manager for the SUMO and FREND robotic spacecraft programs at DARPA, 2002-2006. He has led or participated in technology development programs including robotic marine vessels, energy systems, and underwater technologies.

1971-1975: B.S. Physics, United States Naval Academy

1986-1992: Ph.D. Physics, MIT

Session 2B Presentation 2
Satellite Servicing Mission – Inspection Needs
Demo: No Poster: No
One-on-One Table: No
http://ssco.gsfc.nasa.gov

Jill McGuire
NASA's Goddard Space Flight Center
Satellite Servicing Capabilities Office
jill.m.mcguire@nasa.gov
301-286-2504

Abstract: NASA's Satellite Servicing Capabilities Office (SSCO) was established in 2009 to continue NASA's 30-year legacy of satellite servicing and repair. Comprised of the same team that conducted five successful servicing missions to the Hubble Space Telescope, SSCO is aggressively advancing a suite of diverse technologies that would extend the lives of existent and future spacecraft via robotic refueling, upgrade and repair on orbit. Since 2011, their Robotic Refueling Mission (RRM) on the International Space Station has demonstrated a variety of tools, technologies and techniques to benefit satellites not originally designed for in-flight service. The second phase of RRM will debut a new borescope inspection tool named VIPIR — the Visual Inspection Poseable Invertebrate Robot – that could one day help mission operators who need robotic eyes to troubleshoot anomalies, investigate micrometeoroid strikes, and carry out teleoperated satellite-repair jobs. RRM operations are currently scheduled for late 2014. In addition to RRM, SSCO has also built a space-qualified residual gas analyzer designed for the localized area around a spacecraft. The talk will present an overview of these tools and their capabilities, and discuss their potential applications for spaceflight inspection. Ms. McGuire will also discuss potential needs for other inspection devices, such as backscatter x-ray and x-ray florescent spectroscopy.

Background: Ms. Jill McGuire is the Space Robotics Applications Lead and RRM Project Manager for NASA's Satellite Servicing Capabilities Office. In this role she is responsible for leading a multifaceted team in designing, manufacturing, and launching innovative space tools that both anticipate and answer unique satellite-servicing needs. Previously Ms. McGuire served as the manager of the Hubble Crew Aids and Tool team, which supplied more than 180 unique tools in support of the fifth and final servicing mission to the Hubble Space Telescope.

1989-1993: B.S. Mechanical Engineering, University of North Dakota

1997-1999: M.S. Engineering Management, University of Maryland University College

1999-2002: M.S. Applied Physics, Johns Hopkins University

1992-Present: National Aeronautics and Space Agency

Session 2B Presentation 3
"Overview of NRL Advances in Orbital Inspection"
Demo: no
Poster: no
One-on-One Table: Yes

Glen Henshaw
Naval Research Labortory
Naval Center for Space Technology
glen.henshaw@navy.mil
202-767-1196

Photo/Abstract/Background: Glen Henshaw will be presenting on several recent activities at his laboratory that accommodates advanced multi-body relative GN&C physical simulation and test.

Background: Dr. Henshaw is a roboticist with the Naval Center for Space Technology, U.S. Naval Research Laboratory. Dr. Henshaw leads a team of researchers and engineers in developing robotic systems for use in space and on earth. Dr. Henshaw's major interest is in robotic servicing of spacecraft, and as such he is the lead roboticist for the DARPA Phoenix robotic satellite servicing program. Dr. Henshaw led his team in developing flight–traceable algorithms to enable a robotic spacecraft to autonomously rendezvous with and grapple a disabled satellite without requiring specialized robotic servicing fixtures or cooperative sensor systems. This capability had never before been demonstrated, and potentially allows for robotic spacecraft to service virtually any satellite. He is also the PI for the NRL LIIVe program, a research effort to develop the algorithms and concepts of operation to allow a nanosat to autonomously inspect a larger host.

B. S. in Computer Science (1993)
Brigham Young University

M.S. (1997) and PhD (2003) in Aerospace Engineering
University of Maryland, College Park

Session 2B Presentation 4
"Asteroid Crewed Mission Segment"
Demo: No
Poster: No
One-on-One Table: No

Joe Gard
NASA/JSC Systems Engineering Div
Asteroid Mission SE&I
joseph.a.gard@nasa.gov
281-483-0219

Abstract The next generation of human spaceflight missions presents numerous challenges to designers that must be addressed to produce a feasible concept. The specific challenges of designing an exploration mission utilizing the Space Launch System and the Orion spacecraft to carry astronauts beyond earth orbit to explore an asteroid stored in a distant retrograde orbit around the moon will be addressed. Mission designers must carefully balance competing constraints including cost, schedule, risk, and numerous spacecraft performance metrics including launch mass, nominal landed mass, abort landed mass, mission duration, consumable limits and many others. The Asteroid Redirect Crewed Mission will be described along with results from the concurrent mission design trades that led to its formulation. While the trades presented are specific to this mission, the integrated process is applicable to any potential future mission.

The additional Orion functionality required to perform the Asteroid Redirect Crewed Mission and how it is incorporated while minimizing cost, schedule and mass impacts will be identified. Existing investments in the NASA technology portfolio were leveraged to provide the added functionality that will be beneficial to future exploration missions. Mission kits are utilized to augment Orion with the necessary functionality without introducing costly new requirements to the mature Orion spacecraft design effort. The Asteroid Redirect Crewed Mission provides an exciting early mission for the Orion and SLS while providing a stepping stone to even more ambitious missions in the future.

Background: Joe Gard is a System Engineering & Integration (SE&I) lead for the Advanced Mission Development Group at the Johnson Space Center in Houston Tx. As a SE&I lead, Joe is responsible for integrating various spacecraft architectures to support NASA's deep space exploration goals.

Previously, Joe served as Project Manager for several hardware projects used on ISS and Shuttle including the ISS Laptops, ISS Wireless LAN, and the Space to Space Communications system used to communicate between Astronauts during spacewalks on Shuttle and ISS.

Prior to joining NASA Joe worked for Dynetics, Inc. as a radar systems analysis. Joe participated in several exploitation programs designed to reverse engineer ground-based radar systems to determine the system performance and potential vulnerabilities.

Education: 2006 – MS, Electrical Engineering, University of Houston
1995 – BS, Electrical Engineering, University of Alabama at Huntsville

Session 2C Presentation 1
"Technology Needs in Human Factors and Human Systems Integration "
Demo: No
One-on-One Table: Yes

Gordon Vos, PhD—Senior Human Factors Engineer
Tina Holden, PhD - Human Factors Specialist
Johnson Space Center SF - Wyle Integ. Sci & Eng.
gordon.a.vos@nasa.gov | kritina.l.holden@nasa.gov
281-483-8835 | 281 483-8829

Dr. Gordon Vos

Kritina (Tina) Holden, PhD

Abstract: Human Systems Integration (HSI) is a robust process by which to design and develop systems that effectively and affordably integrate human capabilities and limitations. Human factors is a major component of HSI, dealing with the specific hardware and software portions of the system as well as the detailed ways in which the interaction between the human and the system occurs. This study of the interaction of humans and systems therefore includes an inherent focus on multiple technologies, both from the perspective of designing systems as well as in the assessment of their capabilities, functionality, and usability. This presentation will share some of the key technologies NASA is interested in from an HSI and human factors point of view, and how they may help to address both research and system design needs.

Background: **Dr. Gordon Vos** works for Wyle as a senior human factors engineer with NASA's Human Health and Performance Directorate. He has a PhD in Engineering from Texas A&M University and has been at NASA for 6.5 years. In his time at NASA he has been engaged in research on human performance, human systems integration, served as the lead human factors engineer on the Orion Multi-Purpose Crew Vehicle, and serves on multiple projects as a subject matter expert in areas of human factors, biomechanics, workload, usability, and spacecraft handling qualities. He is an active member of the teaching faculty at the University of Houston, where he teaches graduate classes in Human Factors and Usability Engineering in the Industrial Design program. In the past he worked at Dell computers as a usability engineer, was an Assistant Professor at Texas A&M University, and founded a software company that developed statistical data analysis software for the Department of Defense.

Background: Kritina (Tina) Holden, PhD. is the contractor lead for the JSC Usability Testing and Analysis Facility, and the Science Coordinator for the Human Research Program Space Human Factors Engineering (SHFE) project. She also works on the NASA Human Engineering team for Orion, assisting with the design and evaluation of displays and controls for the Orion spacecraft. Kritina received her Ph.D. in Engineering Psychology from Rice University, focusing on Human-Computer Interaction (HCI). She has been with Lockheed Martin at NASA for over 20 years, and has also worked as the Usability lead for a web-based training company, and a large, international software company. Kritina teaches graduate Human Factors classes at the University of Houston Clear Lake on request.

Session 2C Presentation 2
"OSO In Space Inspection Experience and Needs"
Demo: no
Poster: no
One-on-One Table: Yes

Daniel Perri
MOD Operations Support Officer
NASA/USA—OSO IVA Msn Ops
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281-244-7562

Abstract: The Operations Support Office Console in MCC-H deals with all the IVA On-Orbit Maintenance conducted to keep ISS healthy, and operations of the Common Berthing Mechanism. As a division, DX4 has vast experience with writing procedures to repair ISS components, helping the crew conduct those procedures in real-time, and helping to develop resolutions to all kinds of failures and anomalies on board. Additionally, the OSO console would support the crew in the event of an atmosphere leak, by helping the crew pinpoint the source of the leak, and run the leak patching procedures. In order to do all those things, the OSO console requires quick, reliable access to as much imagery of all the ISS components as they can gather, and the abilities of a well-trained crew to image the vehicle in a variety of ways and provide reliable inspection data. The OSO console would be a beneficiary of in-space inspection and related technologies, as all of these things could potentially make the job of helping the ISS crew maintain an aging vehicle with limited resupply easier and safer. His talk will discuss OSO experiences and lessons learned from an Operations environment, with some suggestions for future needs, as it applies to imagery and inspection techniques for vehicle maintenance used on board.

Background: Daniel Perri is an engineer working in the Mission Operations Directorate (MOD) supporting the EVA, Robotics, and Crew Systems Operations division as a Mechanisms and Maintenance instructor. He joined United Space Alliance in 2007, has been a Mechanisms and Maintenance Training Lead for several Shuttle and Soyuz crews to ISS, and is a certified instructor in the Space Station Training Facility (SSTF), for flight controller training. Additionally, he is the On-Orbit Maintenance Training Flow Lead, which recently involved leading his branch through a lengthy redevelopment process to write and certify all-new lessons, to adapt ISS maintenance training to the changing nature of ISS operations and utilization. He is also a Subject Matter Expert for ISS Leak Repair.

2007; B.S. Aerospace Engineering, Virginia Tech

2007 – Present; United Space Alliance

Session 2C Presentation 3
"Lighting and Robotics Integration"
Demo: No
Poster: No
One-on-One Table: Yes

Michael D. Wright
SPDM Subsystem Manager
NASA/JSC/ER-Engineering Robotics Flt Sys
281-483-4798
michael.d.wright@nasa.gov

Abstract: While imaging is the most prominent aspect of inspection, lighting also plans plays an important role. Without the proper lighting, an imager's performance is not optimized and important details can be lost. These lost details can mean the difference between clearing a vehicle and declaring it unsafe for entry. In this presentation, the impacts of lighting on imaging will be discussed. In addition, some information will be provided on integrating with the ISS robotic systems.

Background: Mr. Wright serves as the Special Purpose Dexterous Manipulator (SPDM) Subsystem Manager (SSM) in Engineering Robotics Flight Systems Branch at NASA's Johnson Space Center (JSC). He provides expertise on the performance capabilities and characteristics of the SPDM hardware and software. He integrates the use of the SPDM with the needs of the ISS Program, payload developers, and other users. Previously, Mr. Wright served as a Space Shuttle Program (SSP) Mission Evaluation Room (MER) Manager in the Orbiter Project Office at JSC. He was responsible for leading, integrating, representing, and directing the Mission Evaluation Team in providing a coordinated position on mission issues and problems related to the Orbiter. Mr. Wright spent his first ten years at JSC as a Flight Controller in the Mission Operations Directorate (MOD) Robotics Operations Group. He was a certified Payload Deployment and Retrieval System (PDRS) Officer supporting Shuttle operations as well as a certified Robotics (ROBO) Officer supporting ISS operations. Mr. Wright obtained a Bachelor of Science Degree in aerospace engineering from Texas A&M University.

2011-Present:	Robotics Flight Systems, Engineering Directorate
2006-2011:	Orbiter Project Office, Space Shuttle Program
1996-2006:	Robotic Operations Group, Mission Operations Directorate
Education:	1994 – BS Aerospace Engineering – Texas A&M University

Session 2C Presentation 4
"The Autonomous Mission Operations Roadmap"
Demo: Yes Poster: Yes
One-on-One Table: Yes

Jeremy Frank
NASA Ames Research Center
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650-60-42524
http://ti.arc.nasa.gov/profile/frank/

Abstract: As light time delays increase, the number of such situations in which crew autonomy is the best way to conduct the mission is expected to increase. However, there are significant open questions regarding which functions to allocate to ground and crew as the time delays increase. In situations where the ideal solution is to allocate responsibility to the crew and the vehicle, a second question arises: should the activity be the responsibility of the crew or an automated vehicle function? More specifically, we must answer the following questions:

What aspects of mission operation responsibilities (Plan, Train, Fly) should be allocated to ground based or vehicle based planning, monitoring, and control in the presence of significant light-time delay between the vehicle and the Earth?

How should the allocated ground based planning, monitoring, and control be distributed across the flight control team and ground system automation?

How should the allocated vehicle based planning, monitoring, and control be distributed between the flight crew and onboard system automation?

When during the mission should responsibility shift from flight control team to crew or from crew to vehicle, and what should the process of shifting responsibility be as the mission progresses?

NASA is developing a **roadmap of capabilities for Autonomous Mission Operations** for human spaceflight. This presentation will describe the current state of development of this roadmap, with specific attention to in-space inspection tasks that crews might perform with minimum assistance from the ground.

Background: Dr. Jeremy Frank is an employee of NASA at NASA Ames Research Center. He works in the Autonomous Systems and Robotics Area of the Intelligent Systems Division. He is Group Lead of the Planning and Scheduling Group, an organization of 30 researchers and staff that designs and builds space mission operations tools. Dr. Frank has an MS and a PhD in Computer Science from the University of California (Davis). He also has a BA in Mathematics from Pomona College.

Dr. Frank's research interests include combinatorial optimization, operations research, artificial intelligence, applied to the automation of space mission operations. Dr. Frank has successfully led and participated in several research and development projects during his 12 years at NASA. Dr. Frank is the Principal Investigator of the Autonomous Mission Operations (AMO) Project, a NASA Advanced Exploration Systems Program project that develops advanced technology prototypes for mission operations in the presence of large time delays. He has received over twenty five NASA awards, including a Silver Snoopy (the Astronaut's Personal Award) and the Exceptional Achievement Medal.

Session 2D, Presentation 1
"Modeling and Simulation for Enabling In-space NDE and Health Monitoring"
One-on-One Table: Yes

Cara Leckey
Co-authors: Erick Burke, Elliott Cramer
NASA/Langley NDE Sciences
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757-864-8622

Abstract: Nondestructive evaluation modeling and simulation tools can aid in the development and optimization of in-space inspection techniques. Realistic simulation tools are needed to establish confidence in inspection of hard-to-reach locations, complex structures, one-off parts, etc. Additionally, such tools can help to establish inspectability during the design stage to allow more lead time for developing custom NDE solutions. Simulation tools are also necessary to validate the performance of in-situ autonomous monitoring systems. Once validated, such systems could be used to trigger inspection, reduce time to locate critical damage, and enable informed decision making (such as repair). However, the current state-of-the-art in NDE/SHM simulation is still far from the goal of simulating inspection techniques for large scale components/vehicles with realistic damage types (especially for composites). This talk discusses NASA's need for NDE simulation tools, with a focus on in-space inspection, and gives examples of ongoing work in the Nondestructive Evaluation Sciences Branch.

Background: Dr. Cara A.C. Leckey has been a research physicist in NASA Langley's Nondestructive Evaluation Sciences Branch since 2010. Her work in NESB is focused on computational methods in NDE and SHM, with a current concentration on ultrasonic wave modeling for composites. Dr. Leckey has published 25+ journal articles and conference proceedings in the areas of mathematical modeling and computational NDE/SHM. She is a member of the editorial board for the international journal *Case Studies in Nondestructive Testing and Evaluation* and serves on the QNDE Conference Scientific Advisory Committee and the organizing committee for the International Symposium on Nondestructive Characterization of Materials. Dr. Leckey also serves as a technical monitor for NASA NRA and SBIR grants, and as the NDE lead on NASA LaRC's "Center Digital Transformation Roadmap" team.

B.S. in Physics ('06)
University of Mary Washington

M.S. ('08) and Ph.D. ('11) in Physics
College of William and Mary.

Session 2D, Presentation 2
"Computational Vision Technology & TAMU's LASR Lab"
als State Awareness Branch
Demo: No
Poster: No
One-on-One Table: Yes

James D. Turner
Research Professor Aerospace Eng. Materi-
Texas A&M University
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Abstract: This paper describes a unique research facility at Texas A&M University, the Land, Air, and Space Robotics (LASR) laboratory. LASR provides a capability for high fidelity six degree of freedom relative motion of multiple controlled or uncontrolled platforms. LASR is a testbed intended for experimental research in sensing and control whereby selected sub-systems hardware and software-in-the-loop can be tested in a high-fidelity way, driven by our best simulation of (say) on-orbit dynamics and control systems for a full-up spacecraft, but with selective elements in the simulation replaced by actual hardware and data from live sensing. A main focus is upon sensing systems and the associated algorithms for extracting real-time information for use in real-time control. In parallel with its advanced robotics research, LASR has developed a suite of high-fidelity, real-time sensing and computational vision processes that allow point cloud reconstruction and proximity navigation relative to previously unknown objects. This methodology has obvious relevance to enable precision proximity motions and manipulation while avoiding collisions with the as-measured structures. This information is useful to provide real-time operator cues and software control logic for robustness of telerobotic operations.

Background: James D. Turner currently holds the rank of Research Professor in the Department of Aerospace Engineering at Texas A&M University. He has served as the Director of Operations for the Consortium for Autonomous Space Systems (CASS) and the Co-Founder and Director of Marketing and Research for the Land, Air, and Space Robotics Laboratory (LASR). He worked in industry for 20+years at several places, including Draper Labs, Cambridge Research Division of Photon Research Associates, Moldyn, Star Vision Technologies, Dynacs Military and Defense, Inc. He worked five years as the Director for Virtual Proving Grounds at the National Advanced Driving Simulator at the University of Iowa. Eight years ago he joined Texas A&M University to return to research and teaching. He is a Fellow of the AAS, Associate Fellow of AIAA, and has published more than 170 research papers in peer-review archival journals and conference proceedings and one research monograph.

2006-Present:	Texas A&M University, Aerospace Engineering
2003-2006:	Dynacs Military and Defense
1996-2003:	University of Iowa, National Advanced Driving Simulator
Education:	1980 – PhD, Engineering Science and Mechanics, Virginia Tech
	1976 – ME, Engineering Physics, University of Virginia

Session 2D Presentation 3/4
"Space Based Sensor Enhancement by Signal Processing"
Demo: No Poster: No
One-on-One Table: Yes

Bob Nellums
Nellums Engineering
nellums@comcast.net

Abstract: This presentation will provide an introductory overview of existing and potential software tools to enhance imagery products in space applications. Objectives include extending resolution and dynamic range, identifying features of interest, and measuring surface contour and motion. Emphasis will be placed on examples involving survey, focused inspection, and vibrometry of video downlinked from space.

Background: Mr. Nellums is retired from an engineering career at Sandia National Laboratories, including acting as chief engineer in developing and applying the Laser Dynamic Range Imager. This system is a video camera and illuminator with 3D capability, compatible with the Orbiter's standard camera interface. Close collaboration between Sandia and NASA resulted in rapid development and Crit-1R qualification of the space-based sensor and the associated real-time video processing system located in Mission Control Center. The sensor first flew on STS97, and became the primary sensor for the wing leading edge inspections mandated for missions STS114 through STS135. Mr. Nellums is currently active in software enhancement of X-ray and borescope imagery.

1970-1975: B.S. Electrical Engineering, M.S. Mechanical Engineering, Rice University

1975-1976: Texas Instruments

1976-1978: M.B.A., Harvard Business School

1978-2011: Sandia National Laboratories

2012-Present: Independent Contractor

Day 2 Lunch Speaker
"Robonaut Activities on ISS"
Demo: No Poster: No
One-on-One Table: No

Myron (Ron) A. Diftler
NASA/JSC/ER Space Robotics Div.
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281-483-0931

Abstract: Robonaut 2 (R2) has completed its fixed base activities on-board the ISS and is scheduled to receive its climbing legs in early 2014. In its continuing line of firsts, the R2 torso finished up its on-orbit activities on its stanchion with the manipulation of space blanket materials and performed multiple tasks under tele-operation control by IVA astronauts. The successful completion of these two IVA experiments is a key step in Robonaut's progression towards an EVA capability. Integration with the legs and climbing inside the ISS will provide another important part of the experience that R2 will need prior to performing tasks on the outside of ISS. In support of these on-orbit activities, R2 has been traversing across handrails in simulated zero-g environments and working with EVA tools and equipment on the ground to determine manipulation strategies for an EVA Robonaut.

Background: Dr. Diftler serves as the Robonaut Project Leader at the NASA Johnson Space Center. Robonaut is a human scale space robotic system designed to assist astronauts, before, during and after space walks. The Robonaut Team's latest robot, Robonaut 2 (R2) is the culmination of 15 years of NASA Robonaut development and a highly successful partnership with General Motors. One of the R2 units was launched on Space Shuttle Discovery in February, 2011 and is currently undergoing testing onboard the International Space Station.

1979-1983: B.S.E. Mechanical and Aerospace Engineering, Princeton University

1985-1988: M.S. Electrical Engineering, Yale University

1993-1998: Ph.D. Mechanical Engineering, Rice University

2004-Present: NASA Johnson Space Center

Session 3A Presentation 1
"NDT Challenges for the Oil & Gas Industry"
Demo: No Poster: No
One-on-One Table: Yes

Jon Rogers
BP Chief Technology Office
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832-620-3100

Abstract: Pressurized vessels used to process oil and gas fluids are required to undergo periodic, statutory inspections to confirm their integrity and ensure their continued safe and reliable operation. Traditionally inspection of these vessels, typically located on the decks of offshore oil platforms, has been achieved by means of internal visual inspections (IVI) which requires man access to the vessel. There can be significant safety advantages if the data required to confirm integrity and ensure continued safe and reliable operation could be obtained from the vessel while it is in normal operation i.e. via non-intrusive sensing/monitoring or non-intrusive inspection (NII), thereby minimizing the need to shut down operations and manually enter vessels.

Techniques for the non-intrusive inspection (NII) of process equipment are becoming increasingly sophisticated, more widely available and confidence in the approach is growing. Industry Recommended Practices have recently been developed, however there are still some degradation mechanisms and / or locations where the industry considers NII cannot currently provide the quality of inspection data obtained via traditional offline, intrusive inspections, e.g. the detection and quantification of fatigue cracking at major internal welded attachments, and defects such as corrosion pits and cracks in vessel shell walls fabricated from carbon steel with integrally bonded corrosion resistant clad layers such as 316 stainless steel.

Background: Jon Rogers is a Technology Director with BP's Chief Technology Office, specializing in upstream oil and gas related technologies including flow assurance, corrosion mitigation and non-destructive testing (NDT). Jon joined BP in 2007 initially serving as Integrity Manager for BP's offshore Gulf of Mexico operations.

In 2011 Jon was appointed Director of BP's Upstream Technology Flagship "Inherently Reliable Facilities" with a focus on Chemistry, Corrosion and Inspection related research and development in conjunction with Academia. Jon joined BP's Chief Technology Office (CTO) in January 2014 and leads multiple CTO efforts to solve major business challenges.

Before joining BP, Jon was Vice President for Champion Technologies, a global chemical and service company supporting the oil and gas industry.

Jon earned a BS in Chemistry from the University of Liverpool, an MBA from the University Of Durham, and holds a post graduate Diploma in Engineering Management from the University of

Session 3A Presentation 2
"Inspection Needs in the Oil and Gas Business"
Demo: No Poster: No
One-on-One Table: Yes

Dr. Sergio Kapusta
Shell International E&P Inc.
Chief Scientist
Sergio.d.kapusta@shell.com

Abstract: Maintaining the integrity of our assets is crucial to assure the safe production, transportation and processing of oil and gas. These assets include oil and gas wells, transportation pipelines, manufacturing and processing facilities, terminals, tankers, etc. The oil and gas industry has overall a very good safety record but recent incidents have highlighted the need to be ever more vigilant of the integrity and safe operation of our assets. Remote monitoring of the condition of the assets is an important component of an asset integrity program, together with robust work processes and trained and competent people. This presentation focuses on the technology aspects and the needs of the industry.

Background: Dr. Sergio Kapusta is Chief Scientist for Materials for the Royal Dutch Shell Group. He is concurrently Manager of the Physics and Materials R&D group in Shell. He is interested in the application of advanced materials, nanotechnology, and novel sensing techniques to improve the operations and safety of oil and gas production facilities.

1983-Present: Shell
1980-1983 Rice University

Education: 1979 – PhD Chemical Engineering Rice University
2006 – MBA Rice University

Session 3A Presentation 3
"Advanced Instrumentation and Inspection for Deepwater Oil and Gas Fields"
Demo: No Poster: No
One-on-One Table: Yes

David Brower
Astro Technology Inc.
President
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281-464-0100

Abstract: Deepwater oil and gas fields pose many technology challenges related to structural integrity, flow assurance, and downhole monitoring. Clear Gulf is an ongoing collaboration between Oil & Gas companies, Astro Technology and NASA to advance deepwater monitoring methods. Recent advancements have been developed in deepwater fields at depths of 7,500 feet and pipeline lengths of up to 60 miles. These measurement system are in real time and include temperature, pressure, stress, strain, vibration, and fatigue. The measurements include local and distributed methods where the entire flow line and riser can be fully characterized in harsh environments, high pressures, temperatures, deep water depths and extreme stress loading. The key objective of Clear Gulf is to prevent anomalous events that lead to failure or hydrocarbon spillage from occurring rather than reacting afterword. Additionally, Astro Technology engineers have devised and implemented measurement methods for high temperature and pressure on the interior of solid rocket motors. In this case the sensors were exposed to a flame temperature of several thousand degrees Centigrade during the operation of subscale and a full scale rocket motor firings.

Background: David Brower founded Astro Technology, a high technology firm specializing in new innovative sensor application methods and high-end data acquisition systems. Directed technical efforts to develop and commercialize new fiber-optic sensor systems used for deepwater oil production equipment, liquefied natural gas pipelines, solid rocket motors, and civil engineering structures. Developed a complete advanced structural monitoring system with fiber optic sensors in deepwater fields of the Gulf of Mexico and West Africa. Developed advanced flow assurance monitoring methods on 60 mile long Subsea flowline. Led hazards analysis work for the elimination of weapons of mass destruction in Russia in support of strategic arms limitation treaties between the U.S. and Former Soviet Union. Formed Clear Gulf Joint Industry Project as a collaboration between NASA and oil and gas companies. This effort has contributed to making deepwater oil production safer and environmentally responsible. The JIP has formed a synergistic relationship between two industries where both parties are benefiting greatly.

B.S., Material Science & Engineering
University of Utah

Graduate Program, Mechanical Engineering leading to Master of Science
University of Utah

Session 3A-4, Presentation 1
"Inspection Needs Supporting Increased Well Integrity"
Demo: No
Poster: No
One-on-One Table: Yes

Robello Samuel
Halliburton Technology Fellow
Landmark/Sperry Drilling Services
(713) 839-2997
robello.samuel@halliburton.com

Abstract: Maintaining well integrity and preventing loss of containment throughout the life of an oil well is of prime importance. Traditionally, oil well reliability analysis is performed on a system design to estimate a reliability number with a given confidence level. The calculation defines total system reliability as the probability of barrier success, or 1- the probability of barrier failure. However, this definition does not account for the changes in the barriers' effectiveness with time. Although such changes are accounted for in engineering calculations (i.e., design loads), conventional reliability calculations do not reflect the engineering assumptions and calculations in barrier design. Also the reliability calculations do not take into consideration of different operations and the stresses they impose on the barriers that may speed the time-to-failure of the barrier. In order to have an effective and reliable system throughout the life of the well, a dynamic reliability analysis needs to be performed to account for multiple states through continuous monitoring and inspection of multiple states including the downhole drilling operations. Due to difficulty in performing dynamic in-earth inspection, the engineering calculations have to be modified through adaptive analytics. The in-earth adaptive analytics based coupled inspection-reliability model incorporates design calculations, any reduction in strength foreseen, and induced loads due to various downhole operations.

Background: Robello Samuel has been a Halliburton Technology Fellow (Drilling Engineering) and working with Halliburton since 1998. He is currently a research and engineering lead for well engineering applications and responsible for research and scientific activities for new drilling technologies. In his present role he also conceives and develops creative/innovative technology drilling solutions critical to the company's success. He has more than 30 years of multi-disciplinary experience in domestic and international oil/gas drilling and completion operations, management, consulting, software development and teaching. His areas of research include: wellbore hydraulics, wellbore and drillstring mechanics and on-shore and off-shore well engineering. He has been an educator and an adjunct Professor at the University of Houston and Texas Tech University, Lubbock for the past 12 years teaching Drilling and Well Completions courses. He has published more than 120 technical papers, reports. He is presently serving in several Editorial Review Committees. His unique blend of skills as a field engineer, researcher and teacher helped him to author seven drilling books and a forthcoming book "*Drilling Engineering Optimization*". He started his career working on rigs as a drilling engineer. He has also worked at Oil and Natural Gas Corporation from 1983 to 1992 as a field drilling engineer. He holds BS and MS degrees in mechanical engineering, as well as MS and PhD degrees in petroleum engineering.

Session 3B Presentation 1
"Overview of USAF NDE R&D Activities"
Demo: No
Poster: No
One-on-One Table: Yes

Stephan M. Russ
Chief, Materials State Awareness Branch
Air Force Research Laboratory
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937-255-9803

Abstract: the USAF Aircraft and Propulsion Structural Integrity Programs (ASIP and PSIP) establish requirements and processes to ensure safety of flight. They are unique in that the preferred option is a 'damage tolerance' approach to life management of key structures / components, relying on predicting and detecting damage (e.g. fatigue cracks). Nondestructive inspection (NDI) is used every day during field- and depot-level maintenance as critical components of ASIP and PSIP and is often the first choice to mitigate risk. As USAF weapon systems age there has been an ensuing increase in both the number and frequency of inspections. Hence, better NDI capability, reliability, and efficiency are needed to reduce the maintenance burden and enhance availability of USAF aircraft. Near-term R&D emphasis areas addressing these will be discussed. In the longer term there is a desire to move away from time-based toward condition-based maintenance. This requires increased fidelity in NDE/I data and analytics such that material and damage state can be assessed sufficiently. NDE research topics/emphasis will be briefly discussed that enable characterization of both material and damage state.

Background: Stephan Russ has been Chief of the Nondestructive Evaluation Branch, Materials and Manufacturing Directorate of the Air Force Research Laboratory since March 2010. In this role he is responsible for the supervision of the government workforce, the strategic direction of the branch, and execution of all resources. Prior to this assignment he was the AFRL Liaison to the AF Fleet Viability Board where his primary contribution was assessing the viability of the airframe structures of both the E-8C and T-38. He has degrees in Mechanical Engineering from the University of Dayton and a PhD in Materials Science and Engineering from the Georgia Institute of Technology. His formative years were spent as a member of the Metals Branch, where he started in the Mechanical Behavior and Life Prediction Group and departed as Chief of Metals Development Section. His technical background is in fatigue, fatigue crack growth, and life prediction of turbine engine materials, and his PhD research was in load-interaction effects on Ti-17. He was instrumental in the formulation and initiation of both the Engine Rotor Life Extension (ERLE) program in the late 1990's and the DARPA Engine System Prognosis (ESP) program in the 2000-2005 timeframe. Both of these programs focused on defining, developing, and implementing S&T to impact sustainment of turbine engines.

2010-Present:	AFRL/RXCA, Materials State Awareness Branch
2008-2010:	Air Force Fleet Viability Board
1985-2008:	AFRL/RXLM, Metals Branch

Education:	2003 – PhD, Materials Science & Engineering, Georgia Tech
	2002 - MS and BS, Computer Science, University of South Florida
	1991 – MS, Mechanical Engineering, University of Dayton
	1987 – MS, Mechanical Engineering, University of Dayton

Session 3B Presentation 2 (Remote)
"Alamo Ballroom"
Demo: No Poster: No
One-on-One Table: No

Timothy A. Floyd, P.E.
AFLCMC/WLNEB
C-130 MECSIP
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478-327-9028

Abstract: The Air Force Life Cycle Management Center / C-130 Hercules Division (AFLCMC/WLN) is responsible for the acquisition, deployment, and sustainment of combat ready systems across the C-130 enterprise. In addition to the large USAF fleet, this office assists a multitude of Foreign Militaries with fleet modernization and logistics support.

Within the C-130 Hercules Division, the Engineering Branch not only executes airworthiness authority over C-130H, LC-130H, and WC-130H aircraft, it maintains an Integrity Engineering Element with responsibility for Structural, Mechanical, and Avionics System Health. An integral part of this activity is implementing Reliability Centered Maintenance (RCM) through Condition Based Maintenance – Plus (CBM+) methodology. However, this can be extremely challenging for an aging aircraft fleet such as the C-130H which does not have the multitude of Health Usage and Monitoring Sensors available on newer aircraft. Leveraging Non-Destructive Inspection (NDI) along with maintenance data analysis and individual aircraft usage tracking is a key strategy to attain the data fusion necessary to paint an accurate picture of the current state of any single tail. This presentation details how WLN is implementing the CSAF's vision for CBM+.

Background: Timothy is currently serving as the C-130 Mechanical Equipment and Subsystems Integrity Program System Engineer for the C-130 Hercules Division of the Air Mobility Directorate of Air Force Life Cycle Management Center.

Before joining Civil Service in 2001, he was part of the GV Type Certification Team at Gulfstream Aerospace in Savannah, GA. Since coming to Robins AFB, Tim has also worked on Aircraft Guns as the lead system engineer, C-130J aircraft as the Propulsion Subject Matter Expert, on the U-2 as the Aircraft Structural Integrity Program engineer and interim Chief Engineer.

1991: Bachelor of Mechanical Engineering, Georgia Institute of Technology

2005: M.S. Engineering (ME), Mercer University

Session 3B Presentation 3 (Remote)
"NAVAIR NDI"
Demo: No Poster: No
One-on-One Table: No
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Abstract: NAVAIR's mission is to provide full life-cycle support of naval aviation aircraft, weapons and systems operated by Sailors and Marines. This support includes research, design, development and systems engineering; acquisition; test and evaluation; training facilities and equipment; repair and modification; and in-service engineering and logistics support. NAVAIR Focus Areas: (1) Increase Speed to the Fleet through program of record planning and execution, and rapid response to urgent warfighter needs; (2) Consistently Deliver Integrated & Interoperable Warfighting Capabilities (platforms, sensors and weapons operating seamlessly in a systems of systems environment) that produce an immediate and sustainable increase in warfighting effectiveness; and (3) Improve Affordability by reducing operating and sustainment costs for fielded systems and implementing life-cycle cost reduction initiatives as part of new systems development.

Background: Mr. Nathan Trepal is a senior materials engineer in the Non-Destructive Inspection & Testing (NDI/T) Branch of the Materials Engineering Division at NAVAIR's Fleet Readiness Center Southwest (FRCSW). He has over 12 years of experience with the U.S. Navy, having started his career in the Metallurgy and Failure Analysis Branch at NAVAIR's Fleet Readiness Center Southeast (FRCSE), in Jacksonville, FL. He later focused on RDT&E of naval ships, working in the Welding & NDE Branch of the Naval Surface Warfare Center Carderock, before coming back to naval aviation at the FRCSW, working in welding and NDI.

1997-2002: B.S. Materials Science & Engineering, Georgia Institute of Technology

2002-2005: U.S. Navy, Fleet Readiness Center Southeast

2005-2011: U.S. Navy, Naval Surface Warfare Center Carderock

2011-Present: U.S. Navy, Fleet Readiness Center Southwest

Session 3B Presentation 4
"Navy NDT&E Needs"
Demo: No Poster: No
One-on-One Table: Yes
www.navy.mil

Patric Lockhart
NAVSEA
Adv. NDT&E Inspect. Meth.
patric.lockhart@navy.mil
401-832-4462

Abstract: The Department of the Navy (DoN) is the largest branch of the Department of Defense (DoD), and a significant part of the DoN budget is maintenance costs. Efforts to streamline, improve efficiency, and reduce costs are imperative at all times. A way to reduce maintenance costs is through nondestructive test and evaluation (NDT&E) alternatives to existing destructive inspection techniques. Existing NDT&E applications can be made more efficient through adoption of advanced NDT&E techniques which improve detection capability, speed of inspection, or NDT&E system longevity. Maintenance activities can be streamlined by utilizing fewer NDT&E systems with greater capability to accomplish the same maintenance tasks of existing inspection methods. This talk will outline a non-exhaustive list of existing DoN NDT&E needs for a variety of naval applications and discuss some of the design challenges when developing maritime equipment and some potential DON technologies of interest. Follow-up discussions of potential solutions are welcome.

Background: Dr. Patric Lockhart is a Lead Engineer for Advanced NDT&E Inspection Methods under the NDT&E Tech Warrant Holder (SEA05P2) and a subject matter expert (SME) on Terahertz (THz) technologies. Dr. Lockhart has been the PI or mentor on numerous NDT&E internal investment projects and the lead researcher on several externally funded projects. His research and efforts at NUWC-NPT have led to acquisition of an in-house THz imaging system & flash IR Thermography system, and he is the TPOC for an SBIR focused on VA-class THz NDT&E hull inspections. Dr. Lockhart also enjoys giving back to the community as the head coordinator for the NUWC New Professional Brown Bag Lunch series and mentoring for the SEAP program and at the University of Rhode Island.

1995-2004: B.S. & M.S. Electrical Engineering USF

2004-2008: Ph.D. & PostDoc Electrical Engineering RPI

2009-Present: Naval Undersea Warfare Center, Division Newport

Session 3C, Presentation 1
"Contamination Control and Possible Use of NDE"
Demo: No Poster: No
One-on-One Table: No
www.ksc.nasa.gov

Miles Skow
NASA KSC
M&P Engineering
miles.skow-1@nasa.gov
321-867-2857

Abstract: Instrumentation and payloads in the space industry are contamination sensitive for both external and internal surfaces and often require surface cleanliness verification prior to closeout. Visual inspections are a typical method to verify and accept the cleanliness levels on external surface areas. These types of inspections can only be performed on surfaces that can be made directly visible to the inspector. Good practices, environmental control, and representative samples can help ensure the understanding of the cleanliness levels of surfaces that are currently not accessible. There is a desire to increase the methods to verify the cleanliness of difficult to access surfaces by inspection. From experience with spacecraft ground processing contamination inspections at Kennedy Space Center (KSC), the author will explore the need and NDE capabilities and methods which can address this need.

Background: Mr. Miles Skow is the primary KSC Materials and Processes (M&P) engineer for the International Space Station (ISS) as well as the NASA KSC contamination control engineer for Orion. He supports a project developing NDE technology to monitor the characteristics of composite panels and the health of Composite Overwrapped Pressure Vessels (COPV's). He joined NASA in 2008 and has been able to support as M&P engineering for 10 shuttle missions, several Expendable Launch Vehicle (ELV) missions, and the upcoming Orion Exploration Flight Test (EFT-1) mission.

2001-2008: Mity Lite Inc. Product Development

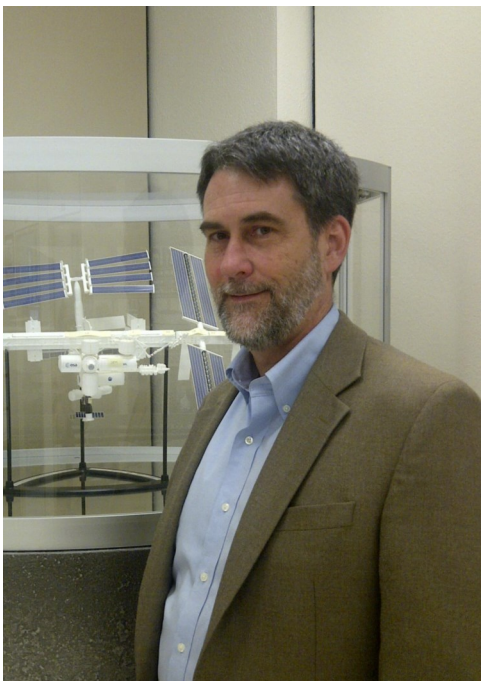
2008-2013: B.S. Mechanical Engineering UofU

2008-2013: NASA Student Co-op Program (M&P Engineering)

2013-Present: NASA KSC M&P Engineering

Session 3C, Presentation 2
"Possible Avionics Inspection Needs"
Demo: No
Poster: No
One-on-One Table: Yes

Montgomery B. Goforth
Strategic Planning & Partnerships
Avionic Systems Division, NASA JSC/EV
Montgomery.b.goforth@nasa.gov
(281) 244-1117



Abstract: The Avionic Systems Division at NASA's Johnson Space Center is looking for innovative ways to inspect avionics equipment while in space during long duration exploration missions. These inspections might take place in situ or in a zero-g workbench within the habitable volume. Inspection techniques should complement diagnostic capabilities, not duplicate them. Connectors, card seating, and solder joints are all possible targets – but other opportunities exist. We are interested in techniques that look at both surface and sub-surface in various spectra. We are also willing to consider methods of inspection other than imaging.

Background: Mr. Goforth has more than 25 years of experience as both Engineer and Manager in a variety of highly technical space and defense-related efforts. He joined NASA in 1990 as part of the Mission Operations Directorate, working on planning systems and automated procedure execution tools for the International Space Station (ISS). He became Deputy Project Manager for the Portable Computer System, the laptop used for command and control of the ISS, in 1996, and ultimately became Chief of the Branch responsible for all laptops onboard ISS and the Space Shuttle. In 2002 he moved to the ISS Avionics and Software Office as Manager of the Flight Software Development Office and later served as Chief Engineer.

During 2005 he spent several months at NASA Headquarters working in the Robotics Lunar Exploration Program. In 2006 he joined the Constellation Program as Chief of Avionics and Software Test and Verification and became Chief of the Software and Avionics Integration Office in 2007. In this role he was responsible for leading a large nation-wide Systems Engineering & Integration (SE&I) organization which provided program-level coordination, oversight, integration and management of the system-of-systems avionics and software, including the coordination of integrated modeling and simulation and test activities across the Constellation program and the technical integration of Constellation's Command, Control, Communications, and Information (C3I) architecture. In 2011, he joined the Avionic Systems Division to support their Strategic Planning and Partnership efforts. He is also currently serving as the Avionic Architect for the Avionics Architectures for Exploration Project.

Education: 1987 – MS, Mechanical Engineering, Rice University
1982 – BS, Mechanical Engineering, Rice University

Session 3C Presentation 3
"Structural Monitoring to Minimize Inspections"
Demo: Yes Poster: No
One-on-One Table: Yes
www.nasa.gov

Michael S Grygier
NASA Johnson Spaceflight Center
ISS Program – Loads & Dynamics
michael.s.grygier@nasa.gov
281-483-6398

Abstract: The ISS structures were certified with a 15-year life. Now that some elements of the ISS have been flying close to that mark, efforts have been spent to show that these structures will last at least through 2020 and beyond. However, this assumes a particular set of loading history and that no damage gets induced to the ISS either through over-loading the structure or through Micro-Meteoroid Orbital Debris (MMOD). The ISS Loads & Dynamics Team has been tracking loading history by using on-orbit data and vehicle telemetry to reconstruct load spectra to use for life assessments. This data has proven invaluable to provide the input to the analysis to prolong the certified life of the ISS structures. Future vehicles should include such systems in their design, and automate some of the processes currently performed on the ground. These systems should also alert the crew of any high dynamic loading as it is occurring to give the crew real-time feedback. Also, there are currently no systems on the ISS that are monitoring for MMOD hits. Such a system could alert the ground of a hit, locate it, and provide a measure of its severity. Such information could then be used to determine if a detailed inspection should be performed. This could minimize the number of generic inspections performed and the scope of an individual inspection. For exploration missions, these systems need to be small, light-weight, and power efficient.

Background: Mr. Michael Grygier has been lead of the ISS Loads & Dynamics Team since 2000. In that capacity he has led the team through numerous loads analyses, reviewed models and their verifications, specified data acquisition systems for flight on the ISS, and led the efforts to validate the assembled ISS dynamic model and the forcing functions used to calculate loads with this model. Before working on the ISS, Mr. Grygier was technical lead for the Shuttle Modal Inspection System, which was used to perform structural inspections of the Space Shuttle Orbiters using modal test methods. He also was Co-Chair of the Shuttle Payload Structures Working Group, where he reviewed the loads analysis process, numerous payload model verifications, and flight data to validate the loads analyses.

Session 3C Presentation 4
"Towards Real-Time and 3D Millimeter Wave Imaging for In-Space Applications"
Demo: No

Dr. Reza Zoughi | M. Tayeb Ghasr
Missouri Univ of Science and Technology
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Reza Zoughi

Tayab Ghasr

Abstract: Millimeter-wave signals span the frequency range of 30 GHz to 300 GHz, corresponding to a wavelength range of 10 mm to 1 mm. Signals at these frequencies can easily penetrate inside dielectric materials and composites and interact with their inner structures. The relatively small wavelengths and wide bandwidths associated with these signals enable the production of high spatial-resolution images of materials and structures. Incorporating imaging techniques such as lens-focused and near-field techniques, synthetic aperture focusing, holographical methods based on robust back-propagation algorithms with more advanced and unique millimeter wave imaging systems have brought upon a flurry of activities in this area and in particular for nondestructive evaluation (NDE) applications. Ultimately, imaging techniques must produce high-resolution 3D images, become real-time, and be implemented using portable systems particularly for in-space applications. To this end and to expedite the imaging process while providing a high-resolution images of a structure, the design of a recently-developed and demonstration 6" by 6" one-shot, rapid and portable imaging system (Microwave Camera) have been expended to accommodate one-sided and mono-static imaging, while enabling real-time 3D image production. This presentation provides an overview of these techniques, along with illustration of several typical examples where these imaging techniques have effectively provided viable solutions to many critical NDE problems.

Background: **Reza Zoughi** is the Schlumberger Distinguished Professor of Electrical and Computer Engineering at Missouri University of Science and Technology (S&T). He has over twenty-five years in R&D of microwave and millimeter wave nondestructive testing and imaging system development. He is the author of a book entitled "*Microwave Nondestructive Testing and Evaluation Principles*", and the co-author of a chapter on Microwave Techniques in an undergraduate introductory textbook entitled "*Nondestructive Evaluation: Theory, Techniques, and Applications*". He was the recipient of the 2007 IEEE Instrumentation and Measurement Society *Distinguished Service Award*, the 2009 American Society for Nondestructive Testing (ASNT) *Research Award for Sustained Excellence,* and the 2011 *IEEE Joseph F. Keithley Award in Instrumentation & Measurement*. He is a *Fellow* of the IEEE and ASNT, and served as the Editor-in-Chief of the *IEEE Transactions on Instrumentation and Measurement* from 2007-2011. Currently, he serves as the President of the IEEE Instrumentation and Measurement Society.

Background: Mohammad **Tayeb Ghasr** is an Assistant Research Professor with the Applied Microwave Nondestructive Testing Laboratory (*amntl*), Electrical and Computer Engineering Department, Missouri University of Science and Technology (Missouri S&T), formerly University of Missouri-Rolla (UMR). He has co-authored over 100 journal papers, conference proceedings and presentations, and technical reports. He has nine awarded and pending patents to his credit. His research interests include microwave and millimeter-wave instrumentation and measurement, RF circuits, antennas, and numerical electromagnetic analysis. His current research is focused on the development of portable and real-time millimeter wave 3D imaging systems (cameras). He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE). He is a recipient of the 2013 I&M Outstanding Young Engineer Award from the IEEE Instrumentation and Measurement Society, and the 2013 H. A. Wheeler Prize Paper Award of the IEEE Antennas and Propagation Society.

Session 4A Presentation 1
"New Developments in Portable Backscatter Scanning"
Demo: Yes
One-on-One Table: No

Seth Van Liew
American Science and Engineering
svanliew@as-e.ocm
978-671-1751

Abstract: X-Ray backscatter is a widely used technology for providing single-sided X-ray imaging of target objects. Because it does not require a film on the opposite side of the target, it is possible to create highly mobile systems that can be rapidly deployed in a wide variety of applications and locations. This talk will discuss three different types of backscatter imaging systems with wide ranging power and energy levels: the Z-Backscatter Van, AS&E's most successful product; the AXISS family, a coming product line of smaller modular backscatter systems with many deployment configurations; and a new portable backscatter prototype which is designed to be transported and used by a single person.

Background: Dr. Seth Van Liew is a research scientist and principle investigator at American Science and Engineering. In the past four years he has been the lead scientist on many internal- and government-funded research programs as well as the scientific lead on new products. These have included various x-ray source and detection technologies in addition to other detection technologies. Prior to AS&E Seth worked in medical physics, where he was most recently faculty at Harvard Medical School.

Session 4A Presentation 2
"Recent Backscatter Xray improvements"
Demo: No Poster: Yes
One-on-One Table: No

Wayne Garber
Nucsafe, Inc.
www.nucsafe.com
wgarber@nucsafe.com
865-220-5050

Abstract: The request from the program chair was what is new in x-ray backscatter. This presentation is focused on the improvements that Nucsafe has made in their x-ray backscatter offerings. Images will be presented that show the improved ability of the systems. The x-ray backscatter offerings have been expanded to 225 kV units from the 160 kV earlier offering. Also a smaller version has been developed at 100 kV. Some images will be repeated from the last workshop.

Background : Dr. Garber currently is serving as the Chief Science Officer with additional duties in project management for several development projects and Radiation Safety Officer. He has over forty years experience in designing, building and marketing radiation instrumentation. This includes managing the ORTEC semiconductor manufacturing group, serving as product manager for an X-ray Residual Stress Analysis system at Technology for Energy Corporation, and program manager for development and marketing of a portable HPGe based source excited florescence analyzer for in-situ gold and uranium assaying. Dr Garber earned his BA in Math and Physics at Southwestern College, Winfield, Kansas and his MS and PhD in Health Physics at the University of Tennessee. Dr Garber holds DOD Secret clearance.

Session 4A Presentation 3
"Recent Progress in 3D Backscatter X-Ray NDE"
Demo: Yes
One-on-One Table: No

Victor Grubsky
Physical Optics Corporation
Director, Adv. X-Ray & Optical Technologies
vgrubsky@poc.com
310-849-6993

Abstract: In this presentation we will describe our recent progress in 3D NDE based on backscatter x-ray Compton Imaging Tomography (CIT). CIT is particularly applicable to non-contact 3D inspection of lightweight aerospace materials, such as thermal protection system (TPS), composites, multilayer aluminum structures, and honeycomb panels. In addition to the traditional benefits of the backscatter x-ray approaches, such as one-sided operation, CIT provides true high resolution 3D tomographic data and allows inspecting deep layers of a structure. To aid in the structure analysis, volume rendering of the scanned structure is also possible. Using NASA SBIR funding, POC is developing a compact, standalone system for in -field NDE that will be demonstrated at the meeting.

B**ackground:** Dr. Victor Grubsky is currently focused on the development of innovative x-ray and optical technologies, including non-destructive inspection and testing (NDI/NDT) systems based on x-ray scattering, terahertz sensors and components, lasers, and optical fiber devices and sensors. Another important area of his interest is the development of advanced image processing techniques, in particular for x-ray image enhancement. Before joining Physical Optics, Dr. Grubsky was involved in the development fiber-optic components and systems for the telecommunications and sensor markets. Dr. Grubsky has co-authored nearly 80 scientific publications and 8 U.S. patents.

2006-Present: Physical Optics Corporation, Sr. Research Scientist/Director
2004-2006 – University of Southern California, Research Associate Professor
1999-2004 – Sabeus Photonics, VP Research & Development

Education:
1999 – PhD Physics, University of Southern California
1995 – MS Physics & Engineering, Moscow Institute of Physics and Technology

Session 4A Presentation 4
"3D Backscatter X-ray"
Demo: No Poster: No
One-on-One Table: No
www.turnerinnovation.com

D. Clark Turner
Turner Innovations
Research & Dev. Labs
cturner@turnerinnovation.com
801-796-2951

Abstract: Utilizing a cone-beam x-ray source and a highly collimated flat panel detector it is possible to collect 2D backscatter images without any motion of the sample or imaging apparatus. Adding motion, one can collect multiple 2D images and perform 3D tomographic reconstructions. Results from a prototype 3D backscatter CT imaging system will be presented for NDT inspection of spray-on foam insulation (SOFI) for voids and delamination. Particular challenges for tomographic reconstruction using backscatter images will be explored. Of particular interest to this Workshop, miniaturization of x-ray components for in-space applications will be discussed. Challenging design issues such as high-voltage stand-off and radiation shielding will be considered. Finally, a roadmap will be proposed to transition this 3D backscatter CT imaging system from gantry-based to handheld configurations.

Background: Dr. Clark Turner is the Founder and CEO of Turner Innovations, an early-stage research and development company focused on x-ray generation and detection, x-ray imaging and associated applications, and radiation shielding materials. Dr. Turner has successfully commercialized a number of innovative x-ray products, including miniature x-ray tubes for use in handheld XRF spectrometers. In his most recent venture, ARIBEX, he developed and commercialized a handheld dental x-ray source for intra-oral radiography. After becoming a leader in the dental radiography space the company was sold in 2012 to Danaher Corp.

1979-1985: B.S. Chemistry, Brigham Young University

1985-1991: Ph.D. Chemistry (Analytical), Brigham Young University

1992-2004: MOXTEK

2004:2013: ARIBEX

2013-Present: Turner Innovations

Session 4A Presentation 5
"Compact Inertial Electrostatic Confinement based multi-radiation source"
Demo: Yes Poster: No
One-on-One Table: No

S. Krupakar Murali
Multiversal Technologies
Radiation Program High-tech Startup
multiversal9@gmail.com
001-91-90473 65548

Abstract: The Multiversal Technologies Inc., Radiation program conceives, develops, builds, integrates, and operates various radiation sources nondestructive material analysis, along with other products. We specialize in space saving multi-radiation sources that produce X-rays, protons, electrons, neutrons, and charged particles. Each of these radiations can be independently controlled for the desired particular application. In the International Space Station it is of paramount importance to save space and weight without compromising the performance. A compact Inertial Electrostatic Confinement device could help a typical scientist perform multiple radiographies (x-ray, neutron), Non destructive testing, and Activation analysis all using a single source. Moreover, since this device produces radiation only when powered, it can be safely shut down when not required and no additional shielding is required. An IEC device is capable of producing upwards of 10^7 n/s using DD fuel and with reverse bias, it would turn into a tunable x-ray machine. While the electrons converge towards a positively biased central grid, they release bremsstrahlung radiation and by varying the voltage applied to the grid and chamber pressure one could vary the energy and intensity of the x-ray source. In short this would act like a compact synchrotron, albeit, a low power – low intensity source that will help advance the space technology. Such a source would help study, develop, analyze and formulate new material compositions in outer space for future applications. In this presentation, the basic principle of operation of an IEC device, and our plans to further miniaturize this device will be introduced.

Background: Dr. S. Krupakar Murali is the CEO and Chief Scientist at the Multiversal Technologies Inc., he leads the R&D team that designs, develops and manufactures multi-radiation sources and nanosatellite propulsion technologies. Beginning in 2011, he has developed Electrothermal and microwave thrusters, was instrumental in the development of compact radiation sources. The Electrothermal thruster is now scheduled to be part of the nanosatellite NIUSAT to be launched in early 2015. We are well positioned to design, develop and deliver compact radiation sources for space applications.

1992-1996: B.Tech. Electronics and Communication Engineering, KL University, India
1997-1998: M.S. Nuclear Engineering, NCSU, USA
1999-2001: M.S. Engineering Physics, UW Madison, USA
2001-2002: M.A. Plasma Physics, UW Madison, USA
1999-2004: PhD, Plasma Physics, UW Madison, USA
2004-2007: Micron Technology, Boise, ID, USA
2007-2009: BTU International, Boston, MA, USA
2009-2011: Lawrenceville Plasma Physics, NJ
2011-Present: Multiversal Technologies Inc.,

Session 4B Presentation 1	**Frank Lafleur**
"Flexible Videoscopes/Borescopes	**Olympus NDT**
- Pushing the Limits of Articulation"	**Product Manager – RVI/HSV Americas**
Demo: Yes	**frank.lafleur@olympusndt.com**
Poster: No	**(713)897-1424**

Abstract: Remote Visual Equipment has grown leaps and bounds, especially in the last 10 years. Olympus has been at the forefront of RVI innovation and continues to seek out and provide cutting edge solutions to the most demanding markets. Find out what technologies Olympus is currently using towards the goal of the 3D videoscope. Based on current and evolving technologies from Taper Flex, pneumatic articulation and micro gravity sensor, Olympus continues to drive innovation forward. What is the next step however? What will bring all these pieces together to provide a functional and repeatable piece of industrial and scientific equipment to answer the call of the 3D Videoscope. What do have to build off of, and who can help us get there.

Background: Mr. Frank Lafleur is the Product Manager for Remote Visual Inspection and High Speed Video equipment at Olympus NDT. With studies in Electro-Mechanical Robotics Engineering, and over 8 years in sales, operations and application support for capital equipment with intelligent control system, he strives to bring the market feedback into product advances. He is part of a team of very experienced professionals that gather information from all over the world, to direct an equally talented team of R&D Engineers to design and introduce the best technology to answer real world applications. Frank is responsible for coordinating the most demanding customer needs into current and future product reality for the Americas. Through his various fields of experience, he is able to grasp a great deal of facets to a customer's requirements, from overall business benefit, to operator ease of use. He is constantly looking for new synergies in Olympus existing products and possible partnerships to aid his long term goal of keeping Olympus NDT at the cutting edge of RVI.

1999-2004 University of Ottawa/Algonquin College of Applied Sciences - Mech Eng. / Electro-Mech Robotics Eng.

2004-2009 Operations and Application Support Specialist – Walter Meier Climate

2009-2011 Operations Manager – PWM Electronic Price Signs

2011-Present Product Manager RVI/HSV Americas – Olympus NDT

Session 4B Presentation 2
"Controllable Snake-like Inspection Robots"
Demo: Yes Poster: No
One-on-One Table: No
www.uniwest.com

Carlos Pairazaman
United Western Technologies
NDT Program
Carlos.Pairazaman@uniwest.com
405-313-9480

Abstract: The United Western Technologies Corp (DBA UniWest) Nondestructive Testing (NDT) program develops, builds, integrates, and implements NDI sensing technologies in aerospace, power generation, nuclear, automotive, and primary metals. We advocate leveraging our vast field implementation experience to generate ROI based innovative solutions. This philosophy allows for the understanding of Life Cycle Cost and implementation issues early in the program. UniWest has participated in Military "Inspection Based Life Management of Fracture Critical components", where highly precised NDT techniques go though reliability testing to generate Probability of Detection (POD) NDT capability numbers, which are used to manage the life of the item. UniWest currently has several NDT programs with the USAF to design, integrate, and deploy NDT solutions for Aircraft Platforms and engines.

Background: Mr. Carlos Pairazaman is a Nondestructive Testing (NDT) Project Manager based at Tinker Air Force base in Oklahoma City, Oklahoma, U.S.A.. He has been active in NDT for the past 32 years. His professional experience includes Research and development of new NDT sensors, new inspection techniques and design and integration of NDI sensors with Robotics and videoscope equipment. Carlos has managed NDT programs worldwide, and specializes on "Inspection Based Life Management and Life extension" military programs.

1976-1980: Non-Destructive Testing Technology, Ridge Water College,
1981 - 1995: General Electric Aviation
1996 – 2008: Wyle Laboratories
2008 to present: UniWest

Session 4B Presentation 3
"Controllable Snake-like Inspection Robots"
Demo: Yes Poster: Yes
One-on-One Table: No
www.aero.org

Adam P. Mallion
OC Robotics
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adam@ocrobotics.com
310-336-5211

Abstract: OC Robotics is a world leader in confined space automation – OC's snake-arm robots are designed specifically for remote handling operations within confined or hazardous spaces. Snake-arm robots excel in their long, slender and flexible design; snake-arm robots effortlessly fit through small openings and around obstacles.

Snake-like inspection tools have been around for many year; videoscopes and borescopes are useful tools for confined space visual inspection. Their weakness is poor controllability and ability to deliver practicable payloads.

Snake-arm robots are actively driven along their length and can be steered into complex shapes to avoid internal obstacles. Snake-arms can be configured to deliver a range of payloads including video cameras, laser scanners and other NDI tools.

This talk presents results from our latest developments, both commercial and developmental, together with recent significant projects.

Background: Mr. Adam Mallion is a senior project manager at OC Robotics. He joined the OC Robotics in 2008 electronic engineer specializing in electromechanical control systems. More recently he has managed a wide range of projects delivering snake-arm robot systems to industries including; aerospace, construction, petrochemical and nuclear.

2004 – 2008: MEng Electronics with Space Science and Technology (University of Bath)

2007: MBDA UK

2008 – Present: OC Robotics

Session 4B Presentation 4
"Controllable Dexterous Video Inspection Device"
Demo: Yes
Poster: No
One-on-One Table: Yes

Mark Baybutt | *Tom Low (Remote)*
SRI International Robotics Program
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mark.baybutt@sri.com | 650-859-2047
tom.low@sri.com | 650-859-2000

Abstract: SRI's Robotics Program invents, applies, and commercializes systems, software, and components that deliver state-of-the-art robotics to government and commercial markets. For more than 40 years, SRI has been at the forefront of robotics R&D, from applied research through the design of advanced prototypes and product development. SRI researchers have a long, rich tradition of pushing the boundaries of robotics. Our heritage includes the foundational intellectual property (IP) used in Shakey the Robot, Intuitive Surgical's da Vinci surgical system, and the enabling patents for electroactive polymer artificial muscle. Our pioneering developments in robotics have evolved into a solid, comprehensive program that spans multiple disciplines and features expertise in artificial intelligence, algorithm development, sensors research, and product development.
Mr. Baybutt will be presenting two talks touching on various technologies from SRI's Robotics Program. The first talk will discuss on a novel approach to dexterous video inspection through application of electroadhesion technology. The second will present Taurus; a compact, dual-arm, telemanipulated robotic system leveraging patented SRI technology that enables the da Vinci surgical system.

Background: Mr. Mark Baybutt is a Senior Research Engineer in the Robotics Program at SRI. He is the lead electrical engineer on many programs, including telemanipulated, humanoid, and medical device systems. His area of expertise is in motion control, sensing, and probabilistic techniques. Prior to his involvement in the Robotics Program, he developed instrumentation and sensing solutions for SRI's FlexTrain system, a platoon to brigade level training system developed for the U.S. Army National Guard.

2002–2007: B.S. Electrical Engineering (Computer Engineering focus)
Rochester Institute of Technology
2008 – 2010: M.S. Electrical Engineering (Probabilistic Robotics focus)
Stanford University

Background: Mr. Thomas Low is the associate director of the medical systems and telerobotics program at SRI International. In this role, he leads a team of engineers and scientists in developing new medical devices, consumer products and technologies for commercial and government clients. Since joining SRI in 1984, Low has led research projects in automation, medical device development, and robotics, including the Extreme Environment Missions deployment of teleoperated robotic systems, drug delivery devices, and blood and plasma processing instruments.

1978 – 1982: B.S. Mechanical Engineering, UC Berkeley
1982 – 1984: M.S. Mechanical Engineering, Stanford University
1984 – Present: SRI International

Session 4B Presentation 5
"Shape Sensing Utilizing c-OFDR"
Demo: Yes
One-on-One Table: No

Alex Tongue
4DSP
alex.tongue@4dsp.com
800-816-1751

Abstract: 4DSP is a provider of high speed digitizers, digital to analogue converters, and FPGA design solutions to companies in the aerospace and defense industries. Through a successful decade-long partnership with an R&D team at the NASA Armstrong Flight Research Center, the company has extended its business into the up and coming field of fiber optic sensing. The collaboration with NASA has yielded the RTS line of fiber optic interrogators. Utilizing interferometric interrogation of small, passive, and extremely lightweight optical sensors and novel demodulation algorithms, this new technology brings to market an unprecedented ability to sense strain, temperature, liquid levels, as well as 2- and 3-D shape.

4DSP's 2- and 3-D shape sensing technology offers a new and unique way to visualize instruments, structures, the human body, pipelines, umbilicals, and much more. Shape sensing is enabled by the RTS instruments' ability to simultaneously interrogate multiple fiber optic cables, each having up to 2000 individual sensors along their length. If three or more of these fibers are brought together and formed into a larger cable, their differential strains indicate the direction and magnitude of the cable's curvature. This information may be used to compute x, y, and z coordinates along the entire length of the cable at very fine spatial increments, allowing one to locate in space any point along the bundle. Applications include visualization of catheters and other minimally invasive instruments in the medical field, borescope tracking and management, and umbilical position sensing for submersible vehicles and instrumentation, just to name a few.

Background: Alex Tongue has been working in 4DSP's FOS R&D department, as well as supporting application development for customers using FOS. He interned with the FOS R&D team at the NASA Armstrong Flight Research Center doing research in FOS application to structural dynamics and composite embedment. He is currently earning his MS and researching FOS application to composite materials.

BS: Aerospace Engineering, University of Texas at Austin, 2007 – 2012

MS: Engineering Mechanics, University of Texas at Austin, 2012 – Present

4DSP: FOS R&D and Applications Engineer, 2012 - Present

Session 4C Presentation 1
"Micro LADAR and Raman Spectral LADAR for Inspection"
Demo: Yes Poster: No
One-on-One Table: No

Bradley Sallee
Systems & Processes Engineering Corp. (SPEC) & TAMU LASR Lab
937-255-9803

Abstract: Systems & Processes Engineering Corp. (SPEC) has developed a family of micro LADARs and a Raman Spectra LADAR which are ideal for cube satellite format inspection of spacecraft. The Raman Spectra LADAR can provide both a 3D image of the surface, but also the chemical content of the surface through the Raman Spectra. This can detect adsorbed chemicals from a leak. Using the Stokes and Anti-Stokes spectra, the temperature of the surface can also be determined. Altogether this gives a 3D profile with a draped chemical content and temperature profile of the surface. SPECs LADARs give high data acquisition rate, up to 12.8Mpps with 3mm range accuracy at long ranges, sensing the first 6 targets in range in each pixel. Closer than 3 meters an alternate waveform can be transmitted, at the cost of scan rate, which as demonstrated range accuracies down to 15microns. LADARs use a high speed, zero angular momentum, scanner with a field of view up to 90 degrees, minimizing the need for gimbals.

Background: Mr. Bradley Sallee is the Vice President of Systems Technology at SPEC, where he has developed numerous sensor systems, including 23 LADAR programs, for the last 11 years. Previously he worked at BAE Systems for 35 years. He was in charge of LADAR and SAL missile systems at BAE Systems where he was awarded four patents in this area. He was also in charge of the RADAR lab in development of stealth materials. His background also included work on ballistic missile and satellite programs where he was awarded 9 patents. He received a BSASE from the University of Texas in 1974.

Session 4C Presentation 2
"Repurposing Game Technology for Real Time, Handheld 3D Data Capture"
Demo: Yes Poster: Yes
One-on-One Table: No

Tom Greaves | Casey Coss
DotProduct LLC | Panoscan Inc.
www.dotproduct3d.com | www.panoscan.com
tom@dotproduct3d.com |ccoss@panoscan.com
281-724-5756 | 818-640-8064

Tom Greaves—DotProduct **Casey Coss—Panoscan**

Abstract: DotProduct has developed handheld 3D imaging technology based on low-cost, off-the-shelf 3D depth sensors and off-the-shelf Android tablets. Real time data quality feedback, on-the-fly registration and the ability to append to previously collected data sets are unique capabilities. DotProduct's soft-ware supports the use of survey control targets as well as scale bars to deliver geo-referenced data sets with better than 5 mm resolution. DotProduct's DPI-7 imager exports color point cloud data to industry standard format including PTS, PTX and PLY. The company's lossless compression technology yields 50-fold improvement in data file reduction for which read/write DLLs are available. The talk will introduce the technology and discuss applications for capturing as-built, as-constructed and as-maintained data for engineering, construction, fabrication and asset management applications.

Background: Mr. Tom Greaves is vice president of marketing and sales at DotProduct. Funded by Intel Capital and others, DotProduct is a startup headquartered in Houston with development offices in Wiesbaden. Greaves is the founder of the SPAR conferences on 3D imaging. Previously he served as a wireline engineer for Schlumberger in Abu Dhabi, Kuwait and Oman.

1978-1982: B.Sc. Physics, Queens University at Kingston, Ontario, Canada

1986-1987: M.Sc. Physics, University of British Columbia, Vancouver, BC, Canada

1989-1990: S.M. Sloan School, Massachusetts Institute of Technology, Cambridge, MA

Background: Casey Coss is Chief Financial Officer and one of four founders of Panoscan Inc., a technology integrator. Casey is part of a team that developed and markets the Panoscan MK series of high resolution panoramic cameras over the last fifteen years. And has most recently introduced a handheld 3D scanner, the PointGun, as a collaborative integration of Panoscan's hardware design and DotProduct's software technology. Casey is a serial entrepreneur who started three mail sorting services located in California and Texas in 1981 and sold those businesses to Bell & Howell in 1989.

Session 4C Presentation 3
"Short Range Full-field Non-Contact Structured Blue Light 3D Scanning and Photogrammetry for Rapid and Accurate Inspection Analysis"
Demo Table: Yes Poster: Yes

Steve DeRemer
Capture 3D, Inc.
steve.deremer@capture3d.com
www.capture3d.com
281-788-4402

Abstract: Optical non-contact fringe projection 3D metrology systems have become firmly established alongside tactile measuring machines as industrial measuring technology for complete, full-surface measurement of component geometry. Optical 3D structured light systems acquire the entire component geometry in a dense point cloud instead of only measuring individual points. The measured data obtained can be used in areas as inspection, reverse engineering, in pattern, tool and mold making, in engineering and machining (CAD/CAM), during first article inspection, in production related quality assurance (CAQ) and in process control (PCS). Capture 3D, headquartered in Costa Mesa, California was founded in 1997 as the North American partner for GOM Optical Measuring Systems in Germany. Capture 3D has offices throughout the United States including an Automated Metrology Solutions Center in Farmington Hills, Michigan. This talk will cover various aerospace applications, and how companies are replacing their traditional contact measurement equipment or adding additional measurement capacity with non-contact structured light metrology to have a better understanding of their manufacturing and production processes. Being able to shorten measurement setup and data collection time allows companies to focus on true process optimization. By having high quality color map inspection data on their part, mold, tool, and/or die allows companies to quickly apply the optimal corrective action and accurately predict trends to help speed up time to market, eliminate iterations and save an enormous amount of costs that were once being spent on rework and waste. Capture 3D and GOM are in a time of next generation metrology technologies, commercial off the shelf (COTS) automation, and customized automated solutions. ATOS non-contact structured blue light 3D scanners can not only accurately scan and inspect various sized parts and components, but optically track for part positioning, incorporate touch probe contact measurements, "back project" onto the part features for machining or welding, and incorporate static and dynamic deformation analysis. Our ScanBox, MCXL and customized automation solutions completely automate the 3D scanning, inspection, and reporting routine. The VMR (Virtual Measuring Room) module allows for automatic sensor positioning for quick and easy offline and online programming for increased throughput, productivity, and repeatability. Automated solutions can also be integrated with a touchscreen Kiosk interface, bar code, and RFID readers.

Background: Mr. Steve DeRemer is a Technical Application Specialist at Capture 3D, a leader in innovative non-contact metrology solutions for 3D scanning, inspection, and reverse engineering applications. During his eighteen year career in the metrology field, he has utilized many different types of scanning and measurement technologies. In 2010, Mr. DeRemer joined the Capture 3D team, where he is tasked with helping companies optimize manufacturing processes with metrology, identify unique applications, and collaborate with companies on process improvement techniques.

1992-1966: BS Computer Aided Design - Eastern Michigan University

2002-2005: Masters of Business Administration - Walsh College of Accountancy and Business

2010 – Current: Capture 3D, Inc.

Session 4C Presentation 4
"Computational Vision Technology & TAMU's LASR Lab"
Demo: No
Poster: No
One-on-One Table: Yes

James D. Turner
Aerospace Eng. Materials Awareness Branch
Texas A&M University
jdturner@tamu.edu
(979) 458-1429

Abstract: This paper describes a unique research facility at Texas A&M University, the Land, Air, and Space Robotics (LASR) laboratory. LASR provides a capability for high fidelity six degree of freedom relative motion of multiple controlled or uncontrolled platforms. LASR is a testbed intended for experimental research in sensing and control whereby selected sub-systems hardware and software-in-the-loop can be tested in a high-fidelity way, driven by our best simulation of (say) on-orbit dynamics and control systems for a full-up spacecraft, but with selective elements in the simulation replaced by actual hardware and data from live sensing. A main focus is upon sensing systems and the associated algorithms for extracting real-time information for use in real-time control. In parallel with its advanced robotics research, LASR has developed a suite of high-fidelity, real-time sensing and computational vision processes that allow point cloud reconstruction and proximity navigation relative to previously unknown objects. This methodology has obvious relevance to enable precision proximity motions and manipulation while avoiding collisions with the as-measured structures. This information is useful to provide real-time operator cues and software control logic for robustness of telerobotic operations.

Background: James D. Turner currently holds the rank of Research Professor in the Department of Aerospace Engineering at Texas A&M University. He has served as the Director of Operations for the Consortium for Autonomous Space Systems (CASS) and the Co-Founder and Director of Marketing and Research for the Land, Air, and Space Robotics Laboratory (LASR). He worked in industry for 20+years at several places, including Draper Labs, Cambridge Research Division of Photon Research Associates, Moldyn, Star Vision Technologies, Dynacs Military and Defense, Inc. He worked five years as the Director for Virtual Proving Grounds at the National Advanced Driving Simulator at the University of Iowa. Eight years ago he joined Texas A&M University to return to research and teaching. He is a Fellow of the AAS, Associate Fellow of AIAA, and has published more than 170 research papers in peer-review archival journals and conference proceedings and one research monograph.

2006-Present:	Texas A&M University, Aerospace Engineering
2003-2006:	Dynacs Military and Defense
1996-2003:	University of Iowa, National Advanced Driving Simulator
Education:	1980 – PhD, Engineering Science and Mechanics, Virginia Tech
	1976 – ME, Engineering Physics, University of Virginia

Session 4C Presentation 5
"Hyper-spectral Imaging for Detecting and Locating Gas Leaks"
Demo: Yes

Nathan Hagen | Robert Kester
Senior Imaging Scientist |CTO
Rebellion Photonics
http://rebellionphotonics.com nhagen@rebellionphotonics.com | robert@rebellionphotonics.com
713-218-0101 | 281-513-4551

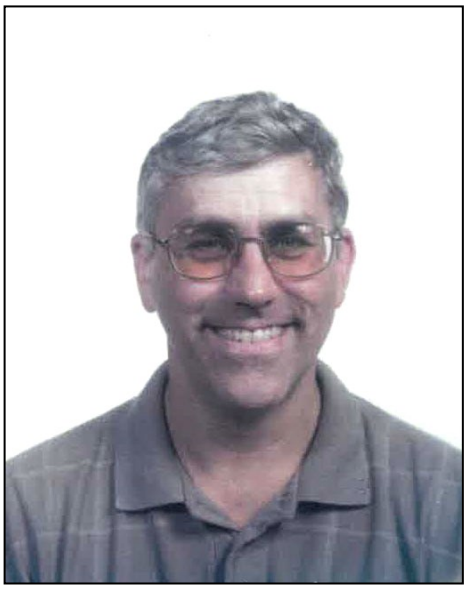
Abstract: Rebellion Photonics' Gas Cloud Imager (GCI) provides video-rate monitoring and quantification of explosive/harmful gas leaks. The GCI system can be used to notify of potentially dangerous leaks and aid in safety management. When not detected early, leaks can accumulate into dangerous clouds that can ignite when they reach a certain concentration (LEL). Current leak detection methods focus on installing point detectors at various locations throughout a facility, to measure pressure or a particular chemical concentration. However, because of their sparse sampling, point detectors provide unreliable and often ineffectual information, despite their high sensitivity. Such sparse sampling cannot provide an accurate picture of the chemical environment within the plant or rig. We present an overview of the GCI system and examples of real-world measurements with methane, propane, and propylene gases.

Background: Nathan Hagen graduated with a PhD degree in Optical Sciences at the University of Arizona in 2007, studying snapshot imaging spectrometry and spectropolarimetry. After stints as postdoc at Duke University, and research scientist at Rice University, he joined Rebellion Photonics in 2011 to develop snapshot imaging spectrometer instruments and applications.

Background: Robert Kester is the Chief Technology Officer and co-founder of Rebellion Photonics. He is also a co-inventor of the image mapping spectrometer (IMS) technology being commercialized by Rebellion Photonics. He has a M.Sc. from the College of Optical Sciences, University of Arizona, Tucson, AZ and a Ph.D. in Bioengineering from Rice University, Houston, TX.

Session 4D Presentation 1
"ISS Leak Location System"
Demo: No
Poster: No
One-on-One Table: No

Eric I. Madaras
Nondestructive Evaluation Sciences Branch
NASA Langley Research Center
(757) 864-4993
eric.i.madaras@nasa.gov



Abstract: The ability to quickly identify, locate, and repair leaks in the ISS pressure wall will minimize the loss of ISS resources, increase efficiency of life support systems, reduce overall resupply costs, reduce operation impacts on science, and reduce the risk of module loss. The ISS Risk Management System, IRMA Watch Item #4669, "Pressurized Module Leak Detection and Repair" addresses a requirement for leak mitigation due to micro meteor and orbital debris (MMOD) damage. Currently, there is a manual capability to locate slow leaks in the ISS utilizing an airborne ultrasound device, the Ultrasonic Leak Detector (ULD). However, this type of device has limitations, such as line of sight operation (ISS pressure wall access is generally blocked by structural components, avionics, equipment racks and stowage). We performed testing that demonstrated that structural ultrasonic noises generated by a small leak (as small as 0.0625" diam.) can be readily detected throughout a space station module and that structure borne ultrasound could form the basis of a comprehensive leak identification and location system. As a step in the risk mitigation process, the ISS office authorized Phase I of the Ultrasonic Background Noise Tests (UBNT) project to implement an on-orbit test to collect background structure-borne ultrasonic noise in two ISS Modules: the US Lab and Node 3. The current results are demonstrating a path forward towards addressing this risk.

Background: Dr. Eric Madaras has been a member of NASA Langley Research Center's Nondestructive Evaluation Sciences Branch for twenty-nine years. His recent responsibilities have included addressing risks to the International Space Station, including addressing how to automatically locate leaks in the ISS pressure hull and the application of NDE methods to address structural integrity should a hull breach occur. Prior to that role, he spend several years addressing issues related to NDE testing in support of the accident investigation and on the Return to Flight program after the Columbia accident. He led NASA Langley Research Center's NDE efforts for the Orbiter Office, participating in development of Terahertz imaging of foam on the Shuttle's external tank and supported the development of the Orbiter's Wing Leading Edge Impact Detection System. Prior to those programs, Dr. Madaras worked on programs related to High-Speed Research (supersonic transportation systems) and performing composite NDE research for aviation. Shortly after Dr. Madaras started his career at NASA, he contributed ultrasonic NDE research and development related to NASA's return to flight after the Challenger accident.

1985-Present:	NASA LaRC, Nondestructive Evaluation Sciences Branch
1981-1985:	Dept. of Physics, Washington University, St. Louis, Mo.
Education:	1981 – PhD, Physics, Washington University, St. Louis, Mo
	1975 – MA, Physics, Washington University, St. Louis, Mo
	1972 – BA, Physics, Colorado College, Colorado Springs, CO

Session 4D Presentation 2
"Considerations for IVA NDE Instrumentation for ISS On-Orbit NDE Applications"
Demo: No
One-on-One Table: Yes

Ajay Koshti
JSC/Structural Engineering
ES4/Materials and Processes Branch
ajay.koshti-1@nasa.gov
281-483-0262

Abstract: The presentation gives information on NASA efforts to address on-orbit NDE needs. The presentation gives NDE requirements for inspecting suspect damage due to MMOD impact on the pressure wall in of ISS. A trade study with demonstrations was conducted to down-select most suitable NDE method and instrument to detect and measure the damage from IVA side. Ultrasonic testing and eddy current testing were selected for the evaluation. Ultrasonic testing was finally selected for initial implementation. Results of the ultrasonic and eddy current demonstration scans on test samples are provided. In order to evaluate the instruments for certification requirements of the flight hardware, some engineering tests were also conducted. The preliminary results of NDE testing using the down selected instrument and results of the engineering evaluation for certification indicate that ultrasonic testing procedures are viable for IVA NDE applications. However, many improvements are desired to increase applicability of the NDE methods. While ultrasonic testing is the initial choice for implementation, eddy current testing can complement ultrasonic testing and would be considered for later phases. Compact eddy current array and conventional probe system is also needed. Wireless or non-contact encoder would be desirable so that the astronaut does not have to move the wheel type encoder with the transducer. Access under the ISS racks or corner panels is very limited. Therefore, NASA needs low profile NDE scanner devices that can be deployed using a reach tool. Software to merge and superimpose NDE scans and images to create a mosaic of image data are also needed.

Background: Dr. Ajay Koshti holds B.S., M.S., D. Sc. degrees and professional engineering (PE) certification in Mechanical Engineering. He also holds ASNT level III certification in five Nondestructive Evaluation (NDE) methods including Ultrasonic Testing, X-ray Radiography Testing, Eddy Current Testing, Magnetic Particle Testing and Liquid Penetrant Testing. He worked as an NDE engineer on NASA Space Shuttle Orbiter for 23 years. He also worked as NASA Space Shuttle Orbiter Handling Engineer for 6 years. Since 2004 He has been working as Lead NDE engineer at NASA Johnson Space Center. He authored over 20 NDE research articles in Ultrasonic Preload Measurements, Infrared Thermography, Eddy Current Testing, X-ray Radiography and X-ray Computed Tomography in SPIE proceedings, ASNT Materials Evaluation, Experimental Techniques and Experimental Mechanics. He has one patent in Infrared Thermography.

Session 4D Presentation 3
"User Friendly NDE; Phased Array"
Demo Table: Yes Poster: No
ed@sonatestinc.com

Ed M. Cabral
Sonatest, Inc.
www.sonatest.com
519-771-9541

Abstract: A challenge for Ultrasound manufacturers, designers and development teams has been keeping Phased Array equipment easy to use. As technology advances, operators have access to more information, more views and more settings. Therefore it is important to keep the user interface simple and easy to use. The question is how has this been achieved and what makes a Phased Array unit USER FRIENDLY? Phased Array (PA) ultrasonics is an advanced method of ultrasonic nondestructive testing which can be used in any application environment where traditional ultrasonic flaw detectors can be used. It is a powerful NDT technology and one that is growing rapidly, nonetheless it can seem extremely complex to the untrained eye and to anyone not familiar with Ultrasonics.

Background: Mr. Ed Cabral is the North American National Sales Manager for Sonatest. He has been with Sonatest for 4 years and previously was a UT & NDT technical consultant for a NDE company in Canada. He was a teacher at the College and University Level for a number of years before he got involved in Nondestructive Engineering and Testing.

1990-1994: Bachelor Science. Waterloo University

1996-2000: B.A. Psychology, McMaster University

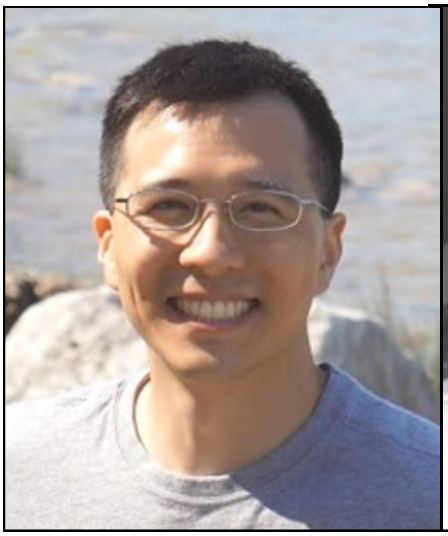
2001-2002: M.S. Western University

2011-present: Sonatest

Session 4D Presentation 4
"Optical Tracking for NDE Sensor Scanning"
Demo: Yes
One-on-One Table: No

Kevin Tang | Douglas Haanpaa
Cybernet Systems
Research & Development
ktang@cybernet.com | dhaanpaa@cybernet.com
734-668-2567 | 734-668-2567

Kevin Tang



Douglas Haanpaa

Abstract: We demonstrate an optical tracking technique to support NDE sensor scanning applications, including in-space inspection of micrometeoroid damage. This technique provides a wireless alternative to rolling encoders attached to the NDE sensor head. The system tracks a 1-inch cube target and displays a map of scan coverage, along with the 3D shape of the scanned area.

The Tracker was originally developed for NASA Langley's Nondestructive Evaluation Sciences Branch to support large area flaw mapping and has also been applied to Air Force depot maintenance inspections. Cybernet's patented tracking technology applies to any need for tracking and mapping the position and orientation of objects in real time. This includes inspection tools, manufacturing, games, and others.

Background: Mr. Kevin Tang leads the Tracker program at Cybernet. Mr. Tang has over a decade of experience performing government R&D in lead engineering and management roles. His designs for automated systems and algorithms for the analysis of complex systems behavior have grown into multi-phase R&D programs for satellites, submarines, aircraft, and robotic vehicles, for the U.S. Army, Navy, Air Force, and NASA. Mr. Tang holds engineering degrees from the University of Michigan (BSE) and Cornell (M.Eng.) in Computer Science.

Background: Mr. Douglas Haanpaa is a senior research engineer developing the software for the Tracker program at Cybernet. Mr. Haanpaa has nearly two decades of experience performing government R&D in various engineering and management roles. While at Cybernet, Mr. Haanpaa has gained experience in the development of applications relying on such technologies as machine vision algorithms, 3D simulation and visualization, augmented reality, qualitative flight dynamics modeling, inertial/GPS navigation systems, robotic control, force-feedback device design and software control, terrain modeling, and networking software development. Mr. Haanpaa holds an applied physics (BS) and computer science (MS) from Michigan Technological University.

Session 4D Presentation 5
"PZT & CNT based SHM for Impact Detection & Localization"
Demo: No Poster: No
One-on-One Table: No
www.metisdesign.com

Seth S. Kessler, Ph.D.
Metis Design Corporation
President/CEO
skessler@metisdesign.com
617-447-2172 x203

Abstract: Traditional monitoring techniques utilize a dense web of analog sensors connected by individual wires routed to centralized data acquisition and processing units. This traditional approach carries a significant weight penalty, can be complex to instrument and is susceptible to EMI. To address these issues, MDC has developed a fully digital SHM solution. The MD7-Pro system is composed of 3 core elements: an Accumulation Node for remote data concentration and diagnostic processing, an Acquisition Node for distributed signal digitization, and analog sensor bases. Two types of sensor packages will be discussed. First, MDC has patented a PZT beamforming array package to facilitate both active and passive structural sonar scans. From a single node position, a probability of damage map can be generated in response to stiffness changes detected by an active guided wave scan, or due to the passively captured acoustic response from an impact event. Second, due to piezoresistivity, CNT provide an effective means for health & usage monitoring. Individual nanotubes represent sensing elements, exhibiting a resistance value that varies according to its strain state. The dynamic response of CNT allow them to capture phenomenon such as stress waves due to an impact event. Damage can be represented as a permanence in local residual strain.

Background: Dr. Kessler is the president of MDC. He received his S.B., S.M. and Ph.D. at MIT with a focus on composites and SHM. He worked at the Lockheed Martin Skunk Works as an advanced concepts engineer on the X33/VentureStar/JSF programs. In 1998, he received the MIT Admiral Luis De Florez Award, in 2001 was awarded the American Society for Composites Ph.D. Research Scholarship, was a Draper Fellow in 1999 and has won best paper in 2002 from the ASC, in 2009 the PHM Society, and in 2011 from the International Workshop on Structural Health Monitoring. Dr. Kessler holds 9 patents (3 pending), has more than three dozen technical publications and serves on the SAE International G11-SHM and HM1 standards committees. Dr. Kessler guest lectures for advanced graduate courses on composite mechanics in the Aerospace Department at MIT, and was the System Engineering section editor and author of 2 chapters for the Integrated Vehicle Health Management for Aerospace Application textbook published by Wiley in 2011.

1995-1998: S.B. Aeronautics & Astronautics MIT
1998-1999: S.M. Aeronautics & Astronautics MIT
2000-2002: Ph.D. Aeronautics & Astronautics MIT

Session 5A, Presentation 1
"Aerospace PICOSAT Program Status 2014"
Demo: Yes Poster: Yes
One-on-One Table: Yes
www.aero.org

David A. Hinkley
The Aerospace Corporation
PICOSAT Program
david.a.hinkley@aero.org
310-336-5211

Abstract: The Aerospace Corporation Picosatellite program conceives, develops, builds, integrates, and operates picosatellites, nanosatellites, and miniaturized spacecraft and their subsystems utilizing the scientific and engineering capabilities existent at the Corporation. We advocate leveraging the quick cycle time to design, build, test, and fly picosatellites (about an order-of-magnitude shorter than the equivalent cycle for traditional spacecraft) to quickly and iteratively evolve new space technologies and concepts as well as mission assurance processes that are applied to much more expensive and important but longer lead-time programs. We support upgrades to launch infrastructure to accommodate secondary payloads, which are crucial to rapid development of space technology (and for the education of the next space generation). We advocate using the low-cost aspect of miniature satellites to leverage the latest technology in electronics as well as demonstrate the high risk / high payoff concepts in order to accelerate space technology development. This talk will show results from prior missions and highlight some of our latest capabilities.

Background: Mr. David Hinkley is a senior project engineer supporting the Picosatellite effort at The Aerospace Corporation, called the PICOSAT Program. He joined the PICOSAT Program at the beginning in 1999 as a mechanical engineer and now is a principal engineer. In total, the PICOSAT program has delivered miniature satellites for 10 missions including 4 that used the space shuttle as a launch platform, with the help of the USAF Space Test Program.

1983-1989: B.S. Mechanical Engineering UCSD

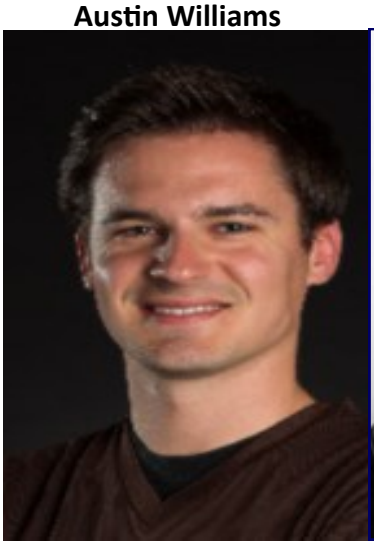
1989-1991: M.S. Mfg. Engineering (Robotics) UCLA

1987-Present: The Aerospace Corporation

Session 5A Presentation 2
"CubeSat Proximity Operations Demonstration Enabling On-Orbit Inspection"
Demo: No Poster: No
One-on-One Table: No

Austin Williams | Al Tsuda
Tyvak Nano-Satellite Systems, Inc
Austin@tyvak.com | Al.Tsuda@tyvak.com
480-227-1113 | 949-237-0833

Austin Williams



Al Tsuda

Abstract: Tyvak Nano-Satellite Systems, Inc has been developing the CubeSat Proximity Operations Demonstration (CPOD), which is one of the most ambitious CubeSat program to date. This technology demonstration mission has two identical 3U CubeSats performing relative proximity operations and ultimately docking in a Low Earth Orbit (LEO). Each vehicle contains multiple radios, antennas, computers, imagers, a 3-axis attitude determination and control system, deployable panels, and a cold gas propulsion system controlled by the navigation computer.

An overview of the vehicle layout is provided, highlighting key functionality and sensor configuration. An overview of the core avionics system including attitude determination and control, telemetry systems, command and data handling, power systems, and guidance, navigation and control are discussed. Lastly, the concept of operations for the mission is stepped through from deployment of the CubeSats, through docking.

Background: Austin Williams is a co-founder of Tyvak Nano-Satellite Systems, Inc. Austin has been developing CubeSats for 7 years, with a focus on hardware avionics design using low power COTS components in compact form factors. Austin's primary responsibilities include the design, fabrication, test, and integration of Tyvak's avionics systems.

2009: B.S. Electrical Engineering, Cal Poly SLO

2011: M.S. Electrical Engineering, Cal Poly SLO

2011-Present: Tyvak Nano-Satellite Systems

Background: Al Tsuda has 20+ years of experience in space and launch systems. His responsibilities include requirements analysis, system trade studies, simulation and analysis, integration & test, and operations support. Al is currently the Chief Engineer for the CPOD mission.

1991: B.S. Aerospace Engineering, UCLA

1992: M.S. Aerospace Engineering, Stanford

2013-Present: Tyvak Nano-Satellite Systems

Session 5A Presentation 3
"NanoRacks ISS Facilities"
Demo: Yes Poster: Yes
One-on-One Table: Yes
www.nanoracks.com

Michael D. Johnson
NanoRacks, LLC
ISS US National Laboratory
mjohnson@nanoracks.com
832-573-7424

Abstract: NanoRacks is a commercial payload provider to the ISS US National Laboratory Program. The company is a turnkey internal and external ISS payload provider that has conceived, developed, constructed, integrated, and operated various pressurized payloads, ISS satellite deployers and external payload facilities. Since it's founding in 2009 NanoRacks has flown over 200 payloads including a record setting deployment of 34 CubeSats in February 2014 with over 100 payloads scheduled to fly in the next year. NanoRacks provides an extremely fast cycle time to design, build, test, and fly payloads (usually 6 to 9 months) to the ISS. The founders of NanoRacks have a long history of commercial space operations and are applying past lessons learned to provide the most cost and time effective means to fly payloads in space. By combining this experience base and leverage of the latest technology in electronics NanoRacks has a proven method of rapid mission performance. This presentation will provide an overview of NanoRacks and our latest capabilities.

Background: Mr. Michael D. Johnson is a co-founder and Chief Technology Officer of NanoRacks, LLC. He co-founded NanoRacks, LLC in 1999 and has continued his role as CTO. In total, NanoRacks has delivered nearly 200 payloads to the ISS in less than four years from the inception of the company. Mr. Johnson previously worked with SPACEHAB, Inc. in various capacities for over 18 years as well as founding two other startups.

1984-1989: B.S. Aerospace Engineering University of Minnesota, I.T.

1989-1991: Rockwell Space Operations, JSC Flight Controller

1991-2009: SPACEHAB, Inc.

2009-Present: NanoRacks, LLC

Session 5B Presentation 1
"External High Definition Camera"
Demo: No Poster: No
One-on-One Table: No
www.nasa.gov

Victor J. Studer
NASA – Johnson Space Center
ISS Program
victor.j.studer@nasa.gov
281-483-0189

Abstract: The Avionic Systems Division at NASA – Johnson Space Center conceives, develops, builds, integrates and certifies hardware in support of manned spaceflight programs. Developments include all areas of avionics including control, power, RF and network communications, display and controls, audio, video and still imagery with in-house and/or access to testing equipment and laboratories needed for flight certification. Division design capabilities include analog, digital, firmware and software required for in-house design as well as adapting Commercial-Off-The-Shelf (COTS) components and systems for space flight applications.

The External High Definition Camera (EHDC) system is a unique International Space Station (ISS) project which incorporates nearly all of these Division core capabilities. The EHDC will be mounted with the existing ISS video cameras but will utilize the ISS External Wireless Communications (EWC) system for control, video, imagery and status communications. Relying heavily on COTS hardware, the EHDC incorporates a wireless radio, antennas, Ethernet switch, video H.264 encoder, DSLR camera and lens with a NASA designed controller and power supply, into a sealed enclosure which will be controlled from the Mission Control Center (MCC) providing high definition video and still imagery downlinked directly to the ground.

Background: Mr. Studer is the Video Systems Lead of the Avionics Systems Division with a history of successful flight projects starting with the STS-7 Space Shuttle flight of the free flying German satellite SPAS-01 with the first in space camera view of the Orbiter, transmitted to the Orbiter and then downlinked to the ground. Between that and the EHDC, to be installed early next year, Mr. Studer has worked on or been responsible for development, certification and flight over 175 different items. He has also worked on the Orion program supporting Avionics subsystems as well as SE&I roles.

1976 – 1981: B.S. Electrical Engineering, U of Akron

1979 – Present: NASA – Johnson Space Center

Session 5B Presentation 2
"DDVS - The Dextre-Deployable Vision System"
Demo: No Poster: No
One-on-One Table: Yes

Yves Gonthier/Sebastien Gemme
Canadian Space Agency
www.asc-csa.gc.ca
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450-926-5032 | 450-926-5066

Abstract: The Canadian Space Agency (CSA) is studying the concept of an inspection and navigation tool to be used on the International Space Station (ISS). This tool is called the Dextre Deployable Vision System (DDVS), and is based on high Technology Readiness Level (TRL) technologies. The suite of sensor technologies has been selected to address immediate needs for inspection on the ISS. The navigation portion is intended for technology demonstration purposes only. Given a successful demonstration, a relative navigation monitoring service would later be offered to the crew and to the operators. The CSA has engaged the ISS partners to seek their inputs on the potential applications for this new tool and help refine its requirements. This talk will introduce the key features of the DDVS and will be an opportunity to initiate a dialogue with the in-space inspection community to help mature the DDVS concept and maximize its benefits to the ISS.

Background: Dr. Gonthier is currently a Senior Engineer in the Space Exploration Strategic Planning Section at the CSA, and he is involved in the development of technologies for the future space exploration missions. He also participates in many international committees for the development of a common international vision for Space Exploration. Dr. Gonthier has published over 40 journal papers, conference articles and various technical reports.

1989-1993: Bachelor's in Mechanical Engineering at McGill University

1993-1996: Master's in Robotics McGill University

2001-2008: Ph. D. in Systems Design Engineering at the University of Waterloo

2000-Present: the Canadian Space Agency

Session 5B Presentation 3	**Phillip Callen**
"Enhanced Ground Control for ISS Robotics"	**NASA/JSC/ER—Robotics Flight Systems**
Demo: No Poster: No	**Branch Chief**
One-on-One Table: Yes	**phillip.s.callen@nasa.gov**
www.nasa.gov	**281-483-8087**

Abstract: ISS Robotic Systems were developed for safety and performance for the assembly and maintenance of the Space Station. Based on his extensive experience, Mr. Callen will explore several areas of ISS robotic operations that can now be made more efficient and eventually automated which will benefit In Space Inspection operations.

Background: Phillip Callen has served as Branch Chief for ER3/Robotics Flight Systems, responsible for ISS flight hardware including robotic and crew exercise systems, as well as developing the next generation of those systems to support exploration.. He has over 33 years of spaceflight experience with NASA at the Johnson Space Center. Including:

2006 – 2012 MSS System Manager, Software, Robotics and Simulation Division

Responsible for the MSS System (SSRMS, MBS, SPDM, RWS) hardware, systems engineering and integration, flight operations planning and support, software development, and the life cycle development of ISS elements to ensure they are compatible with robotic requirements.

2005 – 2006 HTV Integration Lead, Software, Robotics and Simulation Division

Led the early development effort for the ISS Program to define requirements for free-flyer capture and was instrumental in initiating and leading the NASA/contractor team in developing the models and simulations required for the real-time and non-real-time simulation of the robotic capture operation. This capability formed the foundation of the division's current HTV/MSS related work both for training and engineering analysis. The HTV involved the most challenging robotic operations yet attempted on the ISS. This includes HTV proximity operations, capture of the HTV with the SSRMS, berthing of the HTV and subsequent robotics operations to remove and insert the external platforms on the HTV as well as cooperative robotic tasks with the JAXA robotic manipulator. The HTV integration role involved the task coordination of multiple International Partners, multiple organizations in the ISS Program Office, multiple JSC organizations and multiple tasks within the division

2002 – 2005 Manager, MEMS and Nanotechnology Office, JSC/EA

Organized and led the center-wide Nanotechnology/MEMS (micro-electric mechanical systems) working group, investigating and encouraging the use of Nano/MEMS technologies. Also helped to organize an agency wide MEMS working group, working directly with the agency's Chief Engineer.

1998 – 2002 ISS Chief Engineer, Software, Robotics and Simulation Division

Education:

M.S. Studies Of the Future, University of Houston Clear Lake 1985

B.S. Mechanical Engineering, University of Missouri-Rolla 1981

B.A. Physics, Central Missouri State University 1977

Session 5C Presentation 1
"Gecko Inspired Adhesive"
Demo: Yes Poster: No
One-on-One Table: No

Paul Glass
NanoGriptech, Inc.
www.nanogriptech.com
pglass@nanogriptech.com
412-224-2136

Abstract: nanoGriptech, Inc. is focused on understanding and duplicating, using elastomeric microfibers, the amazing controllable sticking, high friction, highly directional, and tactile qualities of gecko feet. nanoGriptech's R&D team is working to optimize and mass produce these advanced micro/nano-materials for a wide range of applications including for defense, civilian, and aerospace customers. nanoGriptech's NASA 2013 SBIR Phase I project focused on using these materials to enhance the dexterity of Robonaut 2 aboard the ISS. Additional potential NASA applications of these materials include temporary anchoring of sensors, equipment, or people, such as aboard the ISS or inflatable space habitats. nanoGriptech adhesives solve many customer problems with conventional pressure sensitive adhesives or hook and loop systems. They are reusable over thousands of cycles, residue-free, and demonstrate excellent, controllable, and directional shear, peel, and normal adhesion strength to a wide range of substrates. Manufacturing of nanoGriptech's gecko-inspired adhesives has been demonstrated at scalable mass-production volumes, and the company is in the process of identifying and working with customers for its upcoming product launch. The company was spun out from Carnegie Mellon University in Pittsburgh in 2009.

Background: Dr. Paul Glass has over eight years of combined academic and industry experience working on the synthesis and evaluation of bio-inspired fibrillar materials, including four years as a Senior and Lead Research Engineer at nanoGriptech, Inc. At nanoGriptech, he has been the PI of a broad federally-funded research portfolio related to the optimization, specifically for biological applications, mass production, closure system development, and space applications of gecko-inspired adhesives. He has also led multiple privately funded initiatives working closely with potential commercialization partners, ranging in size from the Fortune 500 companies to start ups. Dr. Glass has numerous academic publications and patents related to these materials and processes.

2000-2005: B.S. Mechanical Engineering, McGill University

2005-2010: PhD, Biomedical Engineering, Carnegie Mellon University

2010-Present: nanoGriptech, Inc.

Session 5C Presentation 2
"Think Like Geckskin"
Demo: Yes Poster: No
One-on-One Table: Yes

Rana K. Gupta
Felsuma LLC
rana.gupta@felsuma.com
617-306-8280

Video: **http://www.launch.org/innovators/rana-gupta**

Abstract: Felsuma is a spinout company from the University of Massachusetts Amherst, where Geckskin® technology was created. Geckskin is a mechanical adhesive technology developed by Professors Al Crosby and Duncan Irschick at UMass Amherst. Felsuma was created to commercialize this new adhesive.

Because Geckskin is a device, not a material, that can be "tuned" to meet the needs of applications in multiple industry sectors, Felsuma is pursuing a market-pull business model. Corporate partners approach Felsuma with specific application needs. With funding from those partners, Felsuma develops Geckskin for that application. In return for identifying the application and funding the development, Felsuma bestows on the partner exclusivity for that application.

Companies in multiple industries have either begun development or are evaluating Geckskin for application in their market(s). Those markets include, to name a few:

Apparel;
Oil & gas;
Medical devices;
Construction & houseware;
Aerospace & military;
Outdoor & sports equipment and
Assembly line manufacturing

Background: Rana Gupta has spent the last 13 years investing in and developing novel technologies. His professional career has spanned government, consulting, industry, venture capital and startup CEO. Felsuma was incorporated in April 2013. Working with manufacturers and designers, Felsuma is already developing prototypes for corporate partners.

1982-1986 B.A. Mathematics Earlham College
1987-1988 M.S. Operations Research Stanford University
1988-1990 NYC Department of Environmental Protection
1990-1992 M.B.A. New York University Stern School of Business
1992-1997 Arthur D Little (US and India)
1997-1998 Zeneca Pharmaceuticals (Beijing, China)
1998-1999 IndoSine U.S. Link, Ltd.
1999-2001 yet2.com

Session 5C Presentation 3
"Gecko Like Adhesives for In-Space Inspection"
Demo: Yes Poster: No
One-on-One Table: No

Aaron Parness
NASA/Jet Propulsion Lab
Robotic Mobility Section
Aaron.Parness@jpl.nasa.gov
(818) 436-9200

Abstract: Gecko-like adhesives can benefit multiple Earth orbit applications by providing the capability to selectively anchor two surfaces together repeatedly and releasably. Key to this new capability, targets will not need special preparation; gecko-like adhesives can be used with cooperative and non-cooperative objects, like space debris. Geckos adhere to surfaces using arrays of hierarchical hairs with features at the mm, µm, and nm scales that generate enough van der Waals forces to support the animal's weight. The directional bias of these hairs provides a means of turning the adhesion ON and OFF through an applied shear load, a behavior also seen in JPL's synthetic structures. In practice, the applied shear load is generated through a slight sliding motion. Once activated in such a manner, a pad will resist both normal and shear forces aligned roughly to the loading direction. By arranging these pads in counterbalanced pairs, triads, or quads, omni-directional grip can be achieved. This presentation will present work done under the Darpa Phoenix program and JPL internal funding to develop gecko-adhesive grippers for use in Earth orbit. These grippers have been tested on air bearing tables to simulate zero-g and the adhesive has been chamber tested to full vacuum and -60C.

Background: Dr. Aaron Parness (Group Leader, Extreme Environment Robots Group, JPL) is the Principal Investigator of several projects on microgravity grippers and wall climbing robots. He has studied multiple methods of climbing, including insect-inspired approaches, gecko-inspired adhesives, electrostatic mechanisms, and mechanical interlocking methods like clawed climbing. He has over 30 peer-reviewed publications. His PhD dissertation at Stanford University is titled "Microstructured Adhesives for Climbing Applications". Dr. Parness also has experience in the design and fabrication of parts at the millimeter and micrometer scales. He is expert in Shape Deposition Manufacturing techniques and developed novel 3D photolithographic approaches to molding plastic parts for multi-length scale, multi material robotic applications. Dr. Parness also has expertise in mechatronics, and has constructed several autonomous robot prototypes. At JPL, he also works in the Chief Technologist's Office leading work on Innovation and early stage technology development programs.

2010-Present – NASA Jet Propulsion Lab
2004-2009 – Stanford University
2000-2004 – MIT

Session 5D Presentation 1
Flight Systems and Tech for Impact Detection and Location
Demo: No Poster: No
One-on-One Table: No
www.invocon.com

Aaron Trott
Invocon, Inc.
Event-Triggered Inspection
atrott@invocon.com
281-292-9903

Abstract: Event-triggered inspections can be an important aspect to a comprehensive and cost-effective maintenance regimen. If trustworthy sensing is in place, a reactive approach to maintenance may be safer than a proactive approach. This is particularly true for high-value assets that are difficult to access.

For many years, Invocon has been developing instrumentation for impact detection and location. Heritage applications include the Wing Leading Edge Impact Detection System for the Space Shuttle Orbiter and the Distributed Impact Detection System for ISS. This presentation describes these heritage systems and applications. It also addresses new technologies that will help to further decrease the cost of monitoring high-value space assets.

Background: Aaron Trott is a Program Director who has been employed with Invocon, Inc. since 1996. His present responsibilities at Invocon include application engineering, business development, and program management. Specific areas of focus include sensor system developments for applications in the aerospace and defense industries. While at Mississippi State University Aaron spent two years as a co-op at NASA Langley Research Center in Hampton Virginia.

B.S and M.S. In Electrical Engineering

Mississippi State University

Session 5D Presentation 2
"Autonomous Data & Goal Driven Intelligent Inspection for Unknown Precursor Detection"
Demonstration: No Poster: No

Christopher Bowman, PhD.
Data Fusion & Neural Networks (DF&NN), LLC
cbowman@df-nn.com
303-469-9828

Abstract: To affordably find activity patterns of interest in 'big data' we need turn-key intelligent data-driven and goal-driven systems. DF&NN has delivered a TRL 7 system to 3 sites that automatically learns normal activities in 'big' State of Health (SOH) data sets over many months and then provides abnormality detection scores in real-time for moving time windows of over 10K measurands. These abnormality detections are clustered, classified, and tracked over time with the capability for the user to add the desired response for each abnormality type. As such the system detects the unexpected 'unknown-unknowns'. Temporal pattern recognition tools are added to predict effects of detected abnormality precursor signatures based upon historical data.

Background: Dr. Bowman is President of DF&NN. He designed, tested, and delivered the Blue Force Status (BFS) ANOMaly (ANOM) detection intelligent system. holds the patent on this.

1970-1975: NSF Fellow Applied Mathematics Ph.D. at UCI

1975-1978: Missile Guidance & Control Analyst at Logicon

1978-1987: Data Fusion & Neural Networks Analyst at VERAC

1987-1995: Senior Aerospace Engineer at Ball Aerospace

1995 to Present: President of Data Fusion & Neural Networks (DF&NN)

Session 5D Presentation 3
"Smart Sensors for Distributed Event-Triggered SHM"
Demo: No Poster: No
One-on-One Table: No
www.ridgetopgroup.com

Doug Goodman/Kyle Ferrio
Ridgetop Group, Inc,
dgoodman@ridgetopgroup.com
kferrio@ridgetopgroup.com
520-742-3300

Abstract: Ridgetop Group develops diagnostic and prognostic health management (PHM) technologies supporting condition-based maintenance (CBM) for critical electrical, electronic and electromechanical systems. System health monitoring of spacecraft can benefit from progress made in industrial and avionic domains, just as the exceptional demands of in-space inspection are driving advances in PHM. Distributed system health monitoring (SHM), particularly for large and complex craft operating in the hostile environment of space, pose special challenges related to event observability, sensor reliability, and prognostic horizon. Decision-makers, both human and autonomous, require timely, reliable information about the state of health (SOH) of individual structures and subsystems, integrated into decision-support models. Event-triggered inspection provides a framework for transitioning from reactive maintenance to proactive health management to reduce risks to crew, vehicle, and mission. Distributed networks of energy-efficient coordinated smart sensors can provide robust event-triggered inspections enabling actionable, online SOH assessment and response planning with minimal burdens on crew, system power, data storage, and data processing resources.

Background: Mr. Doug Goodman is founder and CEO of Ridgetop Group, and holds BSEE and MBA degrees. His comprehensive background encompasses low-noise instrumentation design, design-for-test (DFT), fault simulation techniques, and design tool development at firms such as Tektronix and Honeywell. He was also part of the team that developed the first DSP-based IF processing for spectrum analyzers. He successfully steered engineering at Analogy Inc. (electromechanical design simulation tools) as vice president until its IPO. Afterwards, he moved to co-found and head Opmaxx Inc., a design-for-test IP firm that later merged with Credence Systems.

1975: B.S. Electrical Engineering,
California Polytechnic State University, (Cal Poly) San Luis Obispo, California

Background: Dr. Kyle Ferrio is Vice President of Advanced Research at Ridgetop Group and an accomplished technical leader, with a record of delivering award-winning software and advanced electro-optical solutions while leading multidisciplinary teams of software, optical, electrical, mechanical, and systems engineers. He has more than 16 years of professional experience, including project management, hands-on product and process engineering, and algorithm development.

1996: Ph.D. in Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, MI
1992: M.S. in Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, MI
1989: B.S. in Electrical Engineering
Bucknell University, Lewisburg, PA

Session 6A Presentation 1
"SPHERES – a Free-Flying Testbed Inside the ISS"
Demo: Yes Poster: Yes
One-on-One Table: Yes
www.nasa.gov/spheres

Jose V. Benavides
SGT Inc.
SPHERES Facility
Jose.V.Benavides@nasa.gov
604-650-4401

Abstract: SPHERES is a facility of the ISS National Laboratory with three IVA nano-satellites designed and delivered by MIT to research estimation, control, and autonomy algorithms. Since Fall 2010, The SPHERES system is now operationally supported and managed by NASA Ames Research Center (ARC). A SPHERES Program Office was established and is located at NASA Ames Research Center. The SPHERES Program Office coordinates all SPHERES related research and STEM activities on-board the International Space Station (ISS), as well as, current and future payload development.

By working aboard ISS under crew supervision, it provides a risk tolerant Test-bed Environment for Distributed Satellite & Free-flying Control Algorithms. If anything goes wrong, reset and try again!

NASA has made the capability available to other U.S. government agencies, schools, commercial companies and students to expand the pool of ideas for how to test and use these bowling ball-sized droids. For many of the researchers, SPHERES offers the only opportunity to do affordable on-orbit characterization of their technology in the microgravity environment. Future utilization of SPHERES as a facility will grow its capabilities as a platform for science, technology development, and education.

Background: Jose Benavides is with the Advanced Control and Evolvable Systems (ACES) Group in the Intelligent Systems Division at NASA Ames Research Center. He has a bachelors and masters degree from Arizona State University in Electrical Engineering, with specialization in control systems. His research interests include embedded systems, rapid prototyping of control systems, air traffic guidance and control, spacecraft, small satellites, and human-machine interaction.

Education:

B.S. and M.S in Electrical Engineering
Arizona State University

Session 6A Presentation 2
"SPHERES-X"
Demo: No Poster: No
One-on-One Table: No
ssl.mit.edu

Alvar Saenz-Otero
MIT Space Systems Laboratory
Cambridge, MA
alvarso@mit.edu
617-699-7311

Abstract: Since 2006 the Synchronized Position Hold, Engage, Reorient, Experimental Satellites (SPHERES) Facility has operated inside the International Space Station allowing the maturation of innovative formation flight and docking algorithms highly relevant to in-space inspection. The MIT Space Systems Laboratory, original developer of SPHERES, believes the next step is an external facility which allows maturation of both algorithms and hardware up to TRL 7, while maintaining the same *laboratory* features of the current facility. SPHERES-X is a highly maneuverable, modular, and low cost nano-satellite system. The program will retain full 6-DOF controllability and observability, replenishable supplies, and easy software updates. Amongst the *laboratory design philosophy* principles, SPHERES-X will continue to enable research in a full Field of Study (not just one specific experiment), allow iterative research, promote incremental technology maturation, and enable modularity and expansion. The current unique risk-tolerant operation of SPHERES inside ISS will be maintained by creating a re-usable facility with standard tested algorithms for basic operations, while allowing complex algorithms to be tested at safe distances from ISS. In order to address safety concerns with autonomous satellites operating around the ISS, the program is proposed in multiple phases: first use disposable satellites launched from within the ISS but not scheduled to return; second, launch another set of disposable satellites which demonstrates motion towards ISS, but always at a safe distance; and third launch reusable satellites which return inside ISS for stowage and maintenance.

Background: Dr Saenz-Otero is a the Director of the MIT Space Systems Laboratory at the MIT Department of Aeronautics and Astronautics. He directly manages the SPHERES program research activities aboard the International Space Station and in ground facilities, as well as working with NASA Ames Research Center. In addition he oversees the other projects of the SSL. He also runs the only student competition which annually concludes in space: Zero Robotics. This outreach program allows both Middle- and High-school students to write programs for the SPHERES satellites aboard the ISS. Academically, he has been a mentor in seven capstone design classes at MIT, working closely with Prof. David W. Miller.

Session 6A Presentation 3
"Remote Underwater Robotic Inspection"
Demo: Yes
Poster: No

Darby F. Magruder
Robotic Systems Technology Branch
NASA-JSC/ER4
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darby.f.magruder@nasa.gov

Abstract: The Robotic Systems Technology Branch at the Johnson Space Center is responsible for the research, engineering, development, integration, and application of robotic hardware and software technologies for specific flight and ground robotic system applications in support of human spaceflight. Advanced robotic systems technology efforts include both remotely controlled and autonomous robots for space and terrestrial application, as well as intelligent robotics for high value functionality. The development of highly dexterous robots, such as R2, places the branch at the forefront of U.S. humanoid robotics while our planetary robotic Rovers are breaking new ground in techniques for exploration and settlement of extraterrestrial bodies. Sensing and inspection capabilities developed for the AERCam (Autonomous Extravehicular Robotic Camera) project have been leveraged to address a technology need in the oil and gas industry. A sonar based inspection device has been developed to map the sediment layer of large oil storage containers. The purpose and application of this inspection device will be briefly discussed in this workshop

Background: Since 1998, Mr. Magruder has been a member of the Robotic Systems Technology Branch. His assignments began with the development of robotics technology; specifically, human-computer interface design. Responsibilities included design, development, test and evaluation of robotic hardware, software, and operator control systems for the remote operation of robotic systems. Having participated in technology development assignments, more and more focus was placed on infusing those technologies into NASA's exploration program. His role in technology infusion has led to more responsibility for coordination and management of personnel and projects and is now serving as the Deputy Chief, Robotic Systems Technology Branch.

Education:

1992 – M.S., Electro-Optics, University of Houston – Clear Lake
1988 – B.S., Electro-Optics, University of Houston – Clear Lake
1984 – B.S., Biomedical Science, Texas A&M University

Session 6B, Presentation 1
"Enabling Monitoring and Inspection with Wireless Power and Data Hotspots Through Barriers"
Demo: Yes Poster: No

Mitchell K. Knaub/Coey Jaskolski
Hydro Technologies
http://www.hydro-tech.com/
mknaub@hydro-tech.com
970-686-6200

Abstract: The Hydro Technologies Wi-Ψ (Wireless Power and Signal Interface) technology utilizes magnetic fields to transfer power and data through barriers without needing a penetrator. Unlike acoustic or RF wireless, magnetic wireless allows for the transfer of both power and modulated data making it a true wireless solution. In addition, magnetic wireless can penetrate conductive barriers (e.g. metal) as well as complex barriers that would inhibit RF or acoustic communication. For these reasons, magnetic wireless is an excellent candidate for enabling monitoring and inspection applications through barriers or in hard to reach locations. Specifically, magnetic wireless technology allows for the creation of wireless hotspots that can provide through-barrier power and a bidirectional data link to any equipment that comes within range.

Background: Mitchell received his Bachelor's Degree in Physics from Colorado State University with a focus on Ferromagnetic Resonance in Magnetic Thin Films. In 2009 Mitchell began his career at Hydro Technologies in Windsor Colorado performing Finite Element Analysis simulations for the development of through-metal communications and through-metal power transfer. While serving as a Design Engineer Mitchell received his Masters in Business Administration in 2012. Mitchell now serves as a Systems Engineer and Project Manager in through-metal communications and power transfer applications in the oil and gas industry, Department of Defense and NASA.

B.S. in Physics
Colorado State University in 2009

MBA in 2012

Session 6B Presentation 2
"Taurus Robot"
Demo: Yes Poster: No
One-on-One Table: No
mark.baybutt@sri.com

Mark Baybutt
SRI International
Robotics Program
http://www.sri.com/
650-859-2047

Abstract: SRI's Robotics Program invents, applies, and commercializes systems, software, and components that deliver state-of-the-art robotics to government and commercial markets. For more than 40 years, SRI has been at the forefront of robotics R&D, from applied research through the design of advanced prototypes and product development. SRI researchers have a long, rich tradition of pushing the boundaries of robotics. Our heritage includes the foundational intellectual property (IP) used in Shakey the Robot, Intuitive Surgical's da Vinci surgical system, and the enabling patents for electroactive polymer artificial muscle. Our pioneering developments in robotics have evolved into a solid, comprehensive program that spans multiple disciplines and features expertise in artificial intelligence, algorithm development, sensors research, and product development.

Mr. Baybutt will be presenting two talks touching on various technologies from SRI's Robotics Program. The first talk will discuss on a novel approach to dexterous video inspection through application of electroadhesion technology. The second will present Taurus; a compact, dual-arm, telemanipulated robotic system leveraging patented SRI technology that enables the da Vinci surgical system.

Background: Mr. Mark Baybutt is a Senior Research Engineer in the Robotics Program at SRI. He is the lead electrical engineer on many programs, including telemanipulated, humanoid, and medical device systems. His area of expertise is in motion control, sensing, and probabilistic techniques. Prior to his involvement in the Robotics Program, he developed instrumentation and sensing solutions for SRI's FlexTrain system, a platoon to brigade level training system developed for the U.S. Army National Guard.

2002–2007: B.S. Electrical Engineering (Computer Engineering focus), Rochester Institute of Technology
2008 – 2010: M.S. Electrical Engineering (Probabilistic Robotics focus), Stanford University
2010 – Present: SRI International

Session 6B, Presentation 3
"Climbing Robots for Inspecting ISS Interior"
Demo Table: Yes
Poster: No

Roger D. Quinn
Professor, Mechanical and Aero Eng.
Case Western Reserve University
RDQ @case.edu | (216) 368-3222
http://biorobots.cwru.edu/

Abstract: Novel animal-inspired foot materials can enable small robots to walk on surfaces regardless of the direction of gravity or in the apparent absence of gravity as in the interior of ISS, allowing for inspections in tight spaces. Mini-Whegs, a small robot that uses four wheel-legs for locomotion, was one of the first robots to climb vertical glass surfaces using an insect-inspired structure polymer adhesive [Daltorio, Horchler, Gorb, Ritzmann, Quinn, IEEE IROS'05]. It was discovered that the feet can be washed and reused with similar results. Research since that time in Stanislav Gorb's lab at Kiel University has led to improvements in the structured polymer along with experimental evidence and analytical descriptions of how it functions. Surface microstructures with mushroom-shaped stalk geometry, which is observed in long-term biological adhesive systems, offer repeatable, reversible, and residue-free adhesion under various, different environmental conditions. A new Mini-Whegs robot is shown to climb vertical glass with greater reliability using the new material.

Background: Roger D. Quinn is an Arthur P. Armington Professor of Engineering at Case Western Reserve University. He has directed the CWRU Biorobotics Laboratory since its inception in 1990. His research, in collaboration with biologists, is devoted to the development of robots and control strategies based upon biological principles. Dozens of robots have been developed to either improve robot performance with biological principles or model animal systems. He has greater than 200 publications and a number of patents on practical devices resulting from his work. His biology-engineering collaborative work on behavior based distributed control, robot autonomy, human-machine interfacing, robot design, and neural control systems have each earned awards. His work on robot autonomy includes the development of an inexpensive autonomous lawnmower that can edge obstacles and mow patterns.

1986-present: Professor, Mechanical and Aero Eng., CWRU
2003 – present: Arthur P. Armington Professor, CWRU

Education: 1985 – PhD, Engineering Science and Mechanics, Virginia Tech
1983 – MS, Mechanical Engineering, University of Akron
1980 – BS, Mechanical Engineering, University of Akron

Session 6C Presentation 1
"Progress Towards Electro-adhesion Application in Space"
Demo: Yes
One-on-One Table: No
www.sri.com

Victor M. Aguero
SRI International
Space and Marine Technology Lab
victor.aguero@sri.com
650-859-2801

Abstract: SRI International has been exploring electroadhesion (EA) technology and related concepts for several decades, and has also spun out a commercial entity, Grabbit, to pursue commercial application of EA. SRI has tested EA in a variety of environments such as the vacuum and plasmas encountered in space. Dr. Aguero served as a PI in the first phase of the DARPA Phoenix program, bringing EA support to the Phoenix team for consideration of its many uses in space, including robotic augmentation, docking assist, and temporary adhesion. The presentation will cover background in these areas, including a discussion of potential uses of EA to support astronaut and in-space inspection activities. There exist significant opportunity to use technologies such as EA, with its ability to turn on and off temporary adhesion under electrical control, as a way to save time during extra-vehicular activities and to increase safety of tool and supply inventories. In addition, EA on robotics allows for the equivalent of wall-crawling robots in space - both inside and outside spacecraft to augmentation capabilities or deal with situations having significant unknowns.

Background: Dr. Aguero is a Senior Program Development Manager leading small satellite activities at SRI International in the Space and Marine Technology Laboratory (SMTL) that he helped found. He joined SRI in 1997 and has supported many technology and research and development efforts, focusing on space related programs and technologies. Dr. Aguero's background and expertise has focused on spacecraft environment interactions and spacecraft system miniaturization. The SMTL program activities include new technology developments, payload development, and mission development and support for government and commercial clients. SMTL activities have included launch integration and test support for government and commercial CubeSat launches. Dr. Aguero was program lead for the first SpaceX Falcon-9 launch of 8 government and commercial CubeSats in 2010. The SMTL program has supported over 30 CubeSat launches, including 3 with SRI developed payloads; and is supporting launch integration and test of at least another 30 CubeSats manifested through 2016.

Education: Massachusetts Institute of Technology, B.S. '84 (Physics)
Stanford Univ., M.S. '85 (Aeronautical and Astronautical Engineering)
Stanford Univ. M.S. '92 (Electrical Engineering)
Stanford Univ., Ph.D. '96 (Aeronautical and Astronautical Engineering)

Session 6C Presentation 2
"Hand's Free Operations in Zero-g"
Demo Table: Yes
mspenko@iit.edu | 312-567-3452

Matthew Spenko, Associate Professor
Mechanical, Materials, and Aerospace Dept
Illinois Institute of Technology (IIT)
robots.iit.edu

Abstract: The Robotics Lab@IIT, in collaboration with JPL, has developed a novel, controllable adhesive that combines the benefits of electrostatic adhesives with gecko-like directional dry adhesives. When working in combination, the two technologies create a positive feedback cycle whose adhesion, depending on the surface type, is often greater than the sum of its parts. The directional dry adhesive brings the electrostatic adhesive closer to the surface, increasing its effect. Similarly, the electrostatic adhesion helps engage more of the directional dry adhesive fibrillar structures, particularly on rough surfaces. This talk presents the new hybrid adhesive's manufacturing process and compares its performance to three other adhesive technologies manufactured using a similar process: reinforced PDMS, electrostatic and directional dry adhesion. Tests were performed on a set of ceramic tiles with varying roughness to quantify the adhesive's ability to generate shear adhesive force. The relative effectiveness of the hybrid adhesive increases as the surface roughness is increased. Experimental data are also presented for different substrate materials to demonstrate the enhanced performance achieved with the hybrid adhesive. Results show that the hybrid adhesive provides up to 5.1x greater adhesion than the electrostatic adhesive or directional dry adhesive technologies alone.

Background: Matthew Spenko is an associate professor in the Mechanical, Materials, and Aerospace Department at the Illinois Institute of Technology. He was an His research is in the general area of robotics with specific attention to mobility in challenging environments. He focuses on biologically inspired locomotion, novel vehicle designs, and robot-terrain interaction. He is a member of IEEE, ASME, ASEE, and ISTVS as well as an associate editor of the Journal of Field Robotics.

B.S. degree *cum laude* in Mechanical Engineering
Northwestern University in 1999

M.S. in Mechanical Engineering
Massachusetts Institute of Technology in 2001

Ph.D. in Mechanical Engineering
Massachusetts Institute of Technology in 2005

Intelligence Community Postdoctoral Scholar
Mechanical Engineering Department's Center for Design Research
Stanford University from 2005 to 2007

Session 6C Presentation 3
"Electro-Adhesion Technology for Space"
Demo: Yes Poster: Yes
One-on-One Table: Yes

Dr Gerhard C Ferreira
Justick International, South Africa
gerhard@justick.com
www.justick.com
+27 82 894 6275

Abstract: Justick International (Pty) Ltd, a South African registered company, invented and patented the Justick electro-adhesion surface that generates Coulomb forces to attract materials for a variety of purposes.

While designed for use in a broad earth-based market, it seems appropriate to attempt to use the device, or a close derivative, in space where the astronauts currently use tape, baggies and bungee cords to secure parts and documents. Without gravity to overcome, the effectiveness of the EA forces and the number of applications will greatly increase. Holding food, catching dust, providing crews a personal area to hold items in their compartments and potentially many other uses which Justick is not yet familiar.

Justick maintains a ready posture for further innovation, performance improvements and adaptations that will enable performance and compliance with many new applications, such as may be required for spaceflight.

Justick products have been field tested in the South African and other Global markets for several years in more than 25 countries.

Justick meets the high regulatory standards (CE, ETL, CETL, CB) required in global markets as well as all safety requirements for home, office and commercial use.

Awards: At America's largest invention show, Inpex 2006, Justick received several Awards: for product innovations in Office Supplies and Stationery, the acclaimed XEROX Innovation Award and overall Grand Prise first runner up of all inventions, in all categories. In 2011 Justick was also awarded as the winner for the "Desk Accessory" category at the London Stationary Show and, in 2012 Justick won Australia's Best Office Products for 2012 in the Technology Category.

Background: Dr Gerhard Ferreira is the CEO of Justick International. In 2003 he became involved in the company and joined on a full time basis as from June 2008. He has been instrumental in the globalization of the technology and product range.

1987-1992: MBChB University of Pretoria, South Africa

Session 6d Presentation 1
"A New NDT Tool"
Demo: No
One-on-One Table: No

Ward Rummel
Consulting Engineer
D&W Enterprises, LTD., LRC
ndter2001@yahoo.com
(303) 791-1940

Abstract: Nondestructive Inspection (NDI) is integral to the production, acceptance and life-cycle management of critical structures. Weight and structural performance efficiencies are important considerations in space structures and systems and the basis for performance acceptance criteria is often driven by the capabilities and reliability of applied nondestructive inspection procedures. NDI is not absolute ("no flaws") and quantification of nondestructive inspection capabilities are not simple tasks. Anomalies (flaws) that impact structural integrity in new build (production) may be assessed by rigorous test to support design/production validation. Service life (life cycle) estimates may be based on additional testing to assess durability and damage tolerance. Damage assessment criteria may change as a result of structures use, rework/mission or environment changes. A permanent NDI record may be useful in assessing continuing fitness for purpose and reduce long term inspection efforts to find flaws by identifying likely candidate areas.

Technology Background: Liquid penetrant inspection is a widely applied NDI method for assessment of structural condition and integrity and results are usually recorded by visual observation. This presentation introduces new **tool** for providing a permanent record of penetrant inspection results in the form of an overlay film. This tool is not needed for most penetrant applications, but may be useful for critical areas, unusual geometries, new service applications, structures test results, failure analyses or materials/designs where durability and damage tolerance are difficult to predict. By documenting the results of the overlay film method during initial penetrant inspections, long term inspection plans can be prioritized for remote space vehicles intended for decades of remote use.

Presenter Background: Ward D. Rummel is best known for his work in development of the Probability of Detection (POD) metric that is used to verify and validate nondestructive evaluation procedure capabilities throughout the world. His career in nondestructive testing spans more then fifty years with more than 200 technical publication and presentations.. He is retired from 35 years of service with Lockheed Martin where his responsibility included: Chief Engineer for the Quality Department, Director of International Procurement, and Program Manager for various projects. His work on NASA programs proceeds the first men in space including major work on the Gemini, Apollo, Skylab, Space Shuttle, Space Station and continuing special oversight work in Nondestructive Testing across the agency. He has been recognized by the: United State Air Force, Lincoln Gold Medal for work in "Aircraft Structural Integrity"); Robert C. McMaster Gold Medal and Philip D. Johnson Lifetime Member (American Society for Nondestructive Testing); A.K. Rao, "Distinguished Memorial Lecture" (Indian Society for Nondestructive Testing); Fellow – American Society for Nondestructive Testing; Honorary Fellow – Indian Society for Nondestructive Testing; Director – Colorado Engineering Council; and is a standing member of "Academia International".

Session 6D Presentation 2
"Fiber Optic Sensing System"
Demo: No Poster: No
One-on-One Table: No
www.aeroi.org

Francisco Pena
AERO Institute / AFRC
Fiber Optic Sensing System
francisco.pena@nasa.gov
661-276-2622

Abstract: Fiber optic sensing systems (FOSSs) have the potential to dramatically improve the design and performance of aerospace vehicles. The FOSS concepts involve the distribution of fiber optic sensors that can be adhered to the surface of a structure in a network analogous to the nervous system in the human body. Optical fibers are approximately the diameter of human hair and can contain thousands of sensors on one fiber. The fiber optic sensors are sensitive to both strain and temperature. The quick response of the FOSS coupled with the high spatial resolution make the system ideal for condition based structural health monitoring (SHM) applications. The high spatial resolution enables engineers to develop dense stress and strain contours which enable the development of real time Factor of Safety assessments, and could potentially be used to provide early warnings of catastrophic structural failures. The distributed strain and temperature measurements also enable engineers to obtain additional parameters in real time such as structural shape deformation, applied loads, liquid level sensing, buckling, mode shapes and natural frequencies to name a few.

Background: Mr. Pena is an Aerospace Engineer working with NASA Armstrong's Fiber Optic Sensing System development team. He began working with Fiber Optic Sensors for strain based structural health monitoring in 2012 while working on Composite Overwrapped Pressure Vessels. Current field of research includes investigation of real-time load sensing algorithms based on distributed sensing network, and active flight load alleviation on aircraft wings utilizing fiber optic sensors.

2003-2008: B.S. Mechanical Engineering UCSB

2008-2010: C&D Zodiac Aerospace

2010-2013: M.S. Mechanical Engineering CSULA

2013-Present: AERO Institute

Session 6D Presentation 3
"In-situ Versus Imbedded Sensing - How Health Monitoring Effects Inspection Needs"
Demo: No Poster: No
One-on-One Table: No

B. Boro Djordjevic
Materials & Sensors Tech
www.mast-inc.com
bbd@mast-inc.com
410-766-5002

Abstract: In-situ autonomous monitoring and inspection system for the space vehicle is ideally small, light, self sustaining, no maintenance and no power use with an operational life of 5 or even 20 years. To reach such goals, one needs to consider sensing technologies, engineering integrity requirements and foremost, predictive sensing information usefulness for the inspection decisions needs. It has been at least 20 to 25 years since the idea of health monitoring and prognostics inspection, based on the platform integrated, permanently mounted sensors, initiated extensive research and development efforts. For all the excitement and promise, with some successful applications, for example on modern jet engines and helicopter monitoring systems, very limited progress has been made on spacecraft structural monitoring. Impacting platform cradle to grave monitoring capability and directly aiding and replacing inspection needs can have enormous operational benefits in both safety and maintenance work in difficult to access areas of the platform. From fiber optic strain sensors to the acoustic/ ultrasonic sensing devices, in-situ or embedded applications are still not developed and we are lacking integrated diagnostic engineering tools. Most of the existing hardware is complex and an understanding of the underlying sensing signals physics is limited. With historic perspective of the early work on "Embedded Sensors for the Submarine Structures" and the efforts related to "Prognostics Diagnostics" for structural integrity, we need to reassess engineering reality of practical in space inspection methodology that can assure safe monitoring of the spacecraft performance. By shrinking size of instrumentation and using enormously increased analytic computing power, it is feasible to develop comprehensive sensors monitoring of the space platforms. However, we are still inadequately knowledgeable on the significance and interpretation of the measured signals or even validity of the sensing approach. By focusing engineering development in sensor technology, it is possible to enable autonomous integrity inspection of the space platforms assuring both safety and controlled repair/problem mitigation actions. Such developments will reduce platform management loads and in manned flight, allow crews the time for other tasks.

Background: Ph.D., 1979, Materials Science and Eng., M.S.E., 1978, Mechanical Eng. and Materials Science, Johns Hopkins University, B.S., 1973, Physics, College of William and Mary. 40+ years of work experience in industry and academia. Technical Director, Manager or Principal Investigator on programs encompassing: NDE, health monitoring, prognostic technologies, advanced composites, advanced materials processing, surface mount technology, packaging chip-on-board, embedded sensors, space launch vehicle and air/space systems. Worked as consultant to industry, NASA, DoD, and served on National Materials Advisory Board committees. Authored over 160 publications, 7 books and holds 7 patents. Presented technical talks throughout the world and organized scientific conferences. Listed in "Who's Who in the World", "Who's Who's in America".

Day 2 Lunch Speaker Presentation 1
"A Novel Inspection Technique Using Spatial Phase Imaging: Applications for the International Space Station (ISS) Program"
Demo: No Poster: Yes
One-on-One Table: Yes

Preston Bornman | *Blair Barbour (Remote)*
RPS Group | Photon-X SPI 3D
www.photon-x.com
preston.bornman@rpsgroup.com
713-416-2281

Abstract: With NASA currently assessing the life extension capacity of the International Space Station (ISS), inspection techniques are used as a critical element in determining how long the ISS can be safely operated. Since there are limited resources available on the ISS, techniques that utilize low power, perform multiple functions, and require no radiation sources are preferred. Photon-X has developed and demonstrated a high- resolution inspection technique that utilizes Spatial Phase Imaging (SPI) to provide 3-D imaging using a single lens camera and natural lighting. SPI can be used across a broad dynamic range and can be used to detect emitted or reflected energy to create a 3-D image of the object under examination. SPI systems are typically comprised of a camera and a laptop. SPI imaging has been used to assess corrosion and physical damage on surfaces, biometric analysis, and object tracking, among others. The broad range of applications to the ISS, as well as future NEO and deep space operations, similarly includes corrosion damage, micro-meteoroid/orbital debris (MM/OD) damage assessment, autonomous rendezvous and docking/berthing, logistics management, biometric measurement, and autonomous robotics. The presentation introduces the fundamentals of SPI, discusses previous applications and demonstrations, and gives an overview of potential ISS applications. The presentation includes an overview of a new proven

Background: Mr. Preston Bornman joined RPS Group in May 2012 where he serves as Director of Business Development. RPS knowledge –Reservoir is the real-time enterprise system integration partner for IDEAS/Photon-X. Preston is the founder of One World Sports, a U.S. cable sports network and a founder of R2M Capital, a commodities trading hedge fund. Preston serves on the board of IDEAS Energy Services, which is the commercialization company for Photon-X in the Aerospace, Energy, and Transportation business segments. Mr. Bornman has a BA (Geology & Anthropology) Southern Methodist University. Mr. Bornman is supported by Photon-X's space integration partner Jim Baker, CEO of Arrow Science and Technology, and by Blair Barbour, Founder and CEO Photon-X (via weblink).

Background: Blair Barbour is the founder, President, and CEO of Photon-X. Blair has over 25 years' experience in development of the Photon-X's Spatial Phase Imaging optical technology. Blair was presented with the "National Defense Industrial Association Materiel Acquisition/Technology Award" in recognition of his accomplishments in furthering sensor technology in the area of Passive Spatial Phase Imaging Techniques. Blair is also the co-founder and CTO of IDEAS Integration a solutions company ("ISC") that was created to prioritize for focus and speed of market entry for the many varied uses of SPI technology. The Healthcare ISC has engineered a Native 3D/Single Lens Surgical Camera that operates through a baroscopic system. The Media and Entertainment ISC has engineered a single lens camera platform designed for 3D film production, motion capture, depth recognition and CGI processing. Blair holds numerous patents and has published over 30 technical papers. Founded in 1999, NASA was one of the Photon-X's first clients.

Day 2 Lunch—Presentation 2
"SPAR 3D Conference Overview"
Demo: No Poster: No
One-on-One Table: Yes
www.sparpointgroup.com

Christopher M. Zmijewski
Advisory Board, SPAR Int'l Conferences on 3D Imaging
czmijewski@haagglobal.com
lmclaughlin@divcom.com

Abstract: The annual *SPAR International 3D Measurement & Imaging Conference* focuses on business and technology considerations for end-to-end 3D measurement to inform attendees on latest technologies to increase safety, mitigate risk, reduce project time and save money. The group also hosts the *International LiDAR & Mapping Forum (ILMF)*, focused on airborne, terrestrial and bathymetric LiDAR. Together, the conferences, webinars, blogs and SPARView newsletters gather experts to answer such questions as:

- Which 3D capture, processing and visualization tools are best for specific project applications?
- Which tools will meet needs for accuracy while staying within cost limitations?
- What are best methods for processing and managing large data sets?
- How best to share 3D information across the web with many stakeholders?

All major 3D hardware and software options are on display in a platform-neutral exhibit hall. SPAR Point Group is part of Diversified Communications based in Portland, Maine.

The next SPAR conference in the US

March 30-April 2, 2015 in Houston, Texas

Website: http://www.sparpointgroup.com/International/

Background: Mr. Zmijewski is a member of the Advisory Board for the SPAR International 3D conferences. He is Vice President of Haag 3D Solutions, prior to which he was the Practice Leader for 3D Digital Imaging and Mapping responsible for all aspects of overall initiatives relative to 3D laser scanning for Stantec North America. With over 28 years of experience in the science of surveying, he has been involved with the technology of 3D laser scanning for the last 10 years.

Demo Table: Yes One-on-One Table: Yes **Charles Nichols/Regor L. Saulsberry**
"Composite Pressure Vessel/Rocket Propulsion Inspections" **NASA/JSC White Sands Test Facility**
charles.nichols@nasa.gov |575-312-4136 **regor.l.saulsberry@nasa.gov| 575-635-7970**

___Regor Saulsberry___ ___Charles Nichols____

Abstract: Nondestructive evaluation (NDE) enhanced endoscopic tools and condition-based monitoring are needed to enhance inspection of current and future NASA spacecraft systems, their associated structures and propulsion components for manufacture and in-service. The types of technologies needed for in-space inspection can greatly benefit ground inspection as well. Components of concern include: high risk composite overwrapped pressure vessels (COPVs), engines (including acoustic cavities injectors, cooling cavities and interface lines) and other system components (including fuel flow liners, regulators, and valves). COPV inspections and monitoring during manufacturing can decrease as manufactured variability, risk from impacts and long term "stress rupture" and other service life issues. NASA has initiated a Profilometry/eddy current Multipurpose COPV Scanner and "Smart COPV" programs.

Background: Mr. Regor L. Saulsberry is a senior project manager and registered Professional Engineer at NASA-White Sands Test Facility (WSTF) Materials and Components Laboratories where he has worked since 1987. These 36 years of testing and analysis of Spacecraft systems, components, and materials for NDE/health assessment were key in Space Shuttle Orbiter Reaction Control Subsystem and Orbital Maneuvering System development and qualification. Saulsberry played a significant role in both Shuttle Post Challenge and Columbia "Return to Flight" efforts and has successfully managed many specialized NDE development projects. He has also led many component failure investigations and propulsion component redesign projects and leads several agency wide technical assessments for the NASA Engineering and Safety Center. Recent R&D in composite pressure vessel, associated NDE and structural health monitoring and state of the art Pyrotechnic device testing have resulted in several new capabilities for NASA.

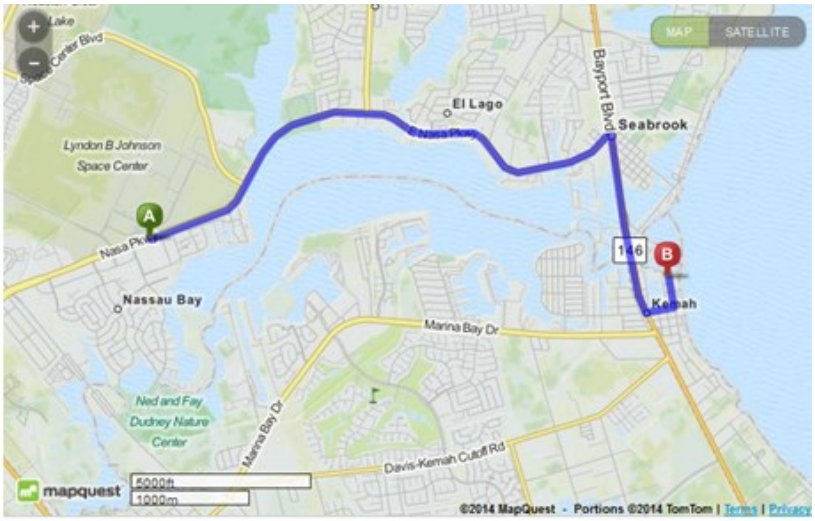
Background: Mr. Charles Nichols manages the Metallurgical Laboratory supporting numerous test programs for NASA's Nondestructive Working Group (NNWG), NASA's Engineering and Safety Center (NESC), and countless international partners. He served as principal modal acoustic emission analyst developing software with GRC for smartly instrumented composite pressure vessels (CPV's). Charles also served as principal CPV profile data analyst during the development of the Nitrogen and Oxygen Resupply System for the International Space Station. Prior experience includes 4 years as a dispatcher and Sergeant for United States Marine Corps Convoy Security. After earning a B.S. in Mechanical Engineering with Honors from NMSU in 2010, he served 1 year as a bridge inspector for NMSU Center for Transportation Research. Having served at WSTF since 2011, he is incumbent NNWG Vice Chairman and incoming Chairman for 2016.

B.S. Mechanical Engineering, with Honors- 2010

Area Restaurant Guide

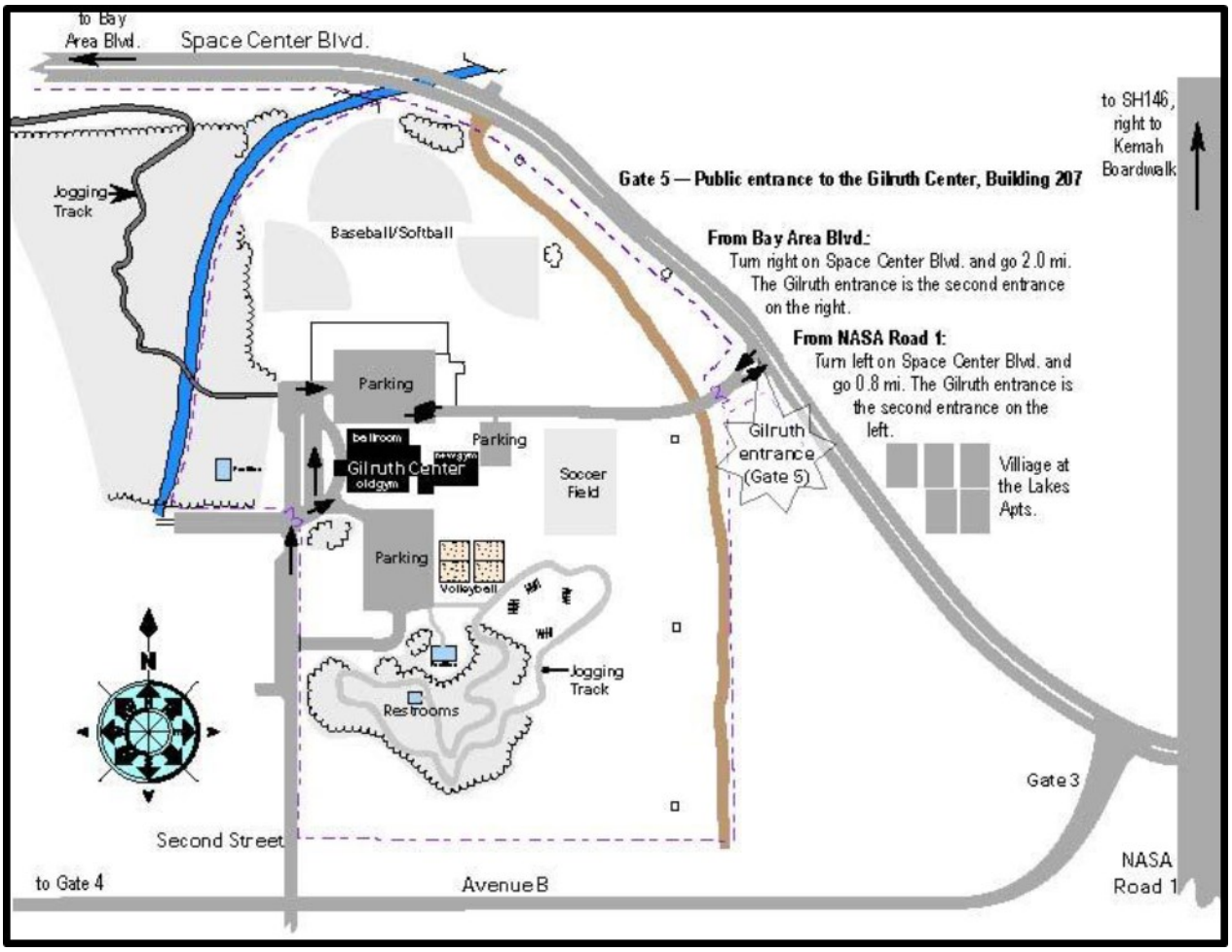
- ★ **Perry's Steakhouse & Grille** (281) 286-8800
  - 487 Bay Area Blvd. Houston, TX
- ★ **Carrabba's Italian Grill** (281) 338-0574
  - 502 Bay Area Blvd. Webster, TX
- ★ **Pappasito's Cantina** (281) 338-2885
  - 20099 Gulf Freeway, Webster, TX
- ★ **The Cheesecake Factory** (281) 488-0822
  - 1450 Bay Area Blvd. Webster, TX
- ★ **P.F. Chang's** (281) 898-7700
  - 1454 W Bay Area Blvd. Friendswood, TX
- ★ **Mamacita's Mexican Restaurant** (281) 332-5362
  - 515 E NASA Pkwy. Webster,TX
- ★ **Tommy's Oyster Bar** (281) 480-2221
  - 2555 Bay Area Blvd. Houston, TX
- ★ **Masa Sushi** (281) 486-9888
  - 977 NASA Pkwy, Houston, TX
- ★ **Frenchie's Italian** (281) 486-7144
  - 1041 NASA Pkwy, Houston, TX
- ★ **Chuy's Mexican Restaurant** (281) 554-2489
  - 20975 Gulf Freeway, Webster, TX
- ★ **BJ's Restaurant and Brewhouse** (281) 316-3037
  - 515 Bay Area Blvd, Webster,TX
- ★ **Kemah Boardwalk Restaurants**

  www.kemahboardwalk.com,
  - 215 Kipp Ave, Kemah, TX
    - Landry's Seafood
    - Aquarium
    - Saltgrass Steakhouse
    - The Flying Dutchman
    - Cadillac Bar



ISIW 2014 Location: NASA Johnson Space Center

Gilruth Center – Outside the Gate – no NASA Badging Needed



Alex Tongue
NASA (S5B-P5)

Bradley Sallee
SPEC (S4C-P1)

Casey Coss
Panoscan (S4C-P2)

Nathan Hagen
Rebellion Photonics (S4C-P5)

Ajay Koshti
NASA (S4D-P2)

Kevin Tang
Cybernet Sys (S4D-P4)

Douglas Haanpaa
Cybernet Sys (S4D-P4)

Seth S. Kessler
Metis Des Corp(S4D-P5)

David A. Hinkley
Aerospace Corp (S5A-P1

Austin Williams
Tyvak NSSI (S5A-P2)

Al Tsuda
Tyvak NSSI (S5A-P2)

Michael D. Johnson
NanoRacks, LLC (S5A-P3)

Victor J. Studer
NASA (S5B-P1)

Yves Gonthier
CSA (S5B-P2)

Paul Glass Rana
noGriptech, Inc. (S5C-P1)

K. Gupta
Felsuma LLC (S5C-P2)

Aaron Parness
NASA (S5C-P3)

Aaron Trott
Invocon, Inc. (S5D-P1)

Christopher Bowman
DF&NN), LLC (S5D-P2)

Doug Goodman
Ridgetop Group, Inc. (S5D-P3)

Kyle Ferrio
RGI (S5D-P3)

Jose V. Benavides
SGT Inc. (S6A-P1)

Alvar Saenz-Otero
MIT (S6A-P2)

Mark Baybutt
SRI (S6B-P2)

Victor M. Aguero
SRI (S6C-P1)

Matthew Spenko
IIT (S6C-P2)

Gerhard c. Ferreira
Justick Intl (S6C-P3)

Ward Rummel
D&W E Ltd. (S6D-P1)

Francisco Pena
AERO/AFRC (S6D-P2)

B. Boro Djordjevic
M&S Tech (S6D-P3)

Christopher Zmijewski
SPAR 3D (S6E-P2)

Mr. Hale
NASA Retired (S?-P?)

NASA Engineering and Safety Center
In-Space Inspection Technology Workshop, 2014