

COE CST Third Annual Technical Meeting: Welcome!

***Ken Davidian
COE CST ATM3 in Washington, DC
Tuesday, October 29, 2013***



**Center of Excellence for
Commercial Space Transportation**



Overview

- Welcome!
 - Pls
 - Students
 - CESTAC
 - Affiliate Members
 - FAA Employees
 - Others!
- Safety & Logistics
- Meals & Network Breaks
- Agenda & Schedule
- Banner Competition

Agenda & Schedule

9:00 AM	OPENING REMARKS	9:00 AM	DAY 2 OPENING REMARKS	9:00 AM
9:15 AM	WELCOME (K. Davidian, FAA AST) FAA OPENING KEYNOTE SPEAKER (G. Nield, FAA AST) NASA OPENING SPEAKER (F. Chandler, NASA HQ OCT)	9:15 AM		9:15 AM
9:30 AM		9:30 AM	3: HUMAN SPACEFLIGHT RESEARCH 184. Comm1 Spacecraft Human Rating (CU-Klaus) 255. Wearable Biomedical Equip (UTMB-Castleberry) 256. Centrifuge Testing (UTMB-Vanderploeg)	9:30 AM
9:45 AM		9:45 AM	294. Minor Injury Severity Scale (UTMB-Castleberry)	9:45 AM
10:00 AM	PROGRAMMATIC OVERVIEWS - FAA COE Welcome & Overview (P. Watts, FAA COE) - COE CST Status Report (K. Davidian, FAA AST)	10:00 AM	295. EMF Effects on Implantable Devices (UTMB-Vanderploeg)	10:00 AM
10:15 AM		10:15 AM		10:15 AM
10:30 AM	Keynote Speaker Congressman Bill Posey	10:30 AM		10:30 AM
10:45 AM	Networking Break	10:45 AM	Networking Break	10:45 AM
11:00 AM		11:00 AM		11:00 AM
11:15 AM	COE CST AFFILIATE AND ASSOCIATE MEMBERS - Overview (K. Davidian), McGill (Y. Nyampong), NASTAR (B. Henwood), ERAU (M. Hickey), DLR (J. Drescher).	11:15 AM	2c: SPACE TRANSPORTATION OPS, TECH & PAYLOADS 244. Autonomous RDV & Docking for Space Debris Mitigation (UF-Fitz-Coy), (FSU-Collins), (SU-Rock), (CU-Axelrad)	11:15 AM
11:30 AM	- Not in attendance: SatWest (B. Barnett), UN Lincoln (M. Schaeffer), NASA ARC (M. Dudley)	11:30 AM		11:30 AM
11:45 AM		11:45 AM		11:45 AM
12:00 PM	Lunch	12:00 PM	Lunch	12:00 PM
12:15 PM	Hyatt Regency Capitol Room A, (Lunch Included in your Registration)	12:15 PM	Hyatt Regency Capitol Room A, (Lunch Included in your Registration)	12:15 PM
12:30 PM	Keynote Speaker: Joseph Rothenberg	12:30 PM	Keynote Speaker: Dr. T. Dwayne McCay	12:30 PM
12:45 PM	(Chairman CESTAC/JHR Consulting)	12:45 PM	(Executive VP-COO, Florida Institute of Technology)	12:45 PM
1:00 PM	1a: SPACE TRAFFIC MANAGEMENT AND OPERATIONS 186. Space Env MMOD Modeling & Prediction (SU-Close), (CU-Fuller-Rowell)	1:00 PM	4: SPACE TRANSPORTATION INDUSTRY VIABILITY 193. Role of COE CST in EFP (SU-Hubbard), (CU-Born)	1:00 PM
1:15 PM		1:15 PM		1:15 PM
1:30 PM	1b: SPACE TRAFFIC MANAGEMENT AND OPERATIONS 185. Unified 4D Trajectory (SU-Alonso)	1:30 PM		1:30 PM
1:45 PM	258. Multi-disc Analysis of Safety Metrics (SU-Alonso)	1:45 PM		1:45 PM
2:00 PM	247. Air & Space Traffic Considerations for CST (FIT-Villaire)	2:00 PM	Parallel Sessions	2:00 PM
2:15 PM	1c: SPACE TRAFFIC MANAGEMENT AND OPERATIONS 257. Master's Launch & On-Orbit Ops Class (Cheetham)	2:15 PM	Allied Organization Presentations	2:15 PM
2:30 PM	187. Space Situational Awareness (CU-Scheeres)	2:30 PM	and CESTAC Closed Meeting	2:30 PM
2:45 PM	220. Space Operational Framework (NMSU-Hynes)	2:45 PM		2:45 PM
3:00 PM		3:00 PM		3:00 PM
3:15 PM	Networking Break	3:15 PM	Networking Break	3:15 PM
3:30 PM		3:30 PM		3:30 PM
3:45 PM	2a: SPACE TRANSPORTATION OPS, TECH & PAYLOADS 228. Magneto-Elastic Sensing for SHM (NMT-Zagrai, Ostergren) 253. Ultra High Temp Composites (UCF-Gou, Kapat)	3:45 PM	CESTAC OUTBRIEF - Joe Rothenberg (CESTAC)	3:45 PM
4:00 PM	293. Reduced Order Non-Linear Dynamic System Models (NMT-Miller)	4:00 PM	CLOSING KEYNOTE Mike Gold (Bigelow Aerospace/COMSTAC)	4:00 PM
4:15 PM		4:15 PM	CLOSING REMARKS - P. Watts (FAA COE), K. Davidian (FAA AST), T. Fiedler (FIT)	4:15 PM
4:30 PM	2b: SPACE TRANSPORTATION OPS, TECH & PAYLOADS 241. High Temp Pressure Transducers (UF-Sheplak), (FSU-Oates)	4:30 PM		4:30 PM
4:45 PM	298. Integration & Evaluation of Payloads (NMSU-Hynes)	4:45 PM	Adjournment	4:45 PM
5:00 PM	299. Nitrous Oxide Composite Tank Testing (NMT-Ostergren, Dr. Robert Abernathy and Dr. Michael Hargather)	5:00 PM		5:00 PM
5:15 PM	Adjournment	5:15 PM		5:15 PM

Banner Competition

Task 238: First Structural Health Monitoring Strategy for Near-Space Environment - Task # 228

Justin Collins (Co-PI) | **William Oates** (Co-PI)

Motivation: There is a need for high-resolution structural health monitoring (SHM) systems for the health and safety of the human spaceflight environment. The SHM system must be able to detect and localize damage in the structure of the vehicle and provide the necessary data for the repair and replacement of damaged components.

SEM Characterization: SEM characterization of the structure of the vehicle and the detection of damage in the structure of the vehicle.

TEM Characterization: TEM characterization of the structure of the vehicle and the detection of damage in the structure of the vehicle.

Coupling Between Fracture and Dislocation Evolution: Coupling between fracture and dislocation evolution in the structure of the vehicle.

Future Work: Future work on the SHM system and the detection of damage in the structure of the vehicle.

Task 241: High-Temperature Pressure Sensors for Hypersonic Vehicles

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: High-temperature pressure sensors are required for the accurate measurement of the pressure in the hypersonic flow field around a vehicle. The sensors must be able to operate at temperatures up to 2000 K and have a response time of less than 100 ns.

Research Methodology: Research methodology for the development of high-temperature pressure sensors.

Results: Results of the research on high-temperature pressure sensors.

Conclusions: Conclusions from the research on high-temperature pressure sensors.

Task 242: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

Fracture Mechanics of Laser Machined Sapphire

Justin Collins (Co-PI) | **William Oates** (Co-PI)

Motivation: Fracture mechanics of laser-machined sapphire is a critical issue for the design of high-temperature, high-pressure components for the space environment. The fracture mechanics of sapphire must be understood to ensure the safe and reliable operation of these components.

SEM Characterization: SEM characterization of the fracture mechanics of laser-machined sapphire.

TEM Characterization: TEM characterization of the fracture mechanics of laser-machined sapphire.

Coupling Between Fracture and Dislocation Evolution: Coupling between fracture and dislocation evolution in laser-machined sapphire.

Future Work: Future work on the fracture mechanics of laser-machined sapphire.

Task 239: Design Framework for Commercial Spaceport Operations

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: A design framework for commercial spaceport operations is needed to ensure the safe and efficient operation of these facilities. The framework must take into account the unique challenges of commercial spaceport operations, such as the need for rapid turn-around times and the ability to handle a wide range of payloads.

Research Methodology: Research methodology for the development of a design framework for commercial spaceport operations.

Results: Results of the research on a design framework for commercial spaceport operations.

Conclusions: Conclusions from the research on a design framework for commercial spaceport operations.

Task 240: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

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Motivation: A design framework for commercial spaceport operations is needed to ensure the safe and efficient operation of these facilities. The framework must take into account the unique challenges of commercial spaceport operations, such as the need for rapid turn-around times and the ability to handle a wide range of payloads.

Research Methodology: Research methodology for the development of a design framework for commercial spaceport operations.

Results: Results of the research on a design framework for commercial spaceport operations.

Conclusions: Conclusions from the research on a design framework for commercial spaceport operations.

Task Area 244: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

Task 240: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

Opportunities for Secondary and Residual Payloads on NASA Missions

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Opportunities for secondary and residual payloads on NASA missions are a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the identification and utilization of secondary and residual payloads on NASA missions.

Results: Results of the research on opportunities for secondary and residual payloads on NASA missions.

Conclusions: Conclusions from the research on opportunities for secondary and residual payloads on NASA missions.

Task 240: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

Task 240: Autonomous Rendezvous & Docking for Space Debris Mitigation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Autonomous rendezvous and docking (ARD) is a key technology for the safe and efficient removal of space debris. The ARD system must be able to detect, track, and identify debris and then maneuver the vehicle to rendezvous with and dock with the debris.

Research Methodology: Research methodology for the development of ARD systems.

Results: Results of the research on ARD systems.

Conclusions: Conclusions from the research on ARD systems.

SPACECRAFT HUMAN-RATING

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Human-rating of spacecraft is a critical issue for the development of commercial spaceflight. The human-rating process must be able to identify and mitigate the risks to the health and safety of the crew during spaceflight.

Research Methodology: Research methodology for the human-rating of spacecraft.

Results: Results of the research on human-rating of spacecraft.

Conclusions: Conclusions from the research on human-rating of spacecraft.

Validation of Non-Invasive Biomedical Monitoring in Centrifuge-Simulated Spaceflight

Alpogret Garcia, MD, PhD (PI) | **Rafael S. Blas, MD, MPH** (Co-PI) | **Traci L. Gentry, MD, MPH** (Co-PI) | **James M. Wandersburg, MD, MPH** (Co-PI)

Motivation: Validation of non-invasive biomedical monitoring in centrifuge-simulated spaceflight is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the validation of non-invasive biomedical monitoring in centrifuge-simulated spaceflight.

Results: Results of the research on validation of non-invasive biomedical monitoring in centrifuge-simulated spaceflight.

Conclusions: Conclusions from the research on validation of non-invasive biomedical monitoring in centrifuge-simulated spaceflight.

Tolerance of Centrifuge-Simulated Suborbital Spaceflight by Disease State

Rafael S. Blas, MD, MPH (PI) | **Alpogret Garcia, MD, PhD** (Co-PI) | **Traci L. Gentry, MD, MPH** (Co-PI) | **James M. Wandersburg, MD, MPH** (Co-PI)

Motivation: Tolerance of centrifuge-simulated suborbital spaceflight by disease state is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the tolerance of centrifuge-simulated suborbital spaceflight by disease state.

Results: Results of the research on tolerance of centrifuge-simulated suborbital spaceflight by disease state.

Conclusions: Conclusions from the research on tolerance of centrifuge-simulated suborbital spaceflight by disease state.

Center of Excellence for Commercial Space Transportation

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: The Center of Excellence for Commercial Space Transportation is a key area of research for the commercial space industry. The center must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the Center of Excellence for Commercial Space Transportation.

Results: Results of the research on the Center of Excellence for Commercial Space Transportation.

Conclusions: Conclusions from the research on the Center of Excellence for Commercial Space Transportation.

Commercial Spaceflight Operations Curriculum Development

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Commercial spaceflight operations curriculum development is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the development of commercial spaceflight operations curriculum.

Results: Results of the research on commercial spaceflight operations curriculum development.

Conclusions: Conclusions from the research on commercial spaceflight operations curriculum development.

Development of Minor Injury Severity Scale for Orbital Human Space Flight

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Development of a minor injury severity scale for orbital human space flight is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the development of a minor injury severity scale for orbital human space flight.

Results: Results of the research on development of a minor injury severity scale for orbital human space flight.

Conclusions: Conclusions from the research on development of a minor injury severity scale for orbital human space flight.

Emerging Space Industry Leaders (ESIL) Workshops

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Emerging space industry leaders (ESIL) workshops are a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the ESIL workshops.

Results: Results of the research on ESIL workshops.

Conclusions: Conclusions from the research on ESIL workshops.

Reduced-Order Non-Linear Dynamic System Models

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Reduced-order non-linear dynamic system models are a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the development of reduced-order non-linear dynamic system models.

Results: Results of the research on reduced-order non-linear dynamic system models.

Conclusions: Conclusions from the research on reduced-order non-linear dynamic system models.

New Metric Aerospace Students Association (NMAA) Equipment Sounding Rocket Project

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: The NMAA equipment sounding rocket project is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the NMAA equipment sounding rocket project.

Results: Results of the research on the NMAA equipment sounding rocket project.

Conclusions: Conclusions from the research on the NMAA equipment sounding rocket project.

Emerging Space Industry Leaders (ESIL) Workshops

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Emerging space industry leaders (ESIL) workshops are a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the ESIL workshops.

Results: Results of the research on ESIL workshops.

Conclusions: Conclusions from the research on ESIL workshops.

Implanted Medical Devices in the Radiation Environment of Commercial Spaceflight

Alpogret Garcia, MD, PhD (PI) | **Rafael S. Blas, MD, MPH** (Co-PI) | **Traci L. Gentry, MD, MPH** (Co-PI) | **James M. Wandersburg, MD, MPH** (Co-PI)

Motivation: Implanted medical devices in the radiation environment of commercial spaceflight is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the radiation environment of commercial spaceflight.

Results: Results of the research on implanted medical devices in the radiation environment of commercial spaceflight.

Conclusions: Conclusions from the research on implanted medical devices in the radiation environment of commercial spaceflight.

Development of Minor Injury Severity Scale for Orbital Human Space Flight

White Sarah-Michele Ringer (PI) | **NASA Kennedy Space Center** (Co-PI) | **Spacecraft America** (Co-PI)

Motivation: Development of a minor injury severity scale for orbital human space flight is a key area of research for the commercial space industry. The industry must be able to identify and utilize these opportunities to ensure the economic viability of commercial spaceflight.

Research Methodology: Research methodology for the development of a minor injury severity scale for orbital human space flight.

Results: Results of the research on development of a minor injury severity scale for orbital human space flight.

Conclusions: Conclusions from the research on development of a minor injury severity scale for orbital human space flight.

