

# Subsea Systems Institute (SSI)

Texas Center of Excellence (RESTORE Act)

## Overview:

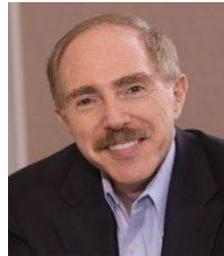
Subsea Systems Institute (SSI) is a Center of Excellence formed under the RESTORE Act and represents a collaboration between the University of Houston, Rice University and NASA/Johnson Space Center.

## Mission:

The mission of SSI is to improve safety and efficiency of offshore energy development by facilitating engineering, science and policy research and through third party unbiased validation of technology and practices.



**Ramanan Krishnamoorti**  
Chief Energy Officer, University of Houston  
Director, Subsea Systems Institute  
[ramanan@uh.edu](mailto:ramanan@uh.edu)  
713-743-4307



**Sergio Kapusta**  
Executive Director,  
Rice Energy and Natural  
Resources Initiative  
Rice University



**Kamlesh Lulla**  
Director, University Collaboration  
and Partnership, NASA-JSC



**Stephanie Coates**  
Program Manager  
Subsea Systems Institute  
[sacoates@uh.edu](mailto:sacoates@uh.edu)  
713-743-6530



# SSI Advisory Board

First	Last	Organization	Title	Category
John	Allen	Allen Energy Consultants LLC	President	Consultant
Yasser	Bangash	BP	Senior Facilities Engineer	Industry - Operator
Paul	Doucette	BHGE	General Manager, Industry Affairs & Stakeholder Engagement	Industry - Service
Tom	Feutrill	Woodside Energy USA (Inc)	Pluto Train 2 Project Manager	Industry - Operator
Luis	Garza-Rios	ExxonMobil Upstream Integrated Solutions	Senior Marine Consultant	Industry - Operator
Diana	Grauer	TechnipFMC	Director of Research, Chief Research Engineer	Industry - Service
Luc	Huyse	Chevron	Facilities Engineering R&D Portfolio Manager	Industry - Operator
Sudhir	Pai	Technology Collaboration Center	Chairman, Board of Directors	Industry - Service
Nikunj	Patel	Oceaneering International	Director, Engineering and Technology	Industry - Service
Francesco	Tripodi	Saipem USA	Commercial GoM, SOLUTIONS business line	Industry - Operator
Sid	Vinyard	HTC-International	Chairman	Industry

# Scope of SSI Activities

## Hardware:

- Drilling:
  - Risers
  - BOPs
  - Well Control
- Wellbore:
  - Integrity
  - Monitoring
- AUVs
- Pipelines
- Platforms

## Systems:

- Integrated Systems
  - Subsea Power
  - Automation
    - Digitalization
    - Sensors
    - Robotics
  - Human Factors
- Flow Assurance
- Renewable Energy
- Emissions Management
- Materials
- Decommissioning

# Previously Funded Projects

## Completed Activities:

- *Subsea Power Delivery and Communications: High Power, Batteries, Super-Capacitors, Acoustic*
- *Model-Based Real-Time BOP Monitoring System*
- *Drilling and Production Facility Monitoring: Seismic and Sonar Imaging*
- *Autonomous Underwater Vehicles (AUVs)*
- *Preliminary Development of Riser Gas Numerical Models*
- *Flange Leak Detection: Piezo - Sensors, Integration & Validation*
- *Flexible Low-Temperature Lithium Ion Batteries for Subsea*

## Ongoing Activities:

- *Remote Robotics for Unmanned Human Environments: Swarms of Drones, Robot Controlled Door Opening & Humanoid Robot Touch Integration*
- *SmartTouch: Towards Autonomous Subsea Robotics for Underwater Pipeline Inspection*
- *Subsea Power and Communications (Consortium Funded)*
- *Riser Gas Modeling and Validation (NAS Funded)*
- *Employee Well-Being and Mindfulness as Predictors of Process and Personal Safety (NAS Funded)*



# SSI Phase 2 Initiatives for Impact

## Late Life Management

Impact of Digital Transformation, Robotics and Automation on Late Life Management (including Decommissioning and Abandonment)

### Background

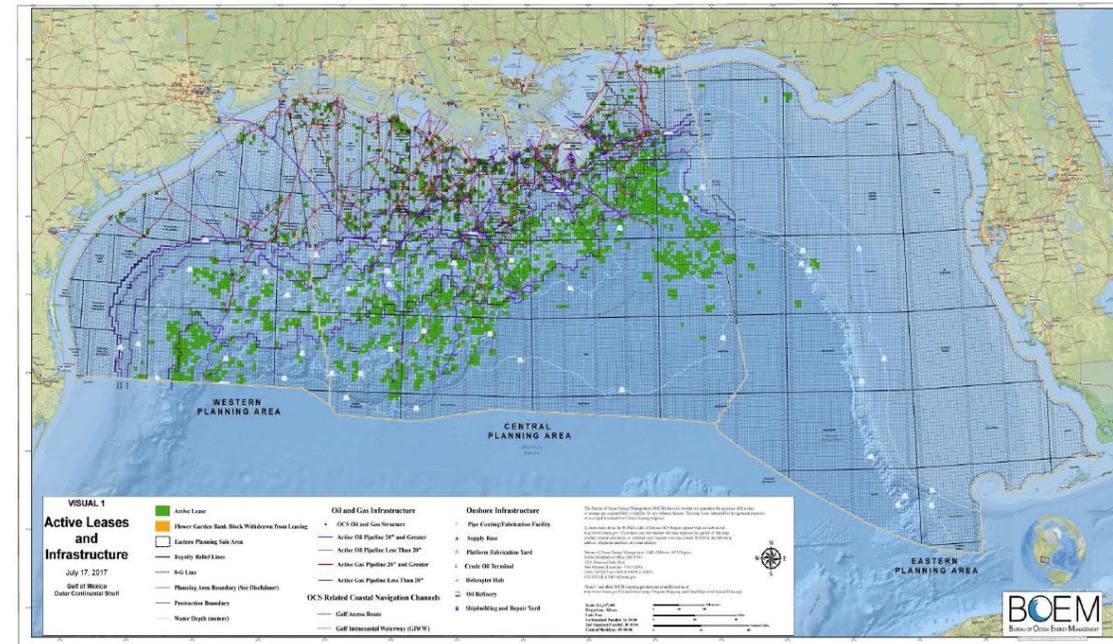
- More than half of the active platforms in the OCS are 25+ years old
- On average, 130 platforms are decommissioned per year
- Current decommissioning liabilities in GoM: \$40 billion



# SSI Phase 2 Initiatives for Impact

## Asset Integrity

- Inventory
- Inspection – Maintenance – Repair (IMR)
  - Conditional Monitoring, Protocol Employed and Operational State
  - Maintenance Surveillance & Non-Destructive Evaluation of Assets
- Predictive Risk Modeling
- Mitigation Strategies & Economic Decision Making



# Late Life Management & Asset Integrity Monitoring for GoM

## Automation & Digitalization

- Robotics - Inspection
- Maintenance & Operations



Continuous, Automated

Short term

Medium term

Long term

Automated Operations

Optimize and standardize late life maintenance of critical items

Automate monitoring and maintenance of critical items

AI/ML assisted late life management

Fully automate late life management

Short term

Medium term

Long term

Digital & Virtual

Digital platform development and data gathering

Extend life

Decommissioning simulation

AI assisted decommissioning management

# Late Life Management for GoM

## Monitoring

- Remote or Robot Enhanced
- Digitally & Technologically Enhanced
  - Condition Based Monitoring

Monitoring for Enhancing Late Life Management & Decommissioning

Short Term

Digital platform development and data gathering

Medium Term

Autonomous remote surveying of marine environment

Long Term

AI enabled Subsea & Platform survey, monitoring and reporting

# Life Extension for GoM Platforms

## Life Extension Focus

- Power
  - Preservation Technologies
- } • Renewable Integration  
• HV DC / Long tie-backs

Power &  
Utilities

Short Term

Replacing Diesel and NG  
based Power : HVDC & Long  
tie-backs

Medium Term

Developing  
Modular Utilities  
Eliminate all non-  
renewable power

Long Term

Integrating  
Renewables

# Asset Integrity Management

## Risk-Based Inspection & Analytics

- AI/ML
- Visualization

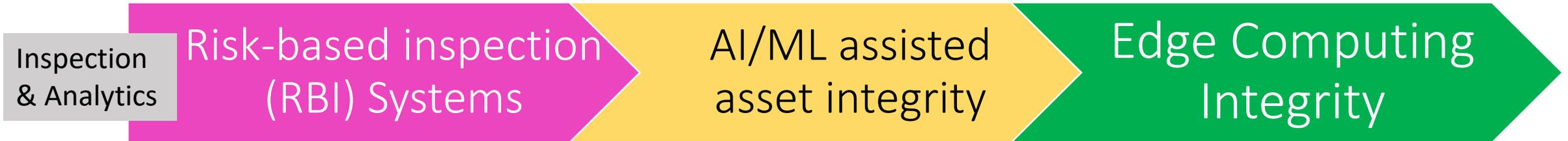
## Detection & Condition based Monitoring

Sensors & Communication  
Edge Computing

Short term

Medium term

Long term



Short term

Medium term

Long term



Funding				
	Year 1	Year 2	Year 3	Year 4
<b>Short Term</b> Each Project for 12 months @ \$75 K	ST1	ST3	ST5	ST7
	ST2	ST4	ST6	ST8
<b>Medium Term</b> Each Project for 24 months @ \$150 K Stage / Gate after 6, 12 and 18 months	MT1		MT4	
	MT2		MT5	
	MT3		MT6	
<b>Long Term</b> Each Project for 48 months @ \$300 K Stage / Gate after 12, 24 and 36 months			LT1	
			LT2	



# SSI Mission Research Grants RFP

## OBJECTIVE

Successful applications will lead to technology advancement consistent with the mission objectives of the SSI. The support of industry partners is strongly encouraged.

## PROGRAM DESCRIPTION

Proposals will address the following challenges:

- a. Life Extension and Decommissioning of Offshore Assets
- b. Offshore Asset Integrity Monitoring
- c. Power Electronics and Power Systems for Offshore Systems

These efforts can range from advances in robotics and automation, digital transformation, renewable energy integration, emissions reductions, offshore communication, artificial intelligence, materials challenges, etc.



# Award Information

Estimated number of awards	7
Anticipated funding amount	Up to \$75,000 in direct costs/award
Period of performance	11/15/2020 – 11/14/2021
Who is eligible	non-profit research institutions (for profit industry organizations are encouraged to participate as collaborators)
Submission information	See our website for requirements and templates
Key Dates	Grant application: 10/2/2020 5:00PM CST <a href="mailto:SSI@uh.edu">SSI@uh.edu</a> Planned start date: 11/15/2020

# Review and Selection Criteria

- Relevance to SSI Objectives: Is the project relevant to SSI objectives at an appropriate TRL level?
- Significance: Does the project address an important need for the oil and gas industry? Is there evidence of industry support?
- Innovation: Can the project provide original and innovative technology?
- Approach and Work Plan: Is there a well-developed work plan with a schedule and outcomes/deliverables?
- Quality of Investigators: Do the investigators have the necessary research background and experience to carry out this work?
- Cost Effectiveness: Is the project cost effective including the impact of any leveraged contributions? Is there evidence of Industry Support and pathways for translation?

# Questions?

## **Ramanan Krishnamoorti**

Chief Energy Officer, University of Houston

Director, Subsea Systems Institute

[ramanan@uh.edu](mailto:ramanan@uh.edu)

713-743-4307

## **Stephanie Coates**

Program Manager

Subsea Systems Institute

[sacoates@uh.edu](mailto:sacoates@uh.edu)

713-743-6530



[www.subseasystems.institute](http://www.subseasystems.institute)