# *Advisory Committee for the Ocean Energy Safety Institute*

29 July 2015

# *Safety Moment*

# *Flash Flood Safety*

- On average, more people are killed by flooding than by any other single severe weather hazard, including tornadoes, lightning, and hurricanes.
  - Most of these deaths occur at night, when it is more difficult to recognize flood dangers,
  - and when people are trapped in vehicles.

# *Remember…*

- DO NOT drive onto a flooded roadway.
- DO NOT drive through flowing water.
- If you approach a roadway that is flooded, TURN AROUND - DON'T DROWN.
- Drive with extreme caution if roads are even just wet or it is raining.
  - Brakes
  - Hydroplaning


*www.floodsafety.noaa.gov*

# *An example…*

# *Welcome*

Dr. M. Sam Mannan

OESI, Principal Investigator

# *Welcome*

Jim Pettigrew

OESI

# DoI Intent…

"The *funding for this initiative* was provided to establish an institute that would operate ***independently*** of the Department of the Interior while also supporting and enhancing Departmental programs through ***collaborative research and development*** and training to help identify operational improvements in the areas of offshore drilling and production safety and spill prevention.

This is an effort to establish an institute that can ***work with academia, the oil and gas industry, regulators and non-governmental organizations*** on the extremely important issues of increasing ***worker safety and environmental protection*** during the exploration, development and production of the nation's valuable offshore oil and natural gas resources."

# Advisory Committee































# *Chair and Vice-Chair Nomination and Vote*

Jim Pettigrew

OESI

# Bylaw Review

- The Chair and Vice-Chair of the Advisory Committee will be elected by members of the AC by a simple majority vote.
- A Chair and Vice-Chair will be elected every year by a simple vote of the AC.
  - If less than a quorum of the AC membership is present, in person, at any election meeting; the vote will be conducted electronically as soon as possible after that meeting.
  - The Vice-Chair will chair all committee meetings when the Chair is absent or unable to discharge the duties of Chair. The Vice-Chair will assume the position of Chair if the position of Chair is vacated.
- A quorum at any AC meeting shall require the presence of either the Chair or Vice-Chair plus twenty (20) Advisory Committee members.
- Only votes from AC members (or their attending delegate / representative) present during a meeting shall be counted.
  - No proxy votes shall be accepted.
- Committee members for each member organization shall be entitled to one vote per represented organization in attendance.
  - A “one member – one vote” rule shall apply during voting, regardless of the number of representative of any particular member organization.

# *Nominations*

Are now open!

# *Review of BSEE Director Tasks*

Jim Pettigrew

OESI

# *Director Salerno Tasks*

- Analysis of Equivalency of International Practices
- Research
  - Material Hardness (Bolts, Subsea equipment)
- Forums
- BSEE Science and Technology Challenge

# *Review of OESI Research Grand Challenges*

Jim Pettigrew

OESI

# *Ocean Energy Safety Grand Challenges*

- Blowout Prevention (not 'Preventer') should be a priority area of research
- Guideline for *Research Grand Challenge*
- Long term broader research areas identified
- A research matrix/community of practice will be prepared
- Process feeds into further development of Research Portfolio and Roadmap
- Research topics will be presented to the Advisory Committee (including BSEE)

# *Research Grand Challenges*

- **Well Construction**
  - well construction optimization, barrier design and verification, kick detection, subsea well control, pore pressure/fracture evaluation and prediction, zonal isolation

- **Instrumentation/Automation**
  - noble sensors, HPHT sensor, condition based health monitoring, health monitoring of BOP, sensor data quality, BOP design, big data management/analytics, real time monitoring

# *Research Grand Challenges*

- **New/Superior Material**
  - metal alloys, corrosion, HPHT materials, elastomers, structural health monitoring, integrated sensor, polymers

- **Human Factor Engineering and Risk Management**
  - leading indicators, human centered design, human machine interface, reengineering design life cycle

# Near-term Research Plan

| Research Areas | Leading Institute | Partner Institute |
|---|---|---|
| New Material (polymers, bolts) | UH | A&M |
| Human Factor Engineering & Risk Management (leading indicators, human centered design for deep water) | A&M | UT |
| Well Construction (well control, zonal isolation, casing) | UT | UH |

# *Quick Deliverable*

- OESI will facilitate development of a document that captures the ‘state-of-the-art best practices for the ‘Grand Challenge’ areas.
  - Human Factors Engineering will be the priority area initially.

# *New Materials in Support of Offshore Operations*

## Research Statement

*To develop, test and validate new materials that support offshore operations and help improve the safety and reliability of exploration and production*

- Research Challenge: New/Superior Materials: metal alloys, corrosion, HPHT materials, elastomers, structural health monitoring, integrated sensor, polymers
- Engineered materials offering improved properties allowing for new designs of offshore structures and operational components such as risers, etc. need to be developed. Serious barriers such as material and fabrication costs, needed design innovations, and the reliability, repair, and inspection of advanced engineered materials need to be addressed.

## Research Plan

- R&D work will be coordinated between UH (R. Krishnamoorti, PI, 1.0 FTE) and TAMU (H. J. Sue, co-PI, 0.5 FTE), $80K total budget
- Developed a plan to develop, test and validate advanced polymeric materials for HPHT and Corrosive Environments
- Specifically focus on the development & testing of Polyaryletherketones (PAEK) based composites

## Desired Value to Stakeholders

Developing corrosion resistant materials that can be exposed to HPHT conditions remains a significant materials challenge for the industry and is a significant area where applied and realistic materials development along with basic scientific advances can make rapid progress. Both PI and co-PI are engaged in developing advanced materials for extreme environments and bring unique fundamental and applied expertise to address these challenges.

# *Human Factors in Support of Offshore Operations*

## Research Statement

*To conduct focused, applied research that inform a reengineering of the design lifecycle to include Human Systems Integration and Human Centered Design.*

- Addresses possible Human Factors (HF) issues associated with:
  - *Workplace and interface design*: fatigue, situation awareness, human machine interface design (for both rig & control room operators), decision support, effective procedure design for comprehension/adherence, etc.
  - *Organizational and culture*: leadership, safety culture, training, hiring practices, etc.

## Research Plan

- R&D work will be coordinated between TAMU (S. C. Peres & M.S. Mannan, PIs, 0.5 FTE each) and UT Austin (R. Bias, co-PI, 0.5 FTE), $80K total budget.
- Plan being developed for independent, applied research into possible Human Factors (HF) issues that are associated with increased risks for incidents. Research will be done in collaboration with industry partners to allow for directly applicable findings.

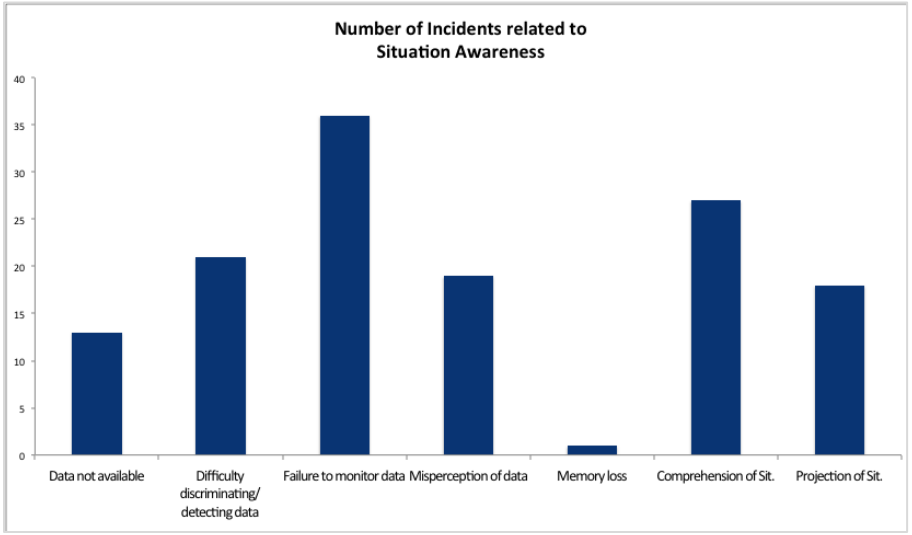
## Desired Value to Stakeholders

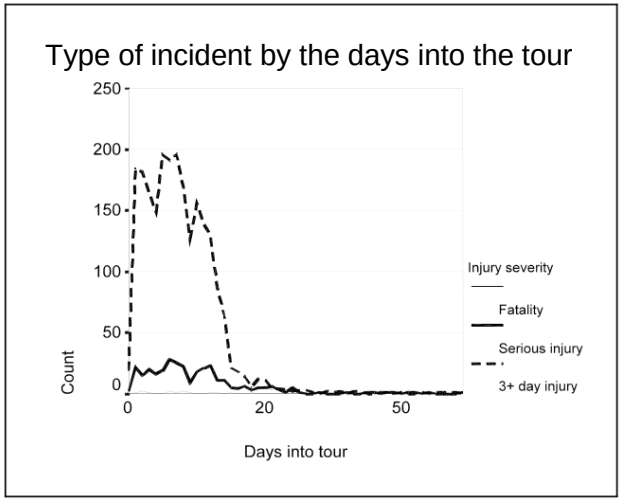
- Estimates indicate that US on & offshore facilities have had a major catastrophic event every ~1.77 years for the last 40 years and that 95%+ of these had direct human involvement in the cause.
- TAMU and UT Austin intend to conduct applied research in conjunction with industry partners to identify what HF findings need to be incorporated into design and leadership practices to mitigate the likelihood of these incidents.

# Examples of Human Factors Issues


**Issues with procedures** are associated with 65% of all industrial incidents. **{left}** Categorization of causes of events for company that involves Upstream, Downstream, Midstream, and Shipping

**Situation Awareness** is ones level of awareness of *task* and *environmental* conditions, and judging how these may change in the near future to *predict how the situation will develop*. **{below}** Shows the number of incident related to elements of situation awareness.




**Fatigue** is the inability to function at the desired level due to incomplete recovery from the demands of prior work, circadian rhythm adjustments, cognitive load, and other waking activities. Acute fatigue can occur when there is inadequate time to rest and recover. Cumulative (chronic) fatigue occurs when there is insufficient recovery from acute fatigue over time. {**left}** Shows effects of *circadian rhythm adjustments* as incidents decrease as the duration of the tour extends over time.

# Drilling Safety – Zonal Isolation Overview

## Research Statement

*To conduct meaningful, applied research and technology development that helps to improve the integrity and reliability of casing and cement barriers in offshore wells*

- Addresses BSEE Director Salerno's grand challenge on integrity of shallow liners and sub mudline casing hangers, and BSEE concerns about cementing
- Addresses issues associated with achieving, maintaining and verifying lasting zonal isolation (ZI) in offshore wells. Note that ZI problems are historically the leading cause of offshore blowouts, and were a lead cause of the Macondo/DW Horizon event

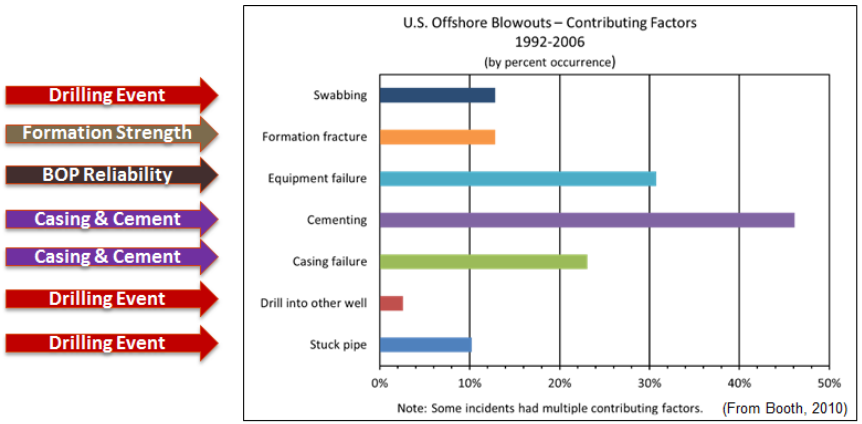
## Research Plan

- R&D work will be coordinated between UT Austin (E. van Oort, PI, 1.0 FTE) and UoH (V. Cumaraswamy, co-PI, 0.5 FTE), $80K total budget
- Plan being developed for independent, applied basic R&D into hanger reliability and improving the quality of offshore cementations, addressing such issues as improved displacement & cement placement, minimizing cement contamination, etc.

## Desired Value to Stakeholders

- Very little independent ZI R&D work is currently ongoing in the industry. UT Austin and UoH intend to execute original work with a strong applied focus to help deepwater operators improve their cementations, particularly across high-pressured / hydrocarbon-bearing zone, and be able to verify their barriers (cement, hangers, seals) better. This will help them improve drilling safety and reduce their exposure to uncontrolled well events.

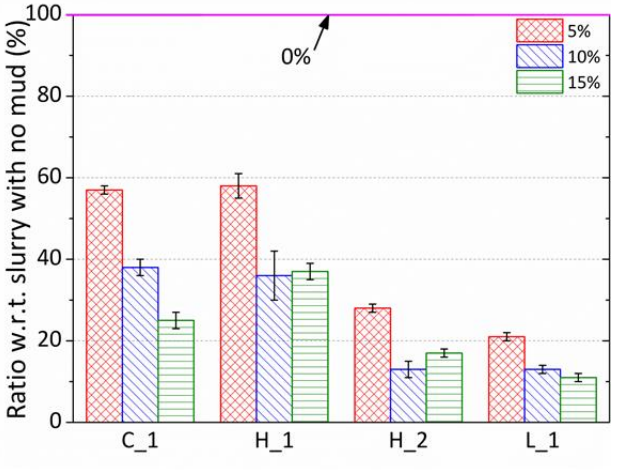
# Drilling Safety – Zonal Isolation Introduction




Barrier verification to help prevent major well control incidents:

- BOP Reliability Verification
- Casing & Cement Evaluation
- Formation Strength Evaluation
- Drilling Event Detection

**SPE 170323-MS** • Improved Regulatory Oversight using Real-Time Data Monitoring Technologies in the Wake of Macondo • Kyle M. Carter & Eric van Oort



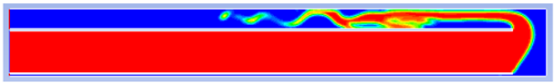

**SPE-170325-MS** • Contamination of Deepwater Well Cementations by Synthetic-Based Drilling Fluids • K. Aughenbaugh, R. Nair and E. van Oort

**{top Left} Cementing is the leading cause of US Offshore blowouts; {top right} portland cement is very sensitive to contamination by synthetic-based mud (SBM) used for drilling; {bottom right} UT Austin and UoH are working on ground-breaking new technologies such as real-time cement sensors and improved fluid displacement models (example shown)**

## Result – Flow pattern

**Case II:**

- Inlet Velocity = 0.1 m/s
- Gravity activated
- Eccentricity: 1 in



**Fluid Properties:**

| **Phase I**: (displaced fluid) | **Phase II**: (displacing fluid) |
|---|---|
| Density : 1500 (kg/m3) | Density : 1500 (kg/m3) |
| Viscosity: 0.003 (kg/(m.s)) | Viscosity: 0.002 (kg/(m.s)) |

# *Advisory Committee Operations*

Jim Pettigrew

OESI

# *Moving Forward with the AC*

- Work with Chair and Vice-Chair for alignment of effort
- Forum Topics and Planning
  - AC Members were very key to planning of today's Forum
- AC Meeting Agenda Development

# *Summary and Closing Remarks*

Jim Pettigrew

OESI

# *Future OESI AC Meeting Dates*

- 22 October 2015
- 19 January 2016
- 19 April 2016
- 19 July 2016
- 18 October 2016

Would your Company be interested in hosting a future AC meeting?

*Thanks and Be Safe Out There…*