

Perspectives on Ocean Energy Safety

Dr. M. Sam Mannan, PE, CSP, DHC, FAIChE, FIChemE, PPSE
Regents Professor and Executive Director
TEES Distinguished Research Professor
Holder of T. Michael O'Connor Chair I

Mary Kay O'Connor Process Safety Center
Artie McFerrin Department of Chemical Engineering
Texas A&M University System
College Station, Texas 77843-3122, USA
(979) 862-3985, mannan@tamu.edu

European Safety and Reliability Conference 2018



MARY KAY O'CONNOR
PROCESS SAFETY CENTER
TEXAS A&M ENGINEERING EXPERIMENT STATION

Outline

- ❑ Learning from past incidents
- ❑ Ocean energy safety research
 - Ocean Energy Safety Institute (OESI)
 - Initiatives and activities of other major research organizations
- ❑ Challenges for the 21st century
- ❑ Future research roadmap

Deepwater Horizon Incident (Macondo Disaster)

- ❑ April 20, 2010
- ❑ 11 fatalities
- ❑ Loss of rig
- ❑ ~4 million barrels of oil spilled¹
- ❑ Cost: ~\$61.6 billion²



U.S. Chemical Safety and Hazard Investigation Board, "Investigation Report Executive Summary: Drilling Rig Explosion and Fire at the Macondo Well", Report No. 2010-10-I-OS, 2010

¹Source: EPA

²Source: Washingtonpost/Rigzone

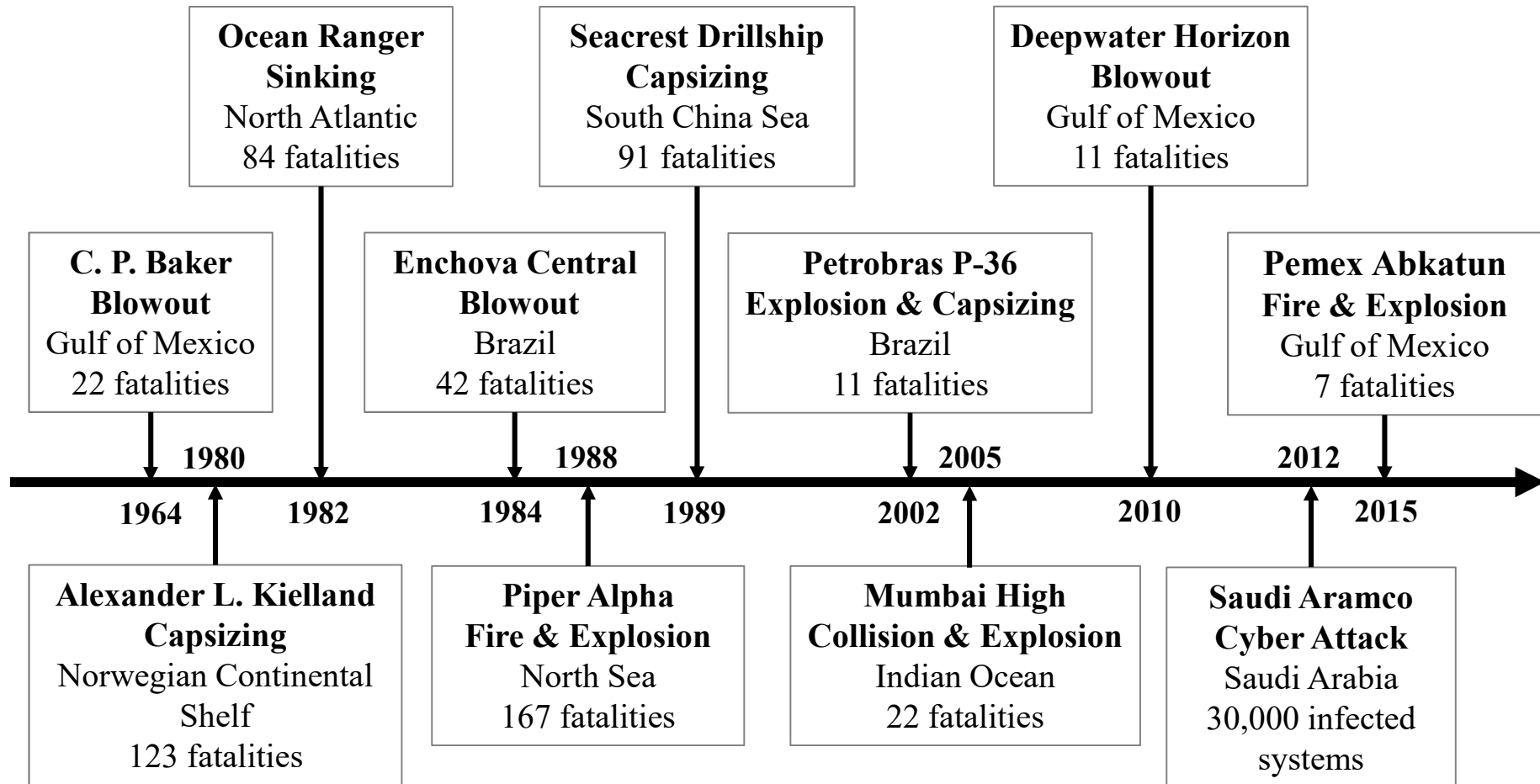
Technical/Operational Factors [1-4]

- ❑ Technical/operational issues: Inadequate/improper barriers/measures
 - Single liner used instead of liner/tieback casing
 - Cementing issues
 - Shoe track barrier
 - Inadequate number of centralizers
 - Inadequate pressure test
 - Design issues of BOP- Blind shear ram could not close because of the buckled off-centered pipe
 - Diversion of fluids to mud-gas-separator

Organizational Factors [1-4]

- ❑ Multiple warnings prior to the incident by various people/organization regarding several technical issues
- ❑ Organizational issues:
 - Poor leadership or management/ Poor safety culture
 - Decision made where safety was not given priority
 - Actions taken with unacceptable levels of risk
 - Not following appropriate maintenance/inspection guidelines
 - Inadequate training
 - Inadequate communication
 - Inadequate preparedness
- ❑ Regulation oversight

Major Offshore Incidents



Ocean Energy Safety Institute

April
2010

- Macondo blowout, Deepwater Horizon burns and sinks.

November
2010

- Secretary Salazar proposes an “Ocean Energy Safety Institute” ...to facilitate research and development, training, and implementation in the areas of offshore drilling safety, blowout containment and oil spill response.

October
2012

- Recommendation from the Ocean Energy Safety Advisory Committee for an “Ocean Energy Safety Institute”

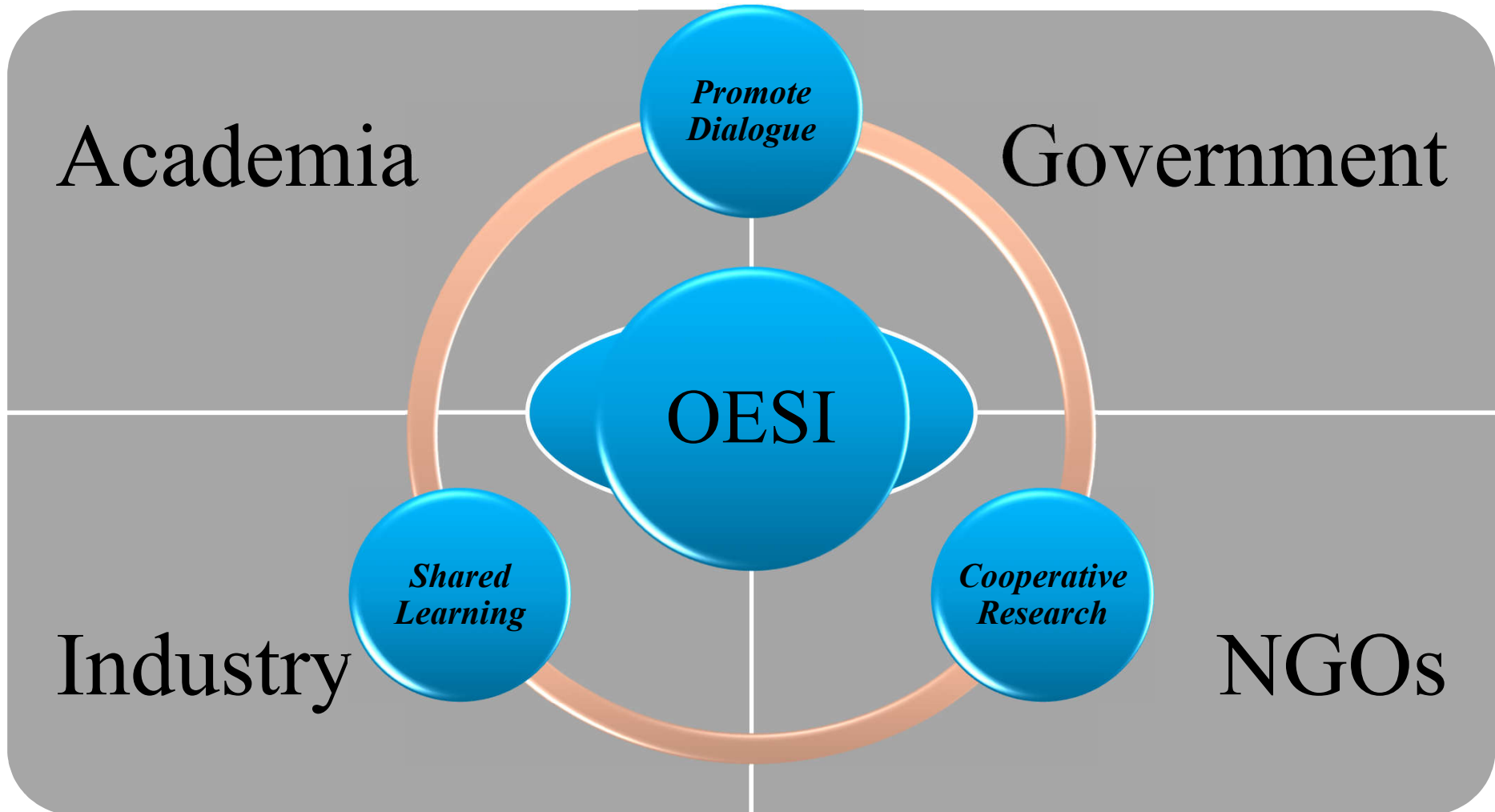
July
2013

- OESI Proposals submitted
 - Mary Kay O’Connor Process Safety Center
 - University of Houston, Texas A&M University, University of Texas

November
2013

- OESI Award announcement
 - Press conference held at Texas A&M with Bureau of Safety and Environmental Enforcement (BSEE) Director Brian Salerno and US Congressman Bill Flores.

Collaborative & Independent Dialogue



Successes to Date...

- ❑ Advisory Committee established and operating
- ❑ Forums for Dialogue
 - Risk; Sharing Data; Research Roadmap; Human Factors; Shallow-water Blowouts; SEMS Next; BAST Process; Safety Barrier Management; Alarm Management; Well Control, Well Integrity; Technology Assessment Program; BAST Technologies; Real-Time Monitoring Best Practices; International Standards Conference; OESI/HFES HF to Support Safer Offshore Operations
- ❑ Training classes developed for regulator
 - CFD, Real-time monitoring, Fracture Gradient and Drilling Margin, ...

Successes to Date...(cont.)

- ❑ Collaborative Research
 - Human Factors Engineering (TAMU/UT)
 - Zonal Isolation (UT/UH)
 - New Materials/Polymers (UH/TAMU)
- ❑ Research Proposals
 - US CSB Riser Gas Unloading scenario
 - Gulf Research Program Proposals
- ❑ Maersk Drilling Cognitive Fatigue research project
- ❑ Analysis of Equivalency of International Practices
- ❑ Review of BSEE Offshore Training Plan
- ❑ Real-Time Monitoring classes ongoing at UT-Austin
- ❑ Ocean Energy Technology Portal (OETP)

Activities of Other Research Organizations

❑ Center for Offshore Safety

- Established in 2011 in response to Macondo incident
- Provides 3rd party accreditation and certification to SEMS/RP 75
- Publishes guidelines and best practices in Safety Management



❑ Gulf Research Program

- Founded in 2013 as part of legal settlement with companies involved in the Macondo incident
- Independent, science-based program
- Helps promote advances in science, practice, and capacity to enhance offshore energy system safety and protect health and environment with long term benefits
- Funds grants, fellowships, and other activities in the areas of research and development, education and training, and monitoring and synthesis.



Activities of Other Research Organization

□ DeepStar

- Industry-led cooperative effort to develop economically viable, fit-for-purpose offshore production technology with global applicability
- Provides a forum to execute deep-water technology development projects and leverage the financial and technical resources of the deep-water industry.



□ RPSEA- Ultra Deep-Water Program

- Nonprofit organization
- Under contract with the Department of Energy's National Energy Technology Laboratory
- Designed to enable the development of new technologies necessary to produce more secure, abundant and affordable domestic energy supplies



Global Activities

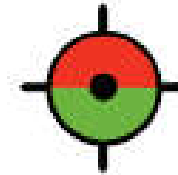
□ Norway

– PSA Safety Forum

- Established in 2001
- Topics: safety, emergency preparedness and working environment issues
- Guidance and project execution on safety related topics: **Risk level in the petroleum activity**

– Independent research institutes

- **International Research Institute of Stavanger (IRIS)**
 - Development of risk decision tools
 - Reliability data collection and assessments



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Global Activities

□ UK

– Oil & Gas UK



- Non-profit organization established in 2007
- Membership is open to all companies operating in the UK continental shelf
- Provides best practice guidelines and organizes forums related to offshore safety

– Marine Safety Forum



- Improve safety within marine sector of the offshore Oil and Gas industry

Global Activities

□ Australia

– Australian Petroleum Production & Exploration Association (APPEA)

- **Cross industry collaboration**
- **Efforts to reduce risk and ensure better emergency response:**

- Self-audit checklist
- MoU for Mutual Assistance
- Well capping strategies



appea

the voice of australia's oil and gas industry

Future Challenges

- ❑ Ultra-deepwater/Subsea operations
 - High Pressure High Temperature (HPHT) conditions
 - Maintenance and inspection
- ❑ Unconventional resources
 - Tight wells
 - Geological uncertainty
- ❑ Adopting with the technological advancements
 - Understanding appropriate level of automation
- ❑ Bridging skill gaps – develop competency
- ❑ Cyber security

Research Roadmap

- ❑ Novel technologies
 - Early kick detection
 - Advanced materials for HPHT conditions
 - Corrosion prevention and detection
 - Subsea leak detection
 - High performance pressure control equipment
 - Zonal isolation
 - Spill containment and mitigation
- ❑ Analytical tools
 - Characterize underground flow, subsea releases
- ❑ Robust risk assessment methodologies
 - Integration of technical, organizational and societal aspects

Research Roadmap

- ❑ Learning from the incidents and near-misses
 - Well-designed databases
 - Application of data mining techniques
 - Improve organizational learning and knowledge retention
- ❑ Predictive tools and techniques
 - Focus on leading safety performance indicators
 - Understand weak signals and incident precursors
- ❑ Human factors
 - Situational awareness, Fatigue management, Cognitive biases, Crew resource management, Human-machine interfaces, Alarm rationalization, Training

THANK YOU

QUESTIONS AND COMMENTS



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3. National Research Council, and Donald C. Winter, "Interim Report on Causes of the Deepwater Horizon Oil Rig Blowout and Ways to Prevent Such Events". National Academy of Engineering and National Research Council of the National Academies, 2010.
4. Smith, Patrick, et al. "Human error analysis of the Macondo well blowout." *Process Safety Progress* 32.2 (2013): 217-221.