PROJECT INFORMATION

Project Director's Name*	Dr. Kevin McSweeney
Organization*	ABS
Project Title*	Developing an Integrated Offshore Energy Industry Safety Culture Evaluation and Improvement Toolbox
Reporting Period*	42 Month

Note to Grantees: In sections 1 to 5, we ask you to highlight your accomplishments (including outputs and outcomes) through this grant award. These sections of the final grant report will be made available to the public.

1. GOALS AND ACCOMPLISHMENTS

1.1 Please restate the goals and objectives of your project.*

To advance the overall understanding of safety culture in the Gulf of Mexico (GoM) offshore industry by improving our understanding and offshore use of the various scales, methodologies, and frameworks among offshore assets and companies and assemble a pragmatic safety culture tool kit to aid in the evaluation and promotion of a positive safety culture.

This was accomplished by; 1) Increasing the understanding of different safety culture frameworks and the various safety culture factors contributing to a good safety culture; 2) Adapting and consolidating safety culture best practices from multiple high-risk industries; 3) Developing tools for safety culture measurement; and 4) This effort will serve as a foundation for the implementation of a pilot program to further understand, promote, and improve safety culture.

1.2 Describe the accomplishments of your project. You should include both the anticipated accomplishments that you outlined in your project proposal as well as any *unanticipated* accomplishments that have since occurred. Describe any activities you have conducted, programmatic progress made, or project benchmarks and milestones met.*

The team has built a safety culture framework that uses the BSEE safety culture guidance as its foundation. Comparisons with other high-risk industry safety culture frameworks further strengthen this foundation.

We have developed the following. These are available on the project's website (https://offshoresafety.lamar.edu/):

1) Questions/statements for the online safety culture survey.
2) An automated data analysis methodology.
3) Defined the protocols for worker interviews, site safety walkthroughs, review of previous incident investigations, and a Safety and Environmental Management System (SEMS) review.
4) For the protocols listed in #3, we have developed job aids and review/audit spreadsheets to support these evaluations.
5) A process for the review of potential leading indicators (accident precursors)
6) A process for the evaluation of overall safety culture maturity.

All the project milestones have been met, with the exception of the piloting of the tools with the industry. This was a goal of this project. However, we did have the chance to talk to many different industry members and received valuable feedback.

2. Outputs

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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** denotes required fields*

2. OUTPUTS

Outputs are tangible or measurable deliverables, products, data, or publications produced during the project period.

2.1. Please indicate the number of students (K-12, undergraduate, or graduate), postdoctoral scholars, citizen scientists, or other trainees involved in the project. *

Please enter 0 if none were involved.

K-12 students	0
Undergraduate students	0
Graduate students	6
Postdoctoral scholars	0
Citizen Scientists	0
Other Trainees	0

2.2. Has your project generated any data and/or information products? *

Generation of data includes transformations of existing data sets and generation of data from existing resources (e.g., maps and images). Information products include publications, models, software, code, curricula, and digital resources.

(Check all that apply.)

Responses Selected:

Information Products

2.3. Briefly describe how you fulfilled the approved Data Management Plan and, if applicable, any changes from the approved plan. *

We have published one journal paper and five conference papers. We presented the results at five conferences and symposiums. A project website (https://offshoresafety.lamar.edu/) has been established at Lamar University to disseminate the research results. The required Excel sheet has been populated and uploaded to "Supplemental Report Materials."

1. The project team has shared Initial Data Sharing / Common Working Files. Multiple advisory committee meetings were held to gather industry experts' feedback on the developed toolkit items. One presentation was delivered at the Center for Offshore Safety (COS) safety culture panel in 2021; numerous presentations were made to potential industry partners to garner industry testing/piloting, and a presentation was delivered in the meeting organized for the spring meeting of the COS, in 2023 to disseminate the final project outcome.

2. Safety Culture "Toolbox" Data and Other Information Products: The project server https://offshoresafety.lamar.edu/ has implemented a copy of the online survey software backed up by the MariaDB relational database. We have not been able to secure a company for a pilot test due to the COVID pandemic and the lengthy internal corporate approval process.

3. Metadata: Describe the Data, Data Collection, and Data Processing: The survey has been defined and implemented. Protocols for interviews, site walkthroughs, SEMS reviews, and incident reviews have been described. These have been reported in our journal paper.

4. Long-term Management: Curation and Accessibility. The Lamar University data center manages the project server https://offshoresafety.lamar.edu/. Activities and research results are stored on this server. The project director Dr. McSweeney also hosts a cloud-based file repository through Microsoft Teams at the American Bureau of Shipping.

If your project has produced publications, websites or data portals, GIS applications, models or simulations, software packages or digital tools, code, curricula, or other interactive media, please download the Excel worksheet entitled GRP Information Management Reporting. Use the "Information Products Report" tab in the worksheet to create an inventory of these products and to verify deposit in a curation facility. Upon completion, please upload the worksheet to your task list. If you need guidance on how to complete the Information Products Report, please e-mail gulfgrants@nas.edu. A member of GRP's data management staff will reach out to you.

2.4. Aside from data and information products, what other tangible or measurable deliverables or products (e.g., workshops, trainings, and outreach events) were produced during the project period? *

Upon completion of this form, you may upload supplemental material that represent the tangible or measurable deliverables or products to complement this narrative report.

1) Multiple advisory committee meetings were held to gather industry experts' feedback on the developed toolkits.
2) A panel session was attended at the Center for Offshore Safety (COS) safety culture panel at OTC 2021;
3) A presentation was delivered at the 2023 spring COS safety meeting to disseminate the final project outcome.
4) Individual briefings/discussions were made with potential industry partners to garner industry testing/piloting. These included, but were not limited to, Shell, Chevron, Valaris, Diamond, Pacific Drilling, Quarter North, W&T Offshore, Beacon, LLOG, etc.…
5) Briefings/updates were made to industry organizations such as COS, USCG, and the US Transportation Research Board – Marine Section - Human Factors Group

4. Information Products

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** denotes required fields*

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4. INFORMATION PRODUCTS

In this section, please provide a response to each question to complement the **Information Products Report** in the **GRP Information Products Management** Excel worksheet.

4.1. Please select the type(s) of information products that your project produced. *

Responses Selected:

1. Scholarly publications, reports or monographs, workshop summaries, or conference proceedings
2. Websites or data portals
6. Software packages or digital tools, or other interactive media

Scholarly publications, reports or monographs, workshop summaries, or conference proceedings *

Please provide a list of citations for project publication, reports and monographs, workshop summaries, and conference proceedings.

1. Kevin McSweeney, James Curry, Rick Curtis, Ezra Wari, Weihang Zhu, Brian Craig, Muhammad Muzamil Hussain, Arturo Haces-Garcia, Oghosa P Idahosa, Emad Zeni, Gubbala Seshasaikrishna, Development of a Comprehensive Multi-Component Toolkit for Offshore Safety Culture Assessment, Process Safety and Environmental Protection, https://doi.org/10.1016/j.psep.2023.05.030

2. Weihang Zhu, James Curry, Kevin McSweeney, Brian Craig, Rick Curtis, Ezra Wari, Development of an Offshore Safety Culture Maturity Model, IISE Annual Conference 2023, New Orleans, LA

3. Weihang Zhu, Rick Curtis, James Curry, Kevin McSweeney, Brian Craig, Ezra Wari, Identifying Safety Leading Indicators for the Offshore Industry, Proceedings of the 28th Offshore Symposium, March 8th, 2023, Houston, Texas

4. Ezra Wari, James Curry, Weihang Zhu, Brian Craig, Muhammad Muzamil Hussain, Arturo Haces-Garcia, Oghosa P Idahosa, Emad Zeni, Gubbala Seshasaikrishna, Describing Offshore Safety Culture with a Multi-Component Toolkit Approach, 1st Ocean Energy Safety Symposium, Mary Kay O'Connor Process Safety Center, College Station, Texas, October 5-7, 2022

5. James Curry, Weihang Zhu, Brian N. Craig, Emad Mohammad Zeni, Saikrishna S Gubbala, An Investigation on the Impact of Safety Culture Surveys Questionnaire on the Results through the Correlation Analysis, 24th Annual Process Safety International Symposium, October 19-21, 2021, College Station, Texas

6. Ning Lou, Ezra Wari, James Curry, Kevin McSweeney, Rick Curtis, Brian Craig, Muhammad Hussain, Weihang Zhu, Identifying Safety Culture Factors for Offshore Industry, 26th SNAME Symposium, Houston, TX, Apr 6-7, 2021

Websites or data portals *

Please provide a list of project websites and data portals (including the website URL).

https://offshoresafety.lamar.edu/ is the project website.

How long beyond the grant period will you maintain the project website/data portal and its contents? Please describe plans to archive the website/data portal and its contents after regular maintenance concludes.*

The web and database servers hosted at https://offshoresafety.lamar.edu/ will be maintained for at least five more years beyond the project. Lamar IT staff maintains The Lamar server at the Lamar Data Center. If the Lamar server becomes outdated after five to ten years, a new server will be purchased and set up there.

The website's contents are periodically archived in the project team member's personal computers and a cloud-based shared folder at Microsoft Teams licensed to the American Bureau of Shipping (ABS). The information will be stored in the cloud as long as ABS owns the Teams license.

Curricula for education and training, GIS applications, Models or simulations, Software packages or digital tools, or other interactive media, and Other *

If you produced any additional documentation to describe information products, please provide a list of this documentation (e.g., model or simulation documentation, software manuals, source code annotation).

1) We have implemented the offshore safety culture surveys on our own server at Lamar University. The set of questions has been published as part of the journal paper accepted by Process Safety and Environmental Protection.

2) We have developed an associated Guidance Document for the project. The contents of the Guidance Document include the basics of safety culture assessment (data gathering, analysis, etc.), the conduct of worker interviews, the basics of conducting a site safety walkthrough, the basics of performing a review of previous incident investigation reports, and SEMS-related audits, the identification of potential leading indicators of safety, safety culture maturity, and guidance on improving safety culture.

3) in support of the worker interviews, site walkthroughs, reviews/audits, job aids, and data spreadsheets have been developed. These include the following:
- NAS Safety Culture Toolkit SEMS-Audit Job Aid FINAL.pdf
- NAS Safety Culture Toolkit Worker Interviews Job Aid FINAL.pdf
- NAS Safety Culture Toolkit SEMS-Incident Investigation Review Job Aid FINAL.pdf
- NAS Safety Culture Toolkit SEMS-Site Walkthrough Job Aid FINAL.pdf
- Spreadsheet - NAS Safety Culture Toolkit Site Walkthrough.xlsx
- Spreadsheet - NAS Safety Culture Toolkit SEMS Incident Investigation Review.xlsx
- Spreadsheet - NAS Safety Culture Toolkit Worker Interviews.xlsx
- Spreadsheet - NAS Safety Culture Toolkit Site Walkthrough.xlsx

NOTE: These supporting documents (#3 above), along with the Guidance Document (#2 above), will be posted on the project's website (https://offshoresafety.lamar.edu/)

4.2. Beyond depositing information products in a repository, what other activities have you undertaken or will undertake to ensure that others (e.g., researchers, decision makers, and the public) can easily discover and access the listed information products? *

We have developed a website https://offshoresafety.lamar.edu/ for hosting the project information for dissemination purposes.

4.3. Are any of the information products you produced confidential, proprietary, or subject to special license agreements? *

No

5. Project Outcomes

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5. PROJECT OUTCOMES

Outcomes refer to the **impact(s), consequence(s), result(s), or effect(s)** that occur from carrying out the activities or outputs of the project. Outcomes may be environmental, behavioral, health-related, or programmatic. Example outcomes include, but are not limited to: increased learning, knowledge, skills, and motivation; policy changes; actions taken by a group as a result of information generated by your project.

5.1. Please describe the outcomes achieved during your project and how they were assessed. For this question, we are interested in learning about the immediate short-term outcomes that have already occurred during or as a result of your project. Do not include long-term outcomes you foresee your work contributing to beyond the end of the project. *

Methods, Procedures, and Process:
The items included in the toolkit include safety culture surveys, safety culture leading indicators and performance analysis tools, safety culture maturity models, an interview process and including analysis, a site observation process, a process for the review of incident investigations, incident reports, and near misses as well as process to review audit results. The team reviewed the literature to identify good / best practices to help quantify safety culture using these techniques. The team has used this information in the tool kit development process.

Results, Observations, and Conclusions:
Offshore and Onshore Safety Culture Survey Questions have been refined based on the 9 BSEE safety factors. We have also defined protocols for interviews, site safety walkthroughs, a review of previous incident investigations, a review of potential leading indicators (accident precursors), and a Safety and Environmental Management System (SEMS) review.

A conference paper on the developed offshore safety toolkit overview is published at Mary Kay O'Connor Process Safety Conference – Offshore Energy Safety Symposium, College Station, TX, October 2022. The paper was improved to be a journal paper accepted for publication in the Process Safety and Environmental Protection journal in May 2023.
Additionally, we have published four other conference papers and presented the research results at these conferences.

Offshore and Onshore Safety Culture Survey Questions have been thoroughly discussed and refined based on the 9 BSEE safety factors. We have also defined protocols for interviews, site safety walkthroughs, a review of previous incident investigations, a review of potential leading indicators (accident precursors), and a Safety and Environmental Management System (SEMS) review.

Research Team Meetings
The research team has been meeting weekly to discuss the research progress, task assignment, meeting arrangements, outreach activities, and the project's financial status.

Industry Outreach
1) A panel session was attended at the Center for Offshore Safety (COS) safety culture panel at OTC 2021;

2) A presentation was delivered at the 2023 spring COS safety meeting to disseminate the final project outcome.
3) Individual briefings/discussions were made with potential industry partners to garner industry testing/piloting. These included but were not limited to, Shell, Chevron, Valaris, Diamond, Pacific Drilling, Quarter North, W&T Offshore, Beacon, LLOG, etc.…
4) Briefings/discussions were made to industry organizations such as COS, USCG, and the US Transportation Research Board – Marine Section - Human Factors Group

5.2. We're interested in hearing not just the results of your project but what are their implications for or contributions to:

- **offshore energy system safety,**
- **environmental protection and stewardship, and/or**
- **health and community resilience**

Please describe what you consider to be the most remarkable accomplishment or finding of your project. What can others learn from your accomplishment and finding? How do you see it fitting in with your greater field of study or community of practice? *

A remarkable accomplishment of the project was sifting through voluminous amounts of safety culture information (from many different industries) and compiling a single set of tools that can be used for offshore oil and gas. Offshore and Onshore Safety Culture Survey Questions have been refined based on the 9 BSEE safety factors. We have also defined protocols for interviews, site safety walkthroughs, a review of previous incident investigations, a review of potential leading indicators (accident precursors), and a Safety and Environmental Management System (SEMS) review. These tools are ready for adoption/testing and to be put into practical use.

6. Communication

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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Note to Grantees: In Section 6, we seek input from you to help us evaluate the Gulf Research Program's funding strategy. This section will not be made available to the public.

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6. Information to Inform GRP Evaluations

6.1. Sharing the difficulties you encountered helps us learn from your experience. Describe any challenges you encountered in your project and how you addressed or overcame them. Challenges are inherent to conducting any complex project. These may include (but are not limited to): unexpected staffing changes, changes in the community you are working in, appearance of a new technology or dataset in the field you are working in, challenges accessing a field site, policy or regulatory changes that affect the issue you are addressing, low recruitment rates, delays in setting up services, or other problems in implementing and conducting your project. *

The project's core team members are Kevin McSweeney, Rick Curtis, James Curry, Weihang Zhu, and Brian Craig. Rick Curtis replaced Steve Arendt, who retired during the project. The ABS leader James Watson also retired in the middle of the project. One team member Julie Pray was shifted to another mission. Nevertheless, the core team members successfully delivered the project outcomes as initially planned.

Another challenge was obviously due to the pandemic. The pandemic occurred at a critical juncture within the project. During this time, we needed to identify potential industry partners to test/trial the toolkit items. Their focus was on safety activities related to COVID, which is completely understood; however, effectively communicating with these companies was challenging. Eventually, communication channels were opened with the increased use of video conferencing tools such as Zoom, MS Teams, etc.; even with industry-wide COVID protocols, however, in-person visits to offshore companies and sites were generally not encouraged.

Another difficulty we experienced was convincing companies to pilot-test our safety culture toolkit. The key issues were the perceived time to conduct the safety culture activities, their internally available resources (possibly pandemic-related), knowledge/skill sets to implement safety culture improvements, and finally, their hesitance to do the survey.

6.2. We like to hear about what you learned from your work and how you feel it affects future work or the work of others. Think back on your project strategies, methods, and activities, what worked and what did not? Is there anything you would do differently in the future? If so, tell us what and why. *

We have executed the plan as designed. Near the end of the project, we requested a six-month extension in the hope of getting a company to run a pilot test with our toolkit. We were not successful in convincing a company to do so.

The COVID pandemic greatly impacted the project in terms of enlisting industry partnerships. The COVID lockdown happened at a critical point in the project where we would have been extremely active in talking to potential industry partners; however, their focus was on establishing COVID protocols and their workers' overall health and safety; this is completely understood.

We also discovered that even though the safety culture evaluation and this project's team support would have been gratis, it took a long time to seek approval within a company. Even with the team's support, there was hesitance among potential industry partners to participate.

6.3. What are the next steps for this work, either for you and your project team or other researchers? Has this project led to other opportunities to work in this area? *

We want to find companies to test with the toolkit. The input from companies that reviewed the tool kit items during their development provided valuable information, which was great. Through multiple iterations of revisions and improvement, we hope to refine the tool to be better and applicable to a broad range of offshore assets. We also hope the same methodology can apply to other safety research areas.

6.4. Have you developed new collaborations or partnerships (formal or informal) as a result of this work? If yes, please describe the new collaborations or partnerships. *

The industry organization we mainly collaborated with was the Center for Offshore Safety (COS). They helped provide initial guidance and access to the various safety committees to hear about our project.

We also found a non-traditional "partnership" with the Transportation Research Board's Marine Group on the Human Element. They expressed interest in the topic and associated tool, but the marine industry is not the initial target of this project; however, we hope that this methodology can be modified to accommodate this maritime sector.

6.5. What, if any, positive changes in policy or practice do you foresee as a result of your work? *

If a company is willing to go through the comprehensive assessment with our safety culture toolkit, we believe a company will be able to find its areas of excellence and room for improvement quickly. Consequently, the company should see an improvement in safety culture in the long term.

6.6. If you could make one recommendation to the Gulf Research Program for how best to build on the work you conducted in this project, what would it be? *

Please connect us with industry participants who may be interested in testing/trialing these types of tools.

7. Communication and Dissemination

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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Note to Grantees: In Section 7, we ask you to help us communicate the importance, progress, and accomplishments of your work. Information provided in this section will be used by the Gulf Research Program to highlight its funded projects in print and electronic informational and promotional materials. The intended audience for the information provided in this section is different and should be thought of as a general audience. When you return to the dashboard, you may upload images that represent and illustrate the work of your project.

7.1. Please describe the most exciting or surprising thing you have learned while working on this project in a way that is understandable by a general audience. *

There were several exciting aspects of this project. One was interacting with different company Occupation Health and Safety (OHS) groups. Their interest in improving safety culture is sincere; unfortunately, we could not find an industry partner to test/pilot the tools even though the safety culture survey activities would cost them no out-of-pocket expenses because this project team would have supported them step by step. Another exciting aspect is that now there is one toolkit that can serve to aid in offshore safety culture assessment.

The major components of this toolkit are safety culture surveys, interviews, site safety walkthroughs, a review of previous incident investigations, a review of potential leading indicators (accident precursors), and a Safety and Environmental Management System (SEMS) review. This multi-component toolkit is expected to comprehensively assess the offshore safety culture at single or multiple facilities. A safety maturity evaluation strategy is proposed to incorporate the results from these safety culture measurements to describe an organization's safety maturity level.

7.2. Do you have any stories that capture the impact of this project? (optional)

If so, please share one or two. Examples of what we are interested in include stories of people/communities that the project has helped; lives that have changed; work that led to policy change, such as legislation or regulation; and research breakthroughs.

(No response)

7.3. Have any communications, outreach, or dissemination activities occurred in relation to your project?*

Please describe:

- Any press releases issued (other than that issued by the National Academies of Sciences, Engineering, and Medicine) about the project.
- Any media coverage or news stories about the project.
- Any social media accounts, websites, listservs, or other communication vehicles used to communicate information about this project. Please include relevant web addresses if available.

ABS had multiple press releases.

Lamar University has a press release.

The project has a dedicated website - https://offshoresafety.lamar.edu.