Scope of Work
Completeness Check and Benchmarking of ISO 19905-1

1 Background

ISO 19905-1 “Petroleum and natural gas industries – Site-specific assessment of mobile offshore units – Part 1: Jack-Ups” has been developed from SNAME bulletin 5-5A (SNAME), but has undergone significant modification in structure, and some content change, during its development. Before 19905-1 can reasonably be released as a Draft International Standard (DIS) it will be necessary to ensure that the document is both complete and produces results that would be expected. As a first step to achieving this, the following three phase scope of work has been developed to give an overall understanding of the benchmarking process. However, at this time, only the phase 1 scope has been detailed, and Consultant Proposals are only sought for Phase 1. Comments on Phases 2 and 3 would be gratefully received. The three phases are:

Phase 1. Completeness Check. A complete run through the entire standard to check that the document is complete and adequately explained to arrive at a single solution for any given particular course through the document. (There are different analysis methods accepted within 19905-1, but each should arrive at a unique, not multiple, solution.) This run through would not be designed to check the validity of the results, however, any inferences that can be drawn from the analysis may help in better defining the phase 2 scope.

Phase 2. Comparison to SNAME Complete run through the entire standard to ensure that the results obtained are in reasonable compliance with results from a similar analysis following SNAME 5-5A. It is anticipated that there will be some differences between the results from the two documents since there have been some real changes to the document, however, it is not anticipated that these changes will cause major changes in results.

Phase 3. “All Routes” Check. Complete run through of all acceptable routes within the standard to ensure that there are no inconsistencies within some of the less often used aspects of the document. Many parts of the standard will be rarely used, and may not be properly checked in Phase 2. These need to be formally checked prior to release of the standard.

While it would be preferable to undertake these three phases of these assessments together, it is likely that phase 1 will yield errors, omissions, and inconsistencies that will need to be addressed before it is reasonable to undertake a formal benchmarking of the document.

One part of SNAME that has proved to be of great assistance, particularly early after its first publication, was the “Go-By” document. No equivalent for ISO 19905-1 has formally been planned. However, through careful documentation, as the above phases of this Scope of Work are completed, it should be possible to develop an ISO “Go-By” document. This ISO “Go-By” could prove to be as valuable as the SNAME version was.

It is likely that some parts of the ISO document will have been subject to their own independent review during the development of the document. For example, clause 12, structural member checks, will have been subject to limited independent assessment to ensure that it is usable. However, this work will not have assessed its compatibility with the rest of the ISO document. The same may be true for some of the other clauses. The latest draft copy of the document to be used for phase 1 will be supplied prior to project commencement, but likely not before project award.

1 Benchmarking is taken to mean the comparison of the results between 19905-1 and SNAME 5-5A. Calibration is an analysis in which the results are assessed in an absolute fashion (e.g. in terms of levels of reliability).

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Note that at this stage there is no proposed scope to undertake a full calibration. The intention was that 19905-1 would be based on, and produce similar results to, SNAME 5-5A, so a formal benchmarking should be sufficient to prove the comparability of the two documents. Formal calibration of the standard is a major task of potentially limited value. SNAME 5-5A has undergone many changes since the original, limited, calibration in the early 1990s, so that work has little value as a basis for future calibrations. The concept of “exemplary rigs” is less easily defined today, in multiple theatres, and it would likely be harder to get consensus on what constitutes such a rig; hence this route would not be easily followed. Calibration against codes for other structural types, while potentially possible, is of extremely dubious value as the inherent assumptions and structural reserves differ so greatly. If it is determined that a full calibration is required, then the foundation for the calibration needs to be carefully established, and it will not be possible to undertake this prior to completing the other work detailed within this scope.

2 Scope of Work – Phase 1, Completeness Check

The first task, and the subject of this request for a proposal, is to undertake a completeness and usability check to ensure that ISO 19905-1 is a workable document. This will entail taking a limited number of cases and running each through the entire document using the most commonly applicable analysis methods. Only the main routes through the document need to be used, and alternate routes are discouraged unless there is good justification for using them. It is anticipated that most of the work will be detailed in the document’s normative and informative clauses, with little coming from the annexes. Such a check should include investigation of:

- Truss unit (although any inferences that can be drawn about tubular leg units would be valuable).
  It is anticipated that an enhanced LeTourneau 116C or FELS B Class unit would be used for the phase 1 assessment, although an alternative common design may be proposed.
- Single water depth and metocean condition combination (but one that gives representative dynamic response)
- Pinned foundation and foundations including fixity
- Sand and Clay (normally consolidated Gulf of Mexico type clay) foundations
- Simple foundation yield surface assessment
- Preliminary development of a “Go-By” document

Because this study is unlikely to be based on a complete document, or is likely to find inconsistencies or incompleteness, it is important that the study aim to complete an analysis rather than get too involved in detailed analysis of all stages. In effect, if an error or omission is found, then it is important that the analysts move forward, and not get bogged down in trying to resolve all of the issues. Conversely, if there are simple assumptions or modifications that can be made to complete an analysis, then it would be reasonable that these be made in order to improve the quality of the results output. It is imperative that any assumptions made are fully documented. The first stages of a “Go-By” document should be easily developed by keeping careful track of actions taken and decisions made during this first pass through.

It is envisaged that the work will be undertaken by a competent engineer, but with limited jack-up experience (junior engineer). There should be, however, a project manager who is experienced with jack-up site assessment, and preferably both SNAME and ISO documents (PM). We recognize the PM may provide instructions beyond the delivery of the documents to the Engineer and my clarify some of the input information. It will be extremely important that any instructions or questions addressed by the PM to the Engineer needed to clarify the project beyond the delivery of the work scope and site assessment document ISO 19905-1 should be documented in a Questions Register. The Junior Engineer should undertake the work with as little assistance from the PM as possible while preventing excursions down erroneous routes and blind alleys. Any area where clarification is needed by the Junior Engineer (excluding basic engineering queries) should be recorded in the Question Register, as detailed in the Deliverables below.
The intent is to prevent a more experienced analyst from making basic assumptions about “what was implied” or “how this should be done”, etc.

The analysis would follow the document but would be expected to include at least the following basic steps:

1. Choose a jack-up and location/metocean condition that are likely to result in the unit being relatively close to its acceptance limits (only one water depth case needs to be considered, but it must be sufficiently deep for the unit to display a reasonably dynamic response)
2. Develop the required metocean assessment conditions from a standard metocean report
3. Develop the foundation parameters from a suitable soils report for both a sand and clay soil condition. The committee is expecting a clay location that will result in penetrations that would be considered deep (greater than 40 feet). Suitable clay soils report can be provided.
4. Develop the rig loading conditions from the operating manual (preload, minimum and maximum storm survival condition, earthquake assessment condition, etc.)
5. Undertake the overall system geometry checks (leg length, etc.)
6. Calculate the hull wind area and leg hydrodynamic parameters (in Phase 1 it may not be necessary to complete detailed calculations as long as the overall process is followed sufficiently to prove its completeness.)
7. Calculate the leg penetration in the two interpreted soils conditions, one sand, one clay. Note that it may be advantageous to check the completeness of some of the other penetration formulae through simple review with modifications of the used soil conditions (e.g. through generation of a simplified layered soils, etc.)
8. Develop spudcan fixity levels and the relevant soil springs
9. Use existing model of the unit to continue analysis, but review modeling clause in light of the development of that model
10. Calculate both a pinned natural period, and one incorporating spudcan fixity
11. Determine loading directions
12. Calculate the structural response based on the model incorporating fixity
13. Assess the strength of the soils and determine level of additional penetration (if applicable)
14. Arbitrarily increase the spudcan loads so that they exceed the capacity envelope, and calculate the additional penetration
15. Develop the (prismatic) chord and (tubular) bracing loads
16. Undertake the tubular and prismatic member checks. As a first pass, it is anticipated that member classification for prismatic members would be checked rigourously only for the specific chord shapes chosen. However, some limited effort should be expended determining the suitability of all the member classifications. This could simply be done by, for example, reducing side plate thickness on a LeTourneau chord until it failed the Class 2 requirements. The Class 3 properties could then be estimated. The same could be repeated for Class 3 / Class 4. It is fully appreciated that the member classification depends on the loading for Class 4 members, so checking at this level needs to be limited. It is anticipated that the initial testing of member classifications will have been completed during the Clause 12 initial benchmarking prior to the start of this work.
17. Develop utilizations for the capacity of the hull holding system. Only one design is being assessed in phase 1 so it will either be jack supported, or have some fixation system. Both jack and fixation system aspects of the utilization check need to be checked for workability so the analysis needs to include an artificial assessment of the alternate holding system.
18. Develop utilizations for each of the limit states set out in the standard.
19. Assess the effects of an abnormal wave crest. (It is not anticipated that at this level significant calculations would be undertaken, but there should be an assessment of the availability of data, and the possibility of undertaking such work, should it have been required.)
2.1 Deliverables from Phase 1

A report should be issued that details the work undertaken in performing the analyses. The report needs to be extremely detailed, well documented, and organized to assist the reader in following the process and logic. Problems with the standard need to be described in the text and summarized within tables. Where options have been taken, either by choosing a permissible path within the standard, or through necessity to get through the analysis, then these need to be clearly stated. Some specific items that need to be brought out in the report include:

- Executive Summary of results
- Inputs used at the start of the analysis (e.g. types of jack-up, metocean conditions, basic soil conditions, and other parameters normally available when undertaking a site specific jack-up assessment)
- Intermediate analysis results and comments (e.g. leg hydrodynamic properties, hull wind areas, loading conditions, air gap, leg penetrations, etc.)
- Full set of analysis results and any relevant comments on the results of the analyses. (The results are needed to ensure that they can be uniquely defined. The thrust of this Phase 1 work is not to compare the results with SNAME, but any information, conclusions and comments that can be made are of value.)
- Detailed register of ALL questions that arose during the work. The register should contain, probably in tabular form, at least the following: the Question, Answer (if coming from within the ISO document), Resolution (if requiring additional information/interpretation from outside the document), Where document needs changing and, if possible/reasonable, Actual suggested changes to the document to clarify the issue.
- List of ALL programs that were used in the analysis, reason for use, brief discussion of whether the program: follows ISO procedure, follows main ISO path or alternate route, reason for chosen analysis method with program, if the part of the document being simulated by the program is adequately defined. Note: as a general rule the use of in-house proprietary programs is discouraged since they do not “test” the document.
- Clauses where there was potential for confusion, but the intent of the standard was relatively clear. Reason for the confusion, and possible way of clearing up confusion (if simple)
- Clauses where assumptions had to be made in order to continue the analysis since the existing standard was either unclear or inconsistent. Need to include what assumptions were actually made to continue analysis and possible way of resolving the need for these assumptions in the future (if simple).
- Clauses where there are errors or omissions that necessitate major assumptions to be made in order to continue the analysis. Need to include the cause of the error and possible corrective measures. In case of omissions, what assumptions were made, and possible addition to the document (if simple)
- Clause with contradictions. Need to include the cause of the contradiction, how issue was resolved, and possible way of resolving contradiction within the document (if simple)
- Format and initial contents of a “Go-By” document
- Scope of work and deliverables list/format for Phase 2. It is appreciated that there may be some bias as to the way the scope is written by the consultant, but the phase 1 deliverables need to include a detailed phase 2 scope and a format for the Phase 2 deliverables. These will be used by the benchmarking oversight committee to help develop the RFQ to solicit bids for phase 2 work. It should also help ensure that the phase 2 work is consistently undertaken and reported – imperative if the results are to be easily assessed.

3 Scope of Work Phase 2 – Comparison to SNAME 5-5A

Phase 1 was completed mainly to check the process of the analysis: can one get through the analysis without too many road blocks. The purpose of Phase 2 is to check the validity of the results of a complete ISO 19905-1 analysis. The steps will be very similar to those taken in Phase 1, but considerable care needs...
to be taken to ensure that there is numerical accuracy. Because the “answer” is so important to Phase 2, it will be important that the method is well established, and that the analysis can be completed with a minimum of unspecified choices having to be made.

Initially Phase 2 would be undertaken by a single consultant to ensure that all, or at least most, of the gaps found in Phase 1 had been plugged. However, after a successful analysis, it is anticipated that three other consultants would be funded to run through a variety of cases (see Table 1) to ensure that they:

1. Did not find any additional roadblocks, and
2. Came to the same conclusions/numerical answers

The process would be to take two jack-up designs at specific locations, and analyze them based on SNAME 5-5A. They would then be analyzed based on 19905-1, using the same assumption (e.g. fixity, pinned, etc.) to ensure that any differences in the solution are expected. It is known that certain areas of 19905-1 are different from SNAME 5-5A, so one would expect different answers from those clauses. However, large parts of the two documents have the same foundation, and should produce the same results.

The intent would be that the Phase 2 work would be carried out more “mechanically” than Phase 1. Phase 1 will require considerable thought and understanding to overcome the probably large number of errors and inconsistencies that will be found. However, Phase 2 needs to be a formal test of the document to ensure that it is usable by the public, and will achieve acceptable answers. Because Phase 2 will require regimented adherence to the document, albeit with considerable thought, it should be relatively simple to build on the embryo “Go-By” document developed in Phase 1 and flesh it out into a more complete template.

The steps taken in Phase 2 will match those from Phase 1, but all intermediate results need to be reported for both the SNAME analyses and the ISO analyses. It is possible that there may need to be “stop points” within the analyses so that the output from a particular phase can be aligned between SNAME and ISO in order to be able to see differences at the next stage. These stop points, if used, will need to be carefully chosen as there is a requirement to understand the overall difference between the codes as well as “local” differences.

The Phase 2 report would need to address any interpretation problems, as for Phase 1. In addition, all results, including all intermediate results, would need to be carefully reported, and the cause of differences identified where possible. It cannot be overstated that the numerical answers and conclusions from the Phase 2 analyses are of critical importance, so extreme care needs to be taken. Conversely, if there are areas within the standard that are easily open to misinterpretation, then these must be highlighted for clarification and correction.

It is possible that the main consultants may use a single independent geotechnical consultant to help with that aspect of the work. The intent would be to check the document, but not put undue burden on consultants who lack certain easily subcontracted skill sets. There would also be little point in each consultant independently going to a single geotechnical company.

4 Scope of Work Phase 3 – All Routes

Phase 1 and 2 should have checked the majority of the routes through the analysis that are likely to be frequently encountered. The purpose of Phase 3 will be to ensure that all the routes and methods that are sanctioned by the standard are workable, and produce reasonable answers. This will require carefully checking the standard for alternative analysis techniques, and for possible parts that have not been used (e.g. long term operations, seismic, abnormal wave crest, some Class 4 prismatic member sections, etc.) In the case of Class 4 prismatic members, there is clear guidance on the specific calculations that need to be performed to check their classification and strength. These need to be followed through rigourously, probably by modifying some chord component properties until they fall into that category. However, the
level of analysis needs to be more rigorous than was used in Phases 1 and 2, probably necessitating some
iterative work (since the member classification depends on the member loads).

For items such as seismic, it will only be necessary to determine if sufficient information is supplied to
allow the analyst to complete the calculations, not necessarily to actually undertake them.

It is during Phase 3 that unexpected differences between SNAME 5-5A and 19905-1 may arise, particularly
in the soils and structural strength check sections. These two clauses have been significantly altered from
the original SNAME. It is therefore necessary to ensure that they do not contain unexpected surprises.
Member classifications need to be checked through both SNAME and 19905 to ensure that there are no
large differences. The same for the load/penetration formulae.

5 Full Calibration

As discussed above, no scope has been developed for a full calibration study at this time as it is felt to be
inappropriate. If such a study should be shown to be necessary, then the scope can be developed on
completion of Phase 3.

6 Number of Consultants and Jack-Ups

It is anticipated that the scope would be awarded to a main consultant (Consultant A) who would be
responsible for the complete Phase 1 analysis and report. As stated in the scope, Phase 1 will entail
analysis of one jack-up type, but with modifications to allow other parts of the standard to be checked.
Consultant A would then be responsible for the first pass through Phase 2 with the original jack-up and one
additional design. This will ensure that there are a limited number of ambiguities or inconsistencies within
the next level document that could waste analysts' time. On completion of at least a first pass through Phase
2, three other consultants (B, C & D) would be commissioned to undertake Phase 2 analyses. Two
additional rig types would be added to the list of those to be assessed through Phase 2, as shown in Table 1.

<table>
<thead>
<tr>
<th>Consultant</th>
<th>Phase 1 Rigs Assessed</th>
<th>Phase 2 Rigs Assessed</th>
<th>Phase 3 Rigs Assessed</th>
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<td>1 &amp; 2</td>
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</tr>
<tr>
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<td>-</td>
<td>1 &amp; 3</td>
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<tr>
<td>C</td>
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<td>2 &amp; 4</td>
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<td>D</td>
<td>-</td>
<td>3 &amp; 4</td>
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<tr>
<td>E</td>
<td>-</td>
<td>Results Analysis</td>
<td>Possible Results Analysis</td>
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Table 1 Rig Cases and Consultants by Phase

The results of the Phase 2 analyses would be assessed by a fifth, independent consultant. The results of the
Phase 2 work would be presented by the consultants in individual reports that would then be summarized
by Consultant E.

The details of Phase 3 will depend, in part, on the outcome from Phases 1 and 2. One possibility is that a
consultant familiar with offshore structures and use of ISO codes, but not familiar with jack-ups, would be
used to follow all routes through the document. If it was necessary, then additional consultants could be
brought in to assess some other situations. Again, the use of an independent Consultant E would only be
warranted if the Phase 3 work was not sole sourced.

As this scope of work is written, it is expected that the consultant awarded Phase 1 will be the lead consultant for
Phase 2. However, the Phase 1 consultant is advised the quality of their deliverables from Phase 1 will have an impact
on the decision about their position in Phase 2. The lead consultant, and indeed all the consultants, for Phase 2 will be
chosen based on submitted proposals for that phase of the work.