DATES HAVE CHANGED. SEE REVISED TIMES ON CHALLENGE WEBSITE

REQUEST # GC9130239

Innovative Sand & Water Technologies for Onshore Operations
Reduced Use of Sand in Onshore Operations

RESPONSE DUE DATE: April 28, 2015

OPPORTUNITY & FINANCIALS:

Total prize pool of up to $500,000 USD available in the form of initial cash prizes (of up to $125,000 USD) and a discretionary pool of development funds (of up to $375,000 USD).

Up to 5 winning respondents will each receive an initial cash prize of $25,000 USD. Each winning respondent also will have an opportunity to receive additional funding for a six (6) month period (from a total prize pool of up to $375,000 USD) to continue further development and/or commercialization of respondent's Entry technology provided winning respondent enter into a mutually agreeable business relationship with Grant Sponsors which includes an agreed upon plan for guided funding.

TIMELINE:

Entries must be submitted by April 28, 2015.
Winners will be announced in ~~June~~ July of 2015.

Submit an Entry

MANAGER: Alfred T. Malouf, Ph.D.

QUESTIONS?

SOLUTION PROVIDER HELP DESK:

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REQUEST FOR PROPOSAL DESCRIPTION

GE and Statoil are seeking to truck less sand to well sites. Sand is used to "prop open" fractures in shale rock and allow oil and gas to flow freely. The goal of this Topic is to find technologies to reduce the amount of sand required to drill and maintain productive wells, which will contribute significantly to the overall Challenge goal to eliminate 20 percent truck trips / year / field.

Focus areas for this challenge include:

1. **Keep sand suspended in an aqueous slurry / more efficient use of sand.** Any approach that will minimize or prevent sand from settling out of hydraulic fracturing solution when injected downhole.

2. **Materials or chemicals to replace sand.** Materials or chemicals must be as strong as sand at "propping open" rock fractures, but weigh less than the equivalent volume of sand and create a porous matrix that allows oil and gas to flow freely out of the rock.

BACKGROUND

GE and Statoil are seeking innovative technologies to replace or reduce the amount of sand required for hydraulic fracturing of oil and gas wells. These solutions will have the potential to improve the environment for affected communities. Drilling new wells requires thousands of truck trips through these communities, which snarls traffic and creates noise, dust and exhaust fumes.

Trucks carrying sand account for a large percentage of the truck traffic to drilling fields. Weight limits on community roadways prevent sand delivery trucks from hauling maximum capacity loads. To improve the health

and safety of these communities, GE and Statoil are seeking innovative technologies to replace or reduce the amount of sand required for hydraulic fracturing of oil and gas wells.

Using sand more efficiently **(Focus Area 1)** will eliminate thousands of truck trips every year. Sand is combined with hydraulic fracturing fluid and injected as a slurry into horizontal wells. The fluid fractures the shale rock and the sand fills the fractures with a strong but porous material that allows oil and gas to flow freely from the fractured rock. Ideally, sand should fill the entire volume of each fracture to maximize the flow of oil and gas. However, sand typically settles from solution before it can fill or "prop open" every fracture completely. The current solution is to inject excess sand, but this approach leads to the deposition of sand near the well bore where it does not improve the recovery of oil and gas. Technologies that keep sand suspended in solution so that it can efficiently fill each fracture would reduce the amount of sand and trucks required to maximize oil and gas recovery from wells.

Another approach to reducing the use of sand in onshore operations would be to *replace sand with lower density material* **(Focus Area 2)**. Finding lower density materials that meet the strength, size and porosity characteristics of sand would enable each truck to carry a full load without exceeding the weight limits of local streets.

APPROPRIATE RESPONSES TO THIS CHALLENGE

Responses from companies (small to large), academic researchers, other research institutes, consultants, venture capitalists, entrepreneurs, or inventors are welcome.

Appropriate responses will address the following:

- **Brief non-confidential description of proposed technology**:
  - Scientific background supporting the proposed technology
  - Preliminary evidence
- **Technical maturity of approach**
- **Expertise and capabilities of responder** (include any relevant prior projects or experiences)

ENTRY GUIDELINES AND REQUIREMENTS

Entries will serve as an introduction to respondent's technology and expertise and should address the following, inclusive of at least one of the Focus Areas below:

The approach set forth in your Entry should have a commercialization timeline ranging from one (1) to five (5) years, be able to demonstrate proof of concept (which may include feasibility studies, prototypes, etc.) within 6-24 months and achieve one or more of the following:

Focus Area 1 – More Efficient Use of Sand:

A. Your Entry should provide a non-confidential explanation of how the proposed technology prevents sand from settling out of aqueous solutions. Data and/or modeling to support the proposed technology's ability to reduce the settling of sand is strongly encouraged. A hypothesis or model demonstrating that the prolonged settling time actually improves the filling of rock fractures is desired but not essential.

Suitable approaches include (but are not limited to):

- Modifying sand particles (e.g., coatings that increase either the buoyancy or spacing sand grains)
- Modifying fracturing fluid (e.g., viscosity)

Focus Area 2 – Materials or Chemicals to Replace Sand:

A. Your Entry should provide a non-confidential explanation of how the proposed technology will match or improve on the ability of sand to "prop open" fractures in shale rock under hydraulic fracturing conditions. The materials or chemicals should:
   1. Exhibit a crush strength ≥6,000 psi

2. Be able to withstand at least 400º F

B. The materials or chemicals should provide a porous medium for the free flow of oil and gas
   1. Conductivity of the porous medium to liquids and gases should be ≥ sand

C. The materials or chemicals should contribute to reducing truck traffic
   1. Weigh less than the equivalent volume of sand
   2. The technology should mimic the current grain sizes of sand used for hydraulic fracturing (mean particle diameter of 0.0083 – 0.0331 inches; 211 - 840µm). If possible, the technology should eliminate or reduce the need to use different size grains of sand (i.e., technologies that adapt to or can self-adjust to the size of the fractures in shale rock).

Suitable technologies include (but are not limited to):

- Synthetic or natural materials / chemistries
- Layering or encapsulating technologies
- Materials that swell and fill rock fractures
- Materials that create strong but porous structures

Objective: The objective of the Competition is to identify innovative technologies to replace or reduce the amount of sand required to drill and maintain productive wells and thereby reduce the impact of truck traffic on local communities near oil and gas fields.

SUBMITTING A RESPONSE

All Entries must be submitted online at NineSights, the NineSigma open innovation community, according to the instructions in the Response Template. Supplemental files may be submitted in additional to the response itself.

For assistance, please contact the Solution Provider Help Desk (grandchallenge@ninesigma.com).

RESPONDING TO THIS CHALLENGE

By submitting an Entry, respondents agree to the Official Challenge Rules, which include but are not limited to the following requirements:

Confidentiality
Respondents confirm that their Entry does not contain any confidential information.

Selection and Review Process
Respondents acknowledge that GE and Statoil reserve the sole and absolute right and discretion to award prizes as stated in the Challenge, including awarding prizes to less than five (5) respondents.

The Judging and award determination will be made by an internal GE and Statoil team.

See Official Rules for details. Contest opens on January 28, 2015. Must submit at least one Entry by April 28, 2015 to be eligible. Must be 18 years of age or older to participate. No purchase necessary. Void where prohibited.

Awards and Opportunities
A total prize pool of up to $500,000 USD available in the form of initial cash prizes (of up to $125,000 USD) and a discretionary pool of development funds (of up to $375,000 USD) will be awarded by GE and Statoil as described below:

Up to five (5) respondents will receive an initial cash prize of $25,000 USD each.

The winning respondents also will have an opportunity to receive additional funding for a six (6) month period (from a discretionary pool of up to $375,000 USD to be distributed across recipients) to continue further development and/or commercialization of their Entry technology provided the winning respondents enter into a

mutually agreeable business relationship with Grant Sponsors which includes an agreed upon plan for guided funding.

Additional Developmental Funding:

Allocation of the additional development funding from the discretionary development pool of up to $375,000 USD will be determined based upon, but not limited to, the following considerations: degree of innovation, level of commercial readiness, nature of the technology, total number of winners continuing to co-development stage, experience and expertise.

An agreed upon plan to guide the development funding will be required. The agreed upon guided funding plan will need to define scope, co-development/commercialization objectives, co-development relationship, timeline and deliverables for the six (6) month funding period, and will also require submission of a final report at the conclusion of the funding period,. This final report must summarize results, compare outcomes to the initial proposed results, and, ideally, show proof of concept.

Upon completion of the 6 month funding period, Grant Sponsors may, at their own discretion and based on the merits of the proposed technology, explore funding further development and/or commercialization and/or purchase or licensing of the winning technology. In addition, Grant Sponsors may consider technologies with which might require longer than 24 months to show proof of concept.

ADDITIONAL INFORMATION

Background Technical Information, Specifications and Images

Technical information about sand and fracturing fluid:

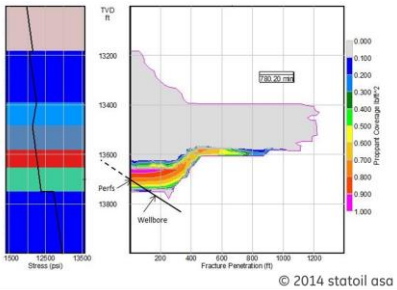
Sand

- S.G. 2.65
- True density 21.1 lb/gal (8.33*2.65)
- Settling velocity is complex
  - Controlled by fluid viscosity, temperature and particle distribution, size, and density
  - Water @ 75 F 20/40 sand = 16.12 feet/min
  - Water @300 F 20/40 sand = 32.75 feet/min
  - Note: 20/40 sand = 20-40 mesh (420 µm - 840 µm diameter)
  - Note: 30/50 sand = 30-50 mesh (297 µm – 589 µm diameter)
  - Note: 40/70 sand = 40-70 mesh (211 µm – 419 µm diameter)

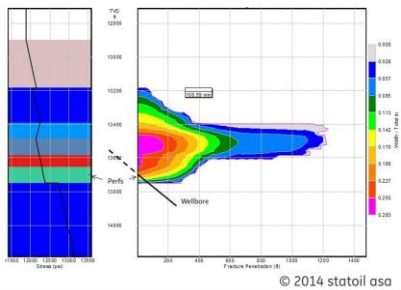
Fracture Fluid

- Viscosity can vary from 1.0 cP to over 1,000 cP for water based fluids
  - 1 centipoise (cP) = 0.01 g/cm-s
- Density is normally around 8.34 lb/gal and if using 7.0% KCl can go to 8.7 lb/gal
- Heavy fluids have been used at densities above 11.0 lb/gal for ultra-deep wells to offset the high pumping pressure

Figure representing the distribution of sand injected downhole:



A: Sand Settled



B: Sand Suspended

A: Current injection methods allow sand to settle out of suspension. The grey area represents the total created area of a hydraulic fracture after injecting a slurry of fluid and sand. The distribution of sand, shown by colored bands, indicates that most of the sand settles to the bottom of the area before the fracture has fully closed.
B: **Focus Area 1** seeks technologies that minimize or prevent sand from settling and results in a more even distribution of sand throughout the created fracture area as shown by the color bands.