Halliburton Vessel-based Modular Solution (VMS)

Flexible Stimulation System Designed to Meet Offshore North Sea Requirements

Halliburton's Vessel-based Modular Solution (VMS) is a flexible stimulation equipment package that can be retrofitted to any available DP2-rated supply vessel. It can deliver specific customer stimulation work scopes while providing the following advantages:

- Easy access to dedicated stimulation vessel without long-term contractual commitments
- Committed vessel with integrated equipment system specifically configured for stimulation work per client designs
- Adaptable and reactive setup to accommodate small campaigns or even single wells as well as large campaigns
- Experienced and dedicated crew
- · Cost effective, mobilizes and demobilizes rapidly

Flexibility

Halliburton's North Sea VMS system provides a level of flexibility and options not available with standards vessels. The VMS system



VMS system set up for 1 million lb of proppant storage

is designed to easily upgrade, increasing the capabilities of the vessel when needed. The VMS system can be mobilized for the following:

- · Gravel pack
- High-rate water frac
- Horizontal gravel pack
- Extension pack
- Fracpack
- Hydraulic fracturing
- Both matrix and fracture acidizing
- Foam acidizing
- Completion brine
 filtration/displacement
- Injectivity testing for injector wells

The system can be quickly reconfigured from proppant fracturing to acid stimulation by replacing the sand-delivery system with the acid configuration that includes acid blender, discharge pump, acid storage tanks with fill and vent manifold, and acid transfer pumps/manifold.



VMS system set up for 120,000 gal of acid storage



VMS system sailing to a southern North Sea drilling rig



Production Enhancement

PRODUCTION ENHANCEMENT

VMS Specifications

General Vessel Specifications	
Туре	Multifunctional PSV
Classification	Dynamic positioning II
Deck details	ca. 1000 m ² with 10 t/m ² deck loading
Fluid capacity	In excess of 1500 m ³ (396.000 gal)

Accommodation 30+ personnel Halliburton Equipment Specifications

Blending and Proportioning Systems

Fracturing blender (50 bpm)

Fluid delivery

Liquid additive metering skid (14 liquid additives)

Powder additive metering skid (1 powder additive)

High Pressure Pumping System

Five HQ-2200[™] pump marine pumping skids (2,250 bhp each)

In excess of 8.0 m³/min (50 bpm)

One HT-400^m pump plus Panther^m pumping skid (715 bhp)

Two 4-in. \times 400-ft flexible hoses with reel (15,000 psi)

High pressure manifold (15,000 psi)

Chemical Storage

One 21,000-gal hydration tank

One 18,000-gal liquid gel concentrate tank

Four 1,500-gal liquid additive tanks

Five 1,000-gal liquid additive tanks

Four compartment gravity proppant bins, each with two 100,000-lb and one 50,000-lb capacity + one 30,000-lb hopper

Two 30,000-gal and two 20,000-gal acid tanks or four 30,000-gal acid tanks

Miscellaneous Equipment

State-of-the-art control house to remotely control equipment

Real-time capability via InSite for Stimulation[™] package

Modular pump manifold and discharge system

Modular water filtration skid

API specification laboratory with HP/HT viscometer

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World-class safety shut-down systems
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View of the API-specification laboratory on board, complete with water/proppant analysis, gel QA/QC, and HP/HT viscosity capabilities

Service Capabilities

The VMS system serves as a platform that enables Halliburton specialists to reliably deliver key services such as:

Hydraulic Fracturing—Fracturing of low-permeability vertical, deviated, and horizontal wells is becoming increasingly critical to unlocking reserves in North Sea wells. Drawing on decades of engineering and operations experience in the area, Halliburton has designed a modular system to deliver safe, fast, and cost-efficient solutions.

Well Kill and Injection—With over 11,000 hydraulic hp available and capable of delivering at rates in excess of 50 bpm, the VMS system has the ability to perform a multitude of well services.

Sand Control Solution—With FracPac[™] service, high-rate water, gravel pack, and formation-stabilization solutions are all available with the VMS system.

Conformance Applications—Using a unique on-the-fly mixing system, water shutoff and relative permeability treatments can be mixed and pumped from the VMS system.

Near-wellbore Damage Removal—With supplementary equipment on the back deck of the VMS system, it can perform acid washes, scale removal, and inhibition treatments at high rates.



VMS basic flow diagram

Focused on Safety and Environmental Performance

All equipment placed on the VMS system meets or exceeds the requirement of DNV. The vessel package is outfitted to provide environmentally sustainable operations.

Operational safety is enhanced by an electronic automatic kick-out feature to prevent over-pressuring of the high-pressure pumps or annulus. Since all operational equipment can be automatically controlled from a central cabin, any risk to personnel on board is minimized. The VMS vessel's power operates independently of the low-and high-pressure equipment on board to help ensure full power is constantly available, avoiding any potential compromise.

Committed Quality Assurance

Halliburton has been providing marine stimulation services in the North Sea area for over 35 years and has pumped in excess of 2,000 stimulation treatments totaling over 450 million lb of proppant and over 94 million gal of acid. The VMS system has drawn from this experience from design through operational execution.

Halliburton recognizes that service quality and equipment reliability is of utmost importance. That's why our North Sea VMS system comes with a control room equipped with a full complement of computerized remote controls and satellite communications. This system is designed to provide real-time job



Halliburton has a long history of working in the North Sea. Our people and technologies have been trusted in offshore operations here for over 35 years.

control that enables faster response to design changes dictated by reservoir constraints or well conditions. An API-specification laboratory is on board, complete with water/proppant analysis, gel QA/QC, and HP/HT viscosity capabilities. The dedicated equipment package and onboard laboratory increases overall performance and reliability during the course of operations, enabling operators to meet and exceed production objectives.



Halliburton's Commitment to Service Quality

Apart from helping to ensure no harm to people or the environment, Service Quality is the single most important factor in delivering goods and services to the upstream oil and gas industry. Operators expect efficient and reliable service delivery that is safe for personnel and the environment. When it's not, the cost of poor quality, such as nonproductive time can far exceed the initial cost of services.

That is why Halliburton has embedded Service Quality into everything we do. We currently deliver a vast array of services around the globe with less than 1% total nonproductive time Our goal, however, is ZERO. ZERO means zero safety incidents, zero environmental incidents, and zero nonproductive time.

Advanced Technologies for Improving Well Performance and Time Efficiency

In a high operating cost environment such as the North Sea, substantial savings can be made through use of proven, modern technology when placing and cleaning out proppant fractures. The Halliburton integrated approach offers several solutions that can deliver such savings.

RapidFrac® Service

RapidFrac[®] service provides operators new options for completing horizontal multi-interval wellbores with highly accurate placement of fractures with minimal or no intervention.

The multi-entry sleeve system enables access to multiple fracture points within an isolated interval, and its unique ball activation feature enables a totally intervention-free completion.



CobraMax® Service

CobraMax* fracturing service offers the well control capabilities and speed of coiled tubing to improve well performance by accurately controlling the placement of fractures in horizontal, deviated or vertical wells.



CobraMax Service Delivers the Following Key Benefits:

- Overcomes flow convergence by providing near wellbore conductivity
- Enables operators to exploit multiple zones individually and in a single trip
- Eliminates the need for explosive perforating and setting mechanical plugs that must be removed later, which can be challenging in horizontal wells
- Utilizes conventional coiled tubing units, typically 1 3/4-in. or 2-in. OD units

SurgiFrac® Service

SurgiFrac* service enables placing fractures with surgical precision. This unprecedented control of fracture initiation and propagation can help operators achieve several important goals:



- Re-enter openhole horizontal wellbores in high perm or low perm formations with coiled tubing or jointed pipe and create fractures precisely in by passed and underperforming zones quickly and cost effectively.
- Precise location of fractures means that treatments can be customized to meet well conditions.
- Multiple fractures can be created in the wellbore in only hours with no sealing (packers, etc.) required between zones.
- Low tortuosity inherent in the process can help cut costs by requiring less equipment and lower viscosity fluids.

For more information on Halliburton's Vessel-based Modular Solution (VMS), contact one of the following:

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