Perforating Heavy-Wall Pipe in a Horizontal Well, Offshore Norway
TuffTRAC tractor multiple runs convey 180 single-shot SafeJet perforating guns

**CHALLENGE**
Perforate a 4,100-ft pay zone in a horizontal well through 65/8-in heavy-wall liner at one shot every 23 ft.

**SOLUTION**
Convey 180 selective single-shot SafeJet* perforating guns delivering the specified entry hole size on the TuffTRAC* downhole well tractor system in multiple runs.

**RESULTS**
Successfully perforated the 4,100-ft zone as specified in two phases.

Perforating a 4,100-ft pay zone in a horizontal well
An operator needed to perforate a horizontal production well offshore Norway with a reservoir pay zone of approximately 4,100 ft. Perforating was to be conducted in two phases of the toe half and then the heel half of the pay zone. A particular entry hole size was specified for the perforations in the 65/8-in heavy-wall liner with one shot approximately every 23 ft. At 90 holes per phase, a total of 180 shots was required.

Customizing the perforating system
To deliver the required entry hole size, coupon testing of various perforation charges in 65/8-in casing was conducted at the Schlumberger Reservoir Completions Center in Rosharon, Texas, USA. Once a suitable charge was selected, the orientation of the 31/8-in SafeJet gun was modified to fire all charges in the correct direction for the hole size.

Schlumberger conveyed the gun string with the TuffTRAC downhole well tractor system in multiple runs. Up to 38 SafeJet guns can be conveyed in a single deployment on tractor. During the first phase of perforating, up to 20 single-shot SafeJet guns were conveyed in a single descent. The number of SafeJet guns conveyed during the first phase was limited by the well trajectory and conditions, positioning of a plug-setting profile, and maximum rigid length of the tractor-gun assembly. In the second phase of perforating, up to 33 single-shot SafeJet guns were conveyed in a single descent.
CASE STUDY: Single-shot SafeJet perforating guns conveyed on TuffTRAC tractor, offshore Norway

Delivering 180 single shots in multiple descents
Both perforation phases were successfully completed using the TuffTRAC tractor system for multiple descents in overbalanced to balanced conditions. In addition to the time savings from using tractor conveyance instead of drillpipe or coiled tubing for deployment, the 3½-in SafeJet gun system brought efficiency and reliability to the overall operation, with only one single gun not firing as planned out of the total 180 single shots. System reliability was further enhanced by using a unique addressable switch and radio-safe technology in combination with a single feed-through connection instead of five sets of wire connections in each gun.