

The following lists some of the design tools that Ultra Deep LLC uses in the engineering of dynamic cable and umbilical systems:

Cross-section Design:

Ultra Deep uses **UmbiliCAD** software (ver. 1.2.1) for drawing/designing of cable and umbilical cross-sections. UmbiliCAD is developed by Ultra Deep, LLC. UmbiliCAD also generates the cross-section description file for the subsequent non-linear cross-section stress analysis program Helica (by DNV GL). UmbiliCAD is marketed and leased to clients by Ultra Deep and DNV GL Software. UmbiliCAD is part of DNV GL's Sesam Floating Structures software package.

Global Analysis:

Ultra Deep uses **OrcaFlex** (ver. 9.7) and **RIFLEX** (ver. 3.6.17) for design and analysis of global configurations. OrcaFlex is developed by Orcina Ltd. (UK) and RIFLEX is developed by Marintek (Trondheim, Norway). Both are among the leading dynamic riser analysis packages used by the offshore oil and gas industry. RIFLEX is marketed and sold by DNV GL Software. RIFLEX is part of DNV GL's Sesam Floating Structures software package.

Ultra Deep uses **Shear7** (ver. 4.8) for the calculation of VIV response on dynamic cable and umbilical systems. Shear7 is developed by Prof. Kim Vandiver of MIT. Shear7 is the leading VIV analysis programs in the oil and gas industry. Shear7 is used for drag amplification calculations for subsequent use in the global dynamic analysis, and VIV response calculations for subsequent calculation of cable and umbilical damping and VIV induced fatigue using HELICA.

Local Analysis:

Ultra Deep uses **HELICA** (ver. 2.3.7) for cross-section capacity calculations and local fatigue analyses. HELICA is developed by DNV GL (Oslo, Norway) and is currently the only non-linear cable and umbilical cross-section analysis program that can consistently handle the effect of internal friction on fatigue.

Ultra Deep uses **ANSYS Workbench** (ver. 14) for 3D FE analysis of the lateral load capacity of cables and steel tube umbilicals.

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