

Stewart Technology Associates Past Project Summaries

Provide expert professional opinions

to Jones Walker as to issues associated with polyester mooring failure and drilling riser emergency disconnect in 7600 feet water depth in Gulf of Mexico, 2015-2016.

Development of customized afloat and elevated stability software

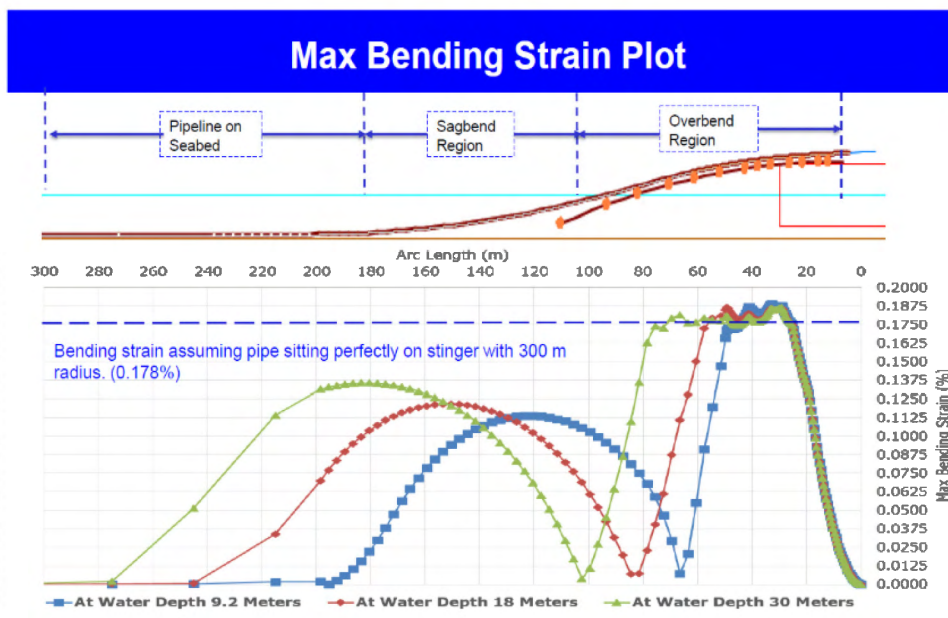
package for Hercules Offshore jack-up rig, 2015.

Feasibility design of 12" subsea pipe-in-pipe cryogenic pipelines

in shallow water in India for ESSAR, 2015.

Installation static and dynamic analysis of 42" subsea pipelines

using OrcaFle for Pipe Lay Analysis, in shallow water in Venezuela for Mecor, 2015.



Mecor Jose Terminal Expansion Pipeline Installation
 Max Bending Strain of Pipeline, Static Analysis, No Wave, No Current,
 300Meters Stinger Radius at different Water Depths

Orcaflex result close to expected response.

STEWART TECHNOLOGY ASSOCIATES

Houston, TX, USA - www.stewarttech.com - info@stewarttech.com - 713-786-0311

09 April 2015

Design assistance with novel large liftboat design

with both lattice and cylindrical legs, for Hercules Offshore, 2014/15.



Design assistance with TLP wind turbines

for Hawaii, including independent OrcaFlex analysis, model test review and literature review, 2014. (Client Private).

Design assistance with WEC (Wave Energy Converter)

for large company, using OrcaFlex and [STA software](#), 2014. (Client private).

Difficult submarine pipeline installation

plan for clients in Venezuela (ongoing) 2014.

Installation analysis (with [Aryatech](#)) for 24" HDPE water disposal pipeline

Qatar, for Union Dredgers/Qatar Petroleum, 2014.

Ongoing ONGC Riser and Mooring analysis/design for two drill ships

in India, with [Aryatech](#), in water depths 200 to 1000 meters, 2014 -2015, using OrcaFlex.

Consultancy to Petrofac,

UK, on structural and mechanical failure issues with elevating system on Irish Sea Pioneer jack-up, involving loss of several teeth on one rack, with associated gearbox failure, 2013/4.

Review of predicted leg penetrations for jack-up vessels

installing 130 WTG (wind turbine generators) in Nantucket bay for Weeks Marine and Mino Marine, LLC. 2014.

Hydrodynamic and structural dynamic analysis

of suspended raw water pump over side of jack-up rig, using OrcaFlex, for hose reel manufacturer, Clyde Union, Houston, 2013.

Analysis and re-design of articulated navigation aids

for Tideland Signal Corp. (TRU-STA International project) for Australian LNG project, using OrcaFlex, 2013/4.

Barge mooring study in Lake Pend Oreille

for SDR Analytics and Maritime, LLC and General Dynamics (for US Navy) using STA BARMOT and OrcaFlex, 2013/4.

Mooring and underbuoy hose dynamic analysis for CALM [SPM](#)

in Okinawa, Japan for US Navy, 2013.

Anchor Pile lateral ultimate load

and internal stress calculations for 900 tonne horizontal load at seabed for Solid State Industries, Singapore, using [STA PILE3](#), 2012.

Technical assistance in the running of OrcaFlex

and its manipulation to simulate jack-up rigs going onto location, ABS and Bennett Associates, 2011 and 2012.

Port Security Barrier simulations with OrcaFlex

for the Singapore Navy, with Truston, 2013.

Introduction of the SeaPerch STEM education program

to the BVI, teaching high school students how to build a remotely operated underwater vehicle (ROV) 2012.

ONGC Riser and Mooring analysis/design for two drill ships

in India, with [Aryatech](#), in water depths 400 to 1000 meters, 2013 and ongoing at new locations.

Investigation and validation of single point mooring design

in Colombia for OCENSA, using VLCCs with dominating effect being wind shifts causing maximum mooring hawser loads, 2012-2013.

Design review of novel Buoyant Tower

oil and gas production platform structure and foundation, in 54 meters water depth off Peru, for Pacific Stratus Energy S.A., 2013.

Mooring analysis of BP THUNDERHORSE SPAR

in temporary stages of upgrades to chain tensioners, for Intrepid, 2012

Provision of on-board stability analysis software STA JACKLOAD

with [Aryatech](#), to North Sea Drilling, 2012-2013

Preliminary design of two-point moorings for four very large iron ore carriers

with side-by-side trans shippers off GOA, India. 2011. Detailed design with buoy drawings, site investigation and metocean conditions reports for Sesa, with [Aryatech](#) and with [Truston](#).

Detailed design of new mooring system

on steeply undulating seabed for two fuel storage barges in Venezuela for Waller Marine. 2011/12.

Static and dynamic design verification

and final design optimization of flexible hose bundles between two fuel storage barges in Venezuela for Waller Marine. (OrcaFlex analysis) 2011.

Detailed design of subsea pipeline end manifold (PLEM) for US Navy,

Okinawa, Japan and [Truston Technologies](#). 3D drawings and shop drawings, piping specifications, etc. 2011. Installation planning using OrcaFlex, and spool piece revisions, 2012. PLEM installed in 2014.

Mat-supported MOPU pre-loading

assistance going onto location in West Africa for Harris Marine Associates., 2011

Design of Mooring System for USS Edson

in Saginaw River, MI, including ice loads, for Saginaw River Naval Ship Museum, and [Truston Technologies](#), 2011.

Calculation of afloat stability of US Navy

Submarine Fenders for [Truston](#), 2010.

Provision of barge RAOs (response amplitude operators) for FPS for pipe lay

barge in Venezuela, using [STA BARMOT](#). Produced RAOs in format for direct input to OrcaFlex. 2010.

Development of [STA BARMOT](#)

a computer program for predicting the motions of barges and ships in the frequency domain. Direct RAO import to OrcaFlex. 2010

Design Verification of [single point mooring](#)

in India for HPCL-Mittal Pipelines, Ltd. Investigation, with [Aryatech](#), into failures of underbuoy hoses. Recommended improvements to system. OrcaFlex main analysis tool. 2010.

Designed new very large scale oil spill collection and separation system

in response to USCG requests for assistance with Horizon (BP) oil spill in Gulf of Mexico, May/June 2010.

Assisted Nelson Engineering with mooring Design

for Arctic Drilling Rig Kulluk in Dutch Harbor. 2010.

Created [hydrostatic stability](#) and crane rating for [crane barge](#)

for [Tuston](#). New interactive Excel application delivered, May, 2010.

Design verification of single point mooring in India for IOCL

with [Aryatech](#), using OrcaFlex and AQWA hydrodynamics. Investigation into failure of underbuoy hose. Verification of design of mooring lines, mooring hawsers, under buoy hoses, floating hoses for CALM. Recommended some changes to the configuration. 2010

Analysis of sway deflections for jack-up rig MOPU 4

to be sited off West Africa, for Afren. Produced Letter of Findings. April, 2010.

Cost estimate and pre-FEED design of SPM off Malaysia

for French client. Sized and costed CALM buoy system, submarine pipelines to shore, beach landing, pumping station and onshore pipelines to refinery. 2010.

FE Structural Analysis and design verification

of gravel infuser skid for DNV Approval, Client Patco, 2010.

Proposal for pipeline replacement for US Navy and single point mooring

upgrade, Oman, with [Truston](#), 2010, including consideration of pipeline on-bottom stability.

Support for litigation for confidential client for navaid failure

in river, using OrcaFlex static and limited dynamic analysis, 2009/2010.

Further development of STA PILE3

for design and analysis of marine anchor piles, to support software sales to Singapore and the USA.

Extremal statistics of Harris MCS buoy riser tensions

in Mediterranean using very long OrcaFlex time domain simulations, 2010.

Design verification of new navigation buoys for US Army Corps of Engineers

to be built by [Truston](#), 2010.

Developed conceptual design for jack-up drilling platform

to operate in large currents in Gulf of Kutch for Focus Energy. 2010.

Design verification analysis of Offshore Container

(Baker Gravel Infuser Skid) to DNV Rules, using linear elastic FEA, for Patco, Houston, 2010.

Dynamic analysis and preliminary design of WEC

float dynamics, using OrcaFlex for Nova, Venezuela, 2009.

Preliminary assistance to [Truston](#), for US Navy with structural design of PLEM

(pipeline end manifold) for SALM (single anchor leg mooring) SPM in Japan. 2010.

Development of OrcaFlex Drift Off

model for Transocean as preliminary to an new OrcaFlex On-Board System for all Transocean DP Drillships. 2010.

Preliminary conceptual design of method for dry berthing Battleship Texas

putting her 30,000 tons on dry land in San Jacinto Battleground, 2009.

Preliminary design of permanent chain mooring system

for USS Missouri, Pearl Harbor, using OrcaFlex time domain dynamic analysis for Truston

Engineering optimization and dynamic mooring/mechanical analysis

including power take-off computation of novel wave energy converter (WEC)

buoy for Seadyne/Waldron, 2009.

Design of two alternative umbilical/mooring/riser systems

for Harris MCS for Mediterranean communications buoy systems in deep (>3000m) water, 2009.

Developed Load Test procedure for Gregg Drilling seabed geotechnical machine

Tests witnessed by DNV in California. 2009.

Analysis of Passing Ship Effects

on 90,000 ton dwt coal carrier moored at a new wharf in the St. John's River, Jacksonville, FL, for Keystone Coal, 2009. Dynamic simulations of motions induced by ships of up to 200,000 ton dwt passing close to the coal carrier, evaluation of dynamic mooring tensions. [Video Report Available here.](#)

Comparison of [STA LIFTBOAT](#) dynamic results

(for elevated jack-up boats) in resonant wave conditions with OrcaFlex solutions for MINO, LLC and ABS, 2009.

Development of customized On-Board Stability Software, [STA JACKLOAD](#)

for Remedial Offshore, Singapore, for new-build jack-up multi-purpose vessels. 2009.

Detailed top-tensioned riser recoil analysis

in 3000 meters water depth for AMOG, Australia, 2009.

Verification and re-design of an 11,500 feet long umbilical/mooring/riser

for a large communications buoy in 8,000 feet water depth in the Mediterranean for Harris MCS, 2009. Dynamic analysis in storm conditions with buoyancy optimization using OrcaFlex.

Advice on mooring requirements

for buoy arrays to produce electrical power from waves, for Seadyne, 2009.

Design of novel self-installing self-elevating 300 feet high Meteorological Tower

for 75 feet water depth and Cat5 Hurricane conditions off New Jersey for Fishermen's Energy of New Jersey, LLC (FERN) 2009.

Re-design of NOAA data buoys

dynamic analysis and technical assistance to [Truston](#), using OrcaFlex and GHS, 2008/9.

Assessment of Up righting/[Salvage](#) of large dredge

that capsized while dredging rutile in Sierra Leone. Dynamic preliminary up righting simulations using OrcaFlex and design of plate anchors for [Truston](#), 2009.

Guidance to Intrepid for re-tensioning chains and adjusting ballast on CALM buoy

for Shell in West Africa that was listing, 2008/9.

Technical and commercial advice to MAPS

for development and marketing of their flexible riser integrity monitoring system for non-invasive determination of absolute stress in the armor wires using a patented magnetic technique, 2008/9.

Re-design of liftboat R/V Peterson

for Aqua Survey, Inc., NJ, 2008/2009. Work included structural (afloat and elevated) design and all naval architecture for afloat conditions, as well as production of detailed drawings for US Coast Guard approval, 2008/9.

Development of customized [On Board Stability](#)

Development of customized Off-Board Stability Software

STA JACKLOAD, with [Aryatech](#), for Virtue Drilling and Discovery Drilling (Jindal) India, 2008.

Review and feasibility redesign of mooring system

for Natuna Field Concrete Floating Production Units for Arup Texas, Inc., for ExxonMobil. Checks on AQWA with OrcaFlex, 2008.

Independent review and verification of dynamic design and analysis

of underbuoy hoses on two [SPMs \(Single Point Moorings\)](#) in Korea for Banner, checking Yokohama's calculations, 2008/9.

Independent review and verification of new drag embedment anchor

design for Banner, to be deployed in Korea in 2009, 2008.

Review and verification of mooring system for FPSO

for Intrepid, in Malaysia, 2008.

Structural evaluation and re-design of composite fender structures

for [Truston](#)/US Coast Guard. Developed STA BERTHING software to deal with dynamic berthing forces and energy absorption. 2008

Evaluation of novel top-tensioned flexible riser

for production and workover of offshore wells from floating production vessel, for Swire Production Systems, 2008.

Crane Barge evaluation

for Truston and the US Navy, Philadelphia Shipyard, 2008.

Independent review of mooring system pre-tensioning methods

proposed by Noble Denton for Conar, 2007.

Debugging jack-up simulator software for Pisys, 2007.

Develop [software for crane barge](#) in Venezuela

for installation of Conoco Corocoro moorings and risers. Barge stability and crane de-rating calculations combined into interactive crane barge lift analysis software. Client: Truston, 2006/2007. Developed [STA CRANE BARGE](#) software.

Provide expert professional opinions to Ince & Co.

as to new and replacement costs for a rig mooring system for a Pemex contract in Mexico and for the same accommodation unit in a Shell contract in the UK. Provide testimony at London Arbitration, 2007.

Independent rapid engineering review of novel self-installing fixed structure

for oil production in marginal field off Tunisia for Swire, 2007.

Organized rapid fatigue assessment of 18-year old tanker

for Swire, for potential use as FPSO in Vietnam. Worked with ABS and Safehull. 2007.

Independent review of failed suction caisson anchors

in GoM at the Devil's Tower SPAR in 5600 ft. water depth. Provided expert professional opinions as to causes of failure to Jones Walker. Review of soil properties for suction pile design and pile buckling strengths, 2007.

Consultancy advice to MMI Engineering on the design and analysis of the Bass Lite SCR

in the GoM (5600 ft. water depth) involving VIV, VIM and storm loads, fatigue assessment and compliance with MMS regulations.

Planned and supervised extensive soil field investigation

and advanced laboratory dynamic testing leading to time domain non-linear dynamic analysis of [Maleo Producer](#), a gas production platform in Indonesia, in earthquake conditions. Extensive contentious arguments about [seismic issues](#) with ABS. Client: GPS, 2007.

Mat-supported jack-up foundation evaluations on soft soils for GPS, and contentious arguments with ABS regarding nature of foundation behavior in storm load conditions, 2007.

3rd Party Review of riser installation (pick-up) analysis for Blind Faith project in GoM for Aker Kvaerner Marine, 6000 ft. water depth.

Forensic investigation into loss of legs of Odin Liberty, a jack-up rig under tow from Texas to Malaysia. Fatigue and marine conditions analysis for Global Process Systems, 2006.

Independent assessment of Patco Machine&Fab.Inc, Houston, large reel design and fabrication procedures. Ensure compliance with EU Machinery Directive and application of CE Mark. Consultant to Patco for CE Marking.

Non-linear and linear hydrodynamic analysis of OOSLFP in Cat5 hurricane conditions in Gulf of Mexico, using AQWA, OrcaFlex and other internal STA software. Novel hybrid synthetic/steel mooring design also developed, for PCCI (USAF) 2006.

Detailed foundation failure analysis for MOPU. [Maleo Producer](#), Indonesia, for Swire Offshore Production Systems, 2006.

Detailed design and analysis of drilling rig mast strengthening (guy-wire) system for Halliburton Energy Services, Dallas, 2006.

Preliminary design of net support towers for PCCI, on behalf of US Navy. These guyed towers are for raising and lowering port security barrier nets in water depths from 45 feet to 130 feet, supporting large lateral loads, 2006.

Ops Manual and Stability Booklet for Maleo Producer Jack-Up MOPU for Swire, 2006.

Development of Open Ocean Stabilized Live Fire Platform (OOSLFP) for PCCI, on behalf of the US Air Force, 2005/2006. Concept is a 450' square concrete floating platform, 40 feet draft, displacement (175,000 tons) in Gulf of Mexico used for weapons targeting and testing program.

Mooring design for Hood Canal Bridge Draw Span pontoons during construction and outfitting stage in Washington state at Todd Pacific Shipyards for Spearman Engineering, 2006.

Safety analysis and HAZOP for powered reel for Patco, on behalf of Cameron,

2006.

Investigation of pier damage in Sabine River caused by passing ships (expert testimony for lawyers) 2005/2006).

Orcaflex dynamic analysis training classes for moorings and risers, 1988-present.

Design of anti-sloshing baffles for separators for Zeta group for separators on FPS, 2000-present.

Investigation of capsizes of Liftboat Miss Nevelyn off Trinidad (expert testimony for lawyers) 2006.

Design of barge mooring system for Suncor Energy, Canada. 2005.

200' Flare boom design for FPS for Swire Production Solutions, Malaysia, 2006.

HAZOP study in UK for Swire Production Solutions for FPS in Malaysia, 2006.

Design of novel mooring system for Raytheon Integrated Defense Systems for rapid deployment in hostile waters to moor a new generation of buoys designed by Ocean Power Technology. Continuing consultancy and design work, 2005.

Structural assessment of Bethlehem Mat Rig Odin Liberty for Swire Production Solutions, Dubai, for conversion to a MOPU for 10 year production contract. Work includes all structural and naval architectural issues (partly subcontracted to MMI Engineering). 2005

Structural assessment of Bethlehem Mat Rig CD10 for Swire Production Solutions, Dubai, for conversion to a MOPU for 12 year production contract in Indonesia. Work includes all structural and naval architectural issues (partly subcontracted to MMI Engineering). 2005.

Analysis of limiting conditions for leg extraction of stuck leg of Irish Sea Pioneer for Halliburton, including development of emergency extraction procedures. 2005.

Technical and marketing support for hypochlorinators for Electriclor, ongoing from 2000 to present (2006).

Design and analysis support to Swire Group for a MOPU conversion from a Bethlehem jack-up to work off West Africa, 2005.

Technical and marketing support for large offshore production separators and scrubbers for various oil and gas fields around the world, working with the European Zeta Group, ongoing from 1996 to present (2005).

Design and dynamic analysis of a near-shore support system for 5MW wind turbines in US waters for Concept Marine Associates, CA. 2005.

Hydrodynamic analysis and design of a wave energy device for use in a near-shore Defense System for Raytheon Company, 2005.

Design of risers for FPS, Houston for OPE Field, West Africa, including design of buoyancy modules and clamps. Dynamic analysis performed with Orcaflex. 2004.

Technical and commercial consultancy to ABB, Houston, for the sale of their Deepwater Group Intellectual Property, comprising patents, software and other IP. 2004/2005.

Analysis and design assistance to Patco, Houston for several large powered reels for up to 15,000-ft umbilical and hose storage/deployment/retrieval. Work

included physical model testing of pressures induced on the reel flanges by reeling/spooling loads as well as detailed FEA of the frames and reels, 2004.
Dynamic analysis and mooring design of ship nests in the James River Reserve Fleet for Oceaneering on behalf of US Navy, 2004.
Design of new (patent pending) riser clamps for Flotation Technologies using novel hinge-spring design, 2004.
ExxonMobil, working as subcontractor to MMI engineering, installation and retrieval of subsea equipment package with structural mass of 200 tonnes in 6000 ft. water depth. Dynamic analysis of complete system using Orcaflex, 2004.
Larsen and Toubro, Due Diligence services for Indian client seeking to acquire American deepwater engineering company. Provided guidance as to companies engineering competence, likely future market share, management structure, etc., 2003.
AC McClure Associates, Design of flexible risers for ConocoPhillips Corocoro field FPSO, off Venezuela in shallow water with large FPSO excursions, 2003.
Zeta-pdm Ltd, Mechanical design and analysis of oil/water/gas separator internals for ChevronTexaco BBT field, West Africa, 2003.
Amerada Hess, Independent valuation of reasons for failure of dynamic sub-sea hoses and recommended solutions to enable system operation. Ceiba Field, Nigeria, 2003.
PCCI, Evaluation of OPIC (Overseas Private Investment Corporation) risks in large loan to develop Albacore Leste field offshore Brazil (Petrobras p-50). Provided independent consulting engineering services in areas of structural, marine, mooring and riser evaluations as to fit-for-purpose, 2003.
ITA Industrial, Anti-terrorist security barriers around offshore platforms of INDIA. Hydrodynamic analysis and detailed structural analysis of trimaran hulls supporting security nets in 300' water depth around several platforms at feasibility stage, 2003.
Aqua Survey, New Liftboat design philosophy and modifications to original design, safety improvements and final design 2002/2003
Bollinger Shipyard, development of new Liftboat design, 2003.
Bollinger Training in the use of STA LIFTBOAT, 2003.
Sea Engineering, Purchase and support of STA PILE3, and STA CHAIN plus support, 2003.
Keppel Fels, Purchase and support of STA LIFTBOAT software, 2003.
ITA Industrial, the Port Canaveral. Port security barrier design and analysis, 2003.
Alderley- White Rose project, BP Alaska, hydrocyclones, sales assistance and success, 2003.
Cabett SubSea – cable cross section design stiffness etc., 2003.
Bollinger shipyard, design verification and design help with new Liftboat design, 2002/2003
MPM, special cathodic protection for BP Pompano, using Orcaflex, 2002/3, special consideration of cable interference with platform members.
Shell Oil company, verification of Delmar design of "taught leg" mooring system

Shell Oil Company, verification of Deimos design of taught-leg mooring system dynamics for Deimos field, with Transocean Nautilus, in deep water using Orcaflex. Helping client understand slow-drift dynamics. Writing technical paper on subject. 2002/2003.

Trip to Peru in order to select best site for LNG export terminal. Coastal survey in accompaniment with MMI engineering. 2001/2. Selected three best possible (economical) sites for potential terminal in conjunction with Gooseneck investigator, considering marine, coastal and seismic concerns

Ocean Works/Hard suits: support to MMI in getting credible solutions to pipe/umbilical problems using Orcaflex. 2002

Hartford Management, 2002, big opening cut-out, designed, built and installed in Houston industrial building.

Global Industries, together with MMI, Shell Manatee, linking of pipes, pipe-in-pipe installation. 2002

Dual string riser analysis for Global Marine in up to 10,000 ft. water depth, re-review., 2002

WW Products, flexible pipe cross-section analysis and derivation of fundamental properties from experience and fundamental principles, corroborated with two reliable (at least credible) sources. 2001

Rapid response to global Marine mooring analysis, semi in GoM, 6 hours to complete analysis on a Friday evening.

Provision of training course with MMI to Stolt/Paragon for Orcaflex for flexible pipe/riser/umbilical analysis. Main input from STA was cross-section behavior understanding. 2001

Assistance to Merlin Associates as an expert in marine affairs associated with Arctic Environments for Sakhalin Island and offshore cold waters, helping Shell decide to invest or not in Sakhalin.

Design (with Zeta Dynamics Ltd.), U.K. of special internals to suit large separators in Siberia, complete fabrication and installation, and on-site testing by Mr. W.P. Stewart.

Expert testimony to lawyers of Halliburton regarding the ISP (Irish Sea Pioneer) in claims against BHP. Evidence given in London, UK.

PCS (Project Consulting Services) LA, a sea-bed sweep of mooring lines in order to determine the area disturbed by the mooring lines, using AutoCad, MathCad, Visio, Excel and Orcaflex, fully dynamic moving of barge forwards, while laying pipe.

ISP 10,000-year return-period safety case for HSE. Overturning and water-in-deck analysis, helped by MMI.

Sage/Delmar suction caisson design verification, Gulf of Mexico, 2000. Finite element structural model to interface to Sage soil model in ABAQUS. Sanity checks with STA PILE.

Unocal Macasar Straights, Mooring verification, in Borneo, 1999.

Kerr-McGee riser failure investigation, 1999/2000.

Design of pier-side moorings and analysis of loads on piers caused by two large

Military Sealift Command SNIPs FPSOs or FSSs). Designed tender systems with elastic properties that protected pier from overload, 2000.

Design and construction of STA Laboratory and separate workshop for Slosh-Testing of separators on FPSOs. Includes motion controls, A/d and D/a data acquisition system, data processing and networking with STA LAN system.

Design review and dynamic analysis of BOP restraint system for Patco/Transocean, 1999/2000

Collision analysis of supply boat with one leg of the Irish Sea Pioneer jack-up vessel. Direct non-linear transient dynamic analysis and soil dynamics. 2000.

Investigated deep water fabrication/shipyard/engineering design capabilities worldwide for confidential client. Investigations covered manpower and facilities capabilities projected over the next five years for deep water field developments (3,000 – 10,000 ft.). 1998/1999. Work performed in co-operation with MAI.

Provision of Expert Testimony and investigation into causes for mooring line failures for confidential client, 1999.

Dynamic analysis of hung-off risers, 10,000 ft. long for Global Marine Drilling Company, 1998/1999.

Investigation into cause of leg failures on Shoreline liftboat off West Africa. Work performed for Shoreline Liftboats, 1998/1999.

Mooring design for MV Whitethorn for Geotechnical Drilling off West Africa. Project performed for Sage Engineering, owners of the vessel, 1998.

Assistance with dynamic analysis of flexible riser systems for deep water, Brazil (Petrobras) for Imodco, 1998.

Evaluation of new patented mooring winch system for semi-submersibles for Skagit Smatco, 1998/1999.

Development of riser analysis specifications for Reading & Bates/Falcon Drilling, 1998.

Re-commissioning STA jack-up simulator for Gulf Coast Electric, Lafayette, Louisiana, 1998. The prototype jack-up simulator originally developed for DNV was re-commissioned by STA.

Investigation of liftboat collapse for lawyers (confidential) 1998.

Riser and mooring analysis for BP on Diamond Ocean America during eddy current event in Gulf of Mexico, 1998.

Design and analysis of flexible risers and buoyant arch system for Wellstream, on behalf of Tanker Pacific, for Benchamas Field, Thailand, 1998/1999.

Cost estimates for Oryx on Yuralpa Field development, Ecuador, 1998.

Detailed design and dynamic analysis of flexible riser for Mustang Engineering on behalf of Canadian Occidental, on the Ukpokiti Field, Nigeria. 1998.

Participation, together with Orcina, in highly compliant rigid-type riser study (HCR study) organized by PMB-Bechtel, on behalf of joint industry project participants. 1998/1999. This work involves detailed dynamic analysis of various steel riser configurations and comparison with 1:5 scale model tests performed in Lake Pen D'Orielle.

Expert Witness services to Sussman Godfrev for a jack-up punch-through

problem in Australia. Work commenced in 1998.

Finite element structural/stress analysis of mooring bits on aircraft carriers for VSE Corporation on behalf of the U.S. Navy, 1998.

Dynamic analysis assistance to Aker Marine on behalf of Texaco for the Fugli Field preliminary riser design, 1998.

Dynamic analysis assistance to Aker Marine for design of SPAR structures in the Gulf of Mexico, 1998.

Detailed design of significant modifications to large liftboat operated by Halliburton in Nigeria. STA designed leg internal strengthening details, designed an aluminum helideck for the vessel and designed width extension to the vessel to provide adequate hydrostatic stability. Work was completed in 1998.

Analysis of riser and mooring system proposed by drilling contractor for deep water location in Gulf of Mexico was performed for Kerr McGee in 1998.

Investigation into causes for riser key seating failure for Kerr McGee in Gulf of Mexico, 1997/1998.

Cost estimates for replacing AGIP's Gulf of Mexico structures for insurance purposes. Work performed in 1998 for Steege Kingston Associates.

Modifications to STA JACKWAVE for Global Marine Drilling Company to suit new requirements for spud cans on hard soil bottom conditions, 1997.

Provision of cost estimates for pipeline in Kazakhstan for Oryx, 1997. Various options were considered.

Development of software to compare downtime on alternative floating drilling vessel for Chevron. The software enables the user to compare downtime of well drilling operations based upon vessel motion restrictions. 1998.

Preliminary design and detailed investigation into riser handling system on Transocean semi-submersible, 1997.

Investigation into causes for riser failure in relatively deep water for Marathon Oil Company, 1997/1998.

Interference analysis on the Troika project with temporary control umbilical. STA performed dynamic analysis of numerous possible rig positions on the Troika Field using a temporary umbilical looking at interference possibilities between the umbilical and the riser. 1997 for BP.

Dynamic analysis and detailed design at feasibility stage for Aker, on behalf of Amoco for King's Project in deep water in the Gulf of Mexico, 1997/1998.

Feasibility study for Global Marine Drilling Company concerning running dual risers from drill ship in water depths up to 10,000 ft. STA provided dynamic riser analysis, 1997.

Dynamic analysis of Troll C flexible risers in the North Sea on behalf of Wellstream, 1997/1998.

Expert Testimony Report to lawyers (confidential) on adequacy of safety equipment inside semi-submersible ballast tank, 1997.

Experimental and theoretical dynamic analysis work with physical tests on impact forces generated by colliding risers. Work performed for Shell Oil Company,

1997

1997.

Development of sizing and cost algorithms for SPARs for MAI Consultants, U.K., to be incorporated into the QUESTOR suite of programs. 1997.

Dynamic analysis of Troll B flexible risers in the North Sea for Wellstream, 1997.

Risk analysis of Main Pass Platform for CNG. Work performed for CNG's risk managers and involved both the production platform and its facilities as well as the pipelines tying into the structure. 1997.

Development of Rig Manager Software (RMS) for BP. Work began in 1997. Completed 1999. The Rig Manager Software is designed to minimize rig downtime in deep water by analyzing the riser and mooring systems together, then making adjustments to the mooring system in advance of severe weather when winch capacity may be exceeded. A concept of drilling watch circles was introduced. The software is to run on all deep water moored drilling vessels, chartered by BP.

Verification of liftboat leg design for Bollinger Machine Shop and Shipyard, 1997.

Design and analysis of riser and mooring combinations for the Kaspomorneft semi-submersible drilling rig in the Caspian Sea for Santa Fe International. STA investigated water depths from around 30 meters to 700 meters. Project completed in 1996.

Stability analysis and design, including propulsion requirements for small U.S. Navy catamaran. 1997.

Production of inspection manual for owners of the Irish Sea Pioneer, UK, in order to comply with HSE requirements. 1996.

Design and analysis of alternative mooring systems for an FPSO in the South China Sea, offshore Malaysia for Care Offshore, Switzerland, working through Sage Engineering. STA designed alternative systems, one for a spread-moored and one for a single point moored tanker in 55 meters water depth, 1996.

Development of software in cooperation with Mobil Oil Company for the design and analysis of tension leg riser systems (TLRs). In these systems a submerged buoy supports multiple steel catenary risers (SCRs). Flexible jumpers link the submerged buoy to a floating production system. The system is patented by Mobil and STA is producing software for preliminary design and cost estimation of these systems. 1997/1999.

Design and analysis of flexible risers for Petrobras performed in 1996 on behalf of Wellstream.

Assistance to Imodco with their bid for the Terra Nova project. STA helped with the detailed design and dynamic analysis of the turret, risers, and mooring system for the Terra Nova project. 3-D AutoCad drawings and computer graphic animations were produced. 1996.

Investigation of ultra-high velocity ballistic underwater projectiles for offshore mooring applications. This work, sponsored by the U. S. Navy was performed by STA in 1996 under contract to Stanley Associates, Washington, DC.

Investigation into loss of a leg on a Falcon jack-up under tow coming around South Africa (similar to the Linn Richardson). STA performed forensic analysis investigating the cause of the loss of leg for Steege Kingston Associates on

behalf of London underwriters. 1996.

Design and dynamic analysis of a pair of fiber optic riser cables for AT&T. These risers are deployed in water depths to 3,000 ft. for Petrobras and are the world's first dynamic riser cables. These are also thought to be the first Lazy wave geometry risers adopted by Petrobras. Work completed in 1997.

Development of mooring design and installation analysis software for Delmar Offshore Systems. STA developed the world's most comprehensive offshore mooring installation software for this project, beginning in 1996, completed in 1998.

Verification of ASME Code compliance for steel pressure vessels (riser tensioner accumulators). STA provided calculations showing compliance with ASME requirements to Patco Machine Shop, 1996.

FPSO mooring design and analysis on behalf of Care Offshore, Switzerland, for ELF for the N'Kossa Field offshore Nigeria. A wire and chain system was designed for a 60,000 DWT tanker for the N'Kossa Field with water depth of 800 meters, 1996.

Investigation into the loss of legs on the Linn Richardson jack-up drilling unit while under transport from the Gulf Coast to West Africa. This rig lost two of its legs while under tow and STA determined the cause of the loss for Steege Kingston Associates on behalf of underwriters in 1996.

Detailed design and analysis of the Troika mooring and riser systems for BP. The Troika field well completions were made by the Glomar Arctic 1, which operated for two years in the Gulf of Mexico in 3,000 ft. water depth. The mooring system was a chain wire chain system and involved placing 4,000 ft. of wire inserts into each of the existing 3" chain mooring lines. The riser design involved extensive investigation into vortex induced vibration (VIV). The final design had staggered buoyancy on the upper 500 ft. of the riser (bare and buoyant joints) to mitigate VIV induced by surface eddy currents. The remainder of the riser was buoyant throughout with the upper 1,000 ft. fitted with strakes fitted to reduce potential VIV caused by submerged eddy currents. The strakes were designed so that they would pass through the rotary table by deflection of their rubber bodies. Work completed by STA in 1996/1997.

Provision of Expert Testimony relating to lakefront bulkhead problems in Clear Lake, Texas. The client was attorney, Kenneth Kay, 1997.

Design of mooring system for FPSO on the Kiame Field off Angola, Africa. A spread-moored system was designed and installed in 1996/1997. The client was Care Offshore Systems/Sage Engineering, Switzerland.

Design of jack-up riser conductor in English Channel with heavy current (6 knots) for France Hunt Oil Company, 1996. This project also involved STA designing and having fabricated aluminum fairings which were installed on the conductor to eliminate vortex induced vibrations. This installation was in the English Channel in 1996.

Investigation into offshore production platform toppling during installation in Gulf of Mexico for confidential client, 1995/1996. STA developed simulation software enabling recreation of the toppling event and providing engineering insight as to actual cause

insight as to actual cause.

Provision of training in riser and mooring design and analysis for Chinese engineers on behalf of Well Completion Technology, 1995.

Mobil, Equatorial Guinea, detailed cross-section analysis of Coflexip pipes providing pipe ultimate capacity and stiffness properties, 1995.

Development of guidelines for location moves for the Irish Sea Pioneer, a four-legged jack-up unit, including afloat stability requirements, specification of limiting conditions for leg jacking, special requirements for operating the elevating system and engaging the ratchet chocks, preloading, special planning to accommodate scour at the sea bed, and limiting variable loads while elevated, 1995.

Risk analysis for delay in start-up insurance performed for London Underwriters for the world's first spar production facility, Neptune field, Gulf of Mexico (insurance for Oryx and CNG). Work commissioned by insurance agents Willis-Corroon and Jenner Fenton Slade, 1995.

Capital and operating cost estimates for oil and gas field in Gulf of Suez for Apache Corporation, 1995.

Development of data acquisition system, detailed methodology and planning for at sea measurement program for the liftboat the Irish Sea Pioneer, internally funded, 1995.

Technical and commercial risk evaluation for Rutherford-Moran Tantawan field (Thailand). Work performed for Chase Manhattan Bank in cooperation with Merlin Associates, 1995.

Special fatigue evaluation associated with CTOD (crack tip opening displacement) tests for butt welds in the chords of the Irish Sea Pioneer for Bollinger Shipyard, 1995.

Preliminary design of flexible risers for Pogo Producing Tantawan field (Thailand), 1995.

Redesign of flexible risers for Conoco Belida field (West Africa) for IMODCO, 1995.

Design review of new "Global" liftboat for Bollinger Shipyard, Inc., 1995.

Cost estimate for platform replacements in Gulf of Mexico for Matthews-Daniel Company, 1995.

Design of mooring system, including winches and emergency release hooks, for Care Offshore, Switzerland, for supply vessel operation off West Africa, 1995.

In-service degradation prediction of umbilicals for BP for Foinaven project, west of Shetland Islands, 1995.

Investigation into failure of mooring systems for drilling barges in Lake Maracaibo, Venezuela, for Paul Munroe/Venezuelan oil companies, 1995.

Mooring and riser analysis for Santa Fe for semi-submersible Aleutian Key, 1995.

Development of specification for Mobil Oil Company for software to provide high level capital cost estimates for onshore oil and gas field production facilities, 1995.

Mooring and riser design for Santa Fe for semi-submersible rig Kaspornneft in

Caspian Sea, 1995.

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Provision of mooring analysis software for IMODCO, 1995.

Review of Chinese ports, including seismic design criteria for Merlin Associates, 1995.

Mooring and riser analysis for Santa Fe for BP Pompano Phase II Development, 1995.

Design and analysis of umbilical with vortex induced vibration problems for Kvaerner FSSL Inc., 1995.

Design and analysis of single point mooring buoy for West Africa for Sage Engineering, 1995.

Mooring analysis for Global Marine for Marlim Field, Brazil, 1994.

Under buoy hose design for single point mooring for IMODCO, 1994.

Provision of mooring analysis software to Engineering Corporation of Louisiana, 1994.

On-board stability and load monitoring software for Liuhua production vessel for Reading & Bates/Amoco, 1994/1995.

Afloat and elevated stability analysis, including finite element structural analysis for liftboat, the Andre Danos, for Danos & Curole. Work performed for Bollinger Shipyard, Inc., 1994/1995.

Expert witness report for on-bottom stability and capsize analysis of barge in Lake Pontchartrain, 1994.

Mooring design and analysis for drillship with tandem moored barge in Gulf of Mexico, 1994.

Risk analysis of downtime for subsea gas development project. Work performed for London underwriters on behalf of CNG interests. Approximately 2,700 feet water depth in the Gulf of Mexico, 1994.

All structural design and naval architecture for the Irish Sea Pioneer, a \$60 million liftboat for UK operations. This project included the most detailed structural analysis ever undertaken on a liftboat or jack-up vessel. The work included unique optimization of the gap widths in the leg guide structures performed using non-linear FE techniques with hundreds of gap/friction elements. Unique ratchet chocks were also designed as part of the leg fixation system. The work was performed for Bollinger Shipyard/Halliburton, 1994/1995.

Design of novel umbilical system for harsh environment 3,300 feet water depth for Multiflex, 1994.

Design and analysis of control umbilicals in 3,000 feet of water for Multiflex, 1994.

Analysis and re-design of lifting frames for marine service for Patco, 1994.

Design of hydraulic A-frame towing assembly for research vessel for work in 15,000 feet water depth, 1994.

Analysis and re-design of novel drag embedment anchor for Costley Associates, 1994.

Design and analysis of dynamic umbilicals for Woodside Cossack/Wanaea project

TOR MULTITEX, 1993.

Non-linear foundation analysis, in compliance with DNV rules, implemented in computer program for jack-up site specific assessment for Global Marine and for Forasol, 1993.

Non-linear dynamic analysis with emphasis on footing stability for liftboat proposed by Halliburton for North Sea, 1994.

Static and dynamic design and analysis of steel catenary risers for Mars TLP for Shell Offshore, Inc., 1993.

Afloat and elevated stability analysis for liftboat, the Marcel Danos, for Danos & Curole, 1993.

Dynamic analysis and design assistance for umbilicals for Petrobras. Work performed for Multiflex, Houston, including bend stiffener design and wire wear computer program, 1993.

Technical support and consultancy for users of the Atkins AQWA suite of hydrodynamic programs for diffraction radiation analysis of floating offshore structures.

Development of software for Huthnance International for prediction of jack-up leg stresses during punch through, 1992.

Failure investigation (forensic) and analysis of risers for APPI, 1993.

Design and analysis of dynamic risers for West Linapacan (second phase) Philippines for APPI, 1991/1992.

Development of stability analysis software for jack-up drilling rig for Japan Drilling, 1992.

Static and dynamic mooring analysis of numerous semi-submersible drilling vessels in the North Sea for Global Marine.

Fatigue analysis of two jack-up production units for Kupe Gas Field, New Zealand for Western Mining Company, Australia, 1992/1993.

Lateral and torsional vibration analysis of numerous pumps and engines for Louisiana Power Systems, 1991/1993.

Design of leg stiffening for 170 foot leg liftboat for Power Offshore Services, 1992/1993.

Analysis of impact forces caused by dropped drill collars on offshore rigs for Sundowner, Houston, 1992/1993.

Design of Two-Point Mooring System with propellant embedment anchors for US Navy, Punta Raton, Honduras, 1992.

Reverse engineering, in excess of \$100,000, and repair of Diamond-M ODECO ballast control and mooring simulator, 1992/1993.

Analysis of bulkhead failure, recommendations for repair, supervision of site investigation and repair, Clear Lake, 1992/1993.

Design and analysis of dynamic risers for West Linapacan FPSO in Philippines for Alcorn International, 1992.

Expert testimony in multi-million dollar lawsuit in UK involving failure of marine anchors to trip and rig grounding, 1992.

Development of suction anchor design software for group of oil companies organized by Aker Omega, 1992/1993.
Development of various computer programs for design and analysis of laterally loaded piles and pile anchors, 1991/1992.
Performance analysis and comparison in the elevated and transit conditions for four liftboats for Shell Oil Company, 1992.
Design of multi-purpose spread mooring systems to accommodate aircraft carriers or up to 20 fast frigates, Bremerton, for US Navy, 1990/1992.
Design of aircraft carrier berthing systems at Puget Sound Naval Shipyard for US Navy, 1990/1992.
Design and analysis of flexible flowlines and dynamic risers for Amoco Gabon FPSO project, 1991.
Detailed finite element analysis and global performance analysis of CFEM rigs for Global Marine Drilling Company, 1991/1992.
Jack-up analysis including site specific location analysis for South America for Diamond M Drilling Company, 1992.
Expert testimony involving liftboat capsize and loss. Developed method for predicting energy loss during liftboat rolling transient motion, 1991/1992
Expert testimony involving drilling vessel capsize and multiple loss of life, 1991.
Mooring analysis of semi-submersible flotel for Foramer, France, 1991.
Measurement of forces in rollers for industrial production of graphite gaskets for Flexitallic Group, Pasadena, Texas, 1991.
Production of computer program for a consortium of oil companies to predict the drag-embedment performance of large marine anchors, 1991.
Certification approval for DNV for hydraulic winch gearboxes, including mechanical engineering analysis of gear train, 1991.
Design and analysis of flexible risers and underwater power cables for floating production system for Occidental in South China Sea, 1991.
Technical Review and Risk Analysis of Floating Production Facility for Cossack Field for Woodside Petroleum, Australia, 1991.
Capital cost estimate preparation for 400,000 bbl/day offshore oilfield in the Gulf of Mexico for major US oil company, 1991.
Structural analysis of Freedom Space Station Mockup for Astronaut on Earth Training, for NASA, 1991.
Mooring design and analysis of 3 groups of 10 inactive nuclear submarines in PSNS, 1991/1993.
Feasibility design and costing of LNG export marine facility in Indonesia for ARCO, 1991.
Design, fabrication, installation of world's first liftboat simulator for training marine crews, 1991.
Expert testimony regarding stability of two mat-supported rigs, 1989.
Consulting advice to Chase Manhattan Bank, London, regarding reliability of floating production concept proposed by Norwegian Consortium for Conoco for

early production on Heidrun Field in Norwegian Sector of N.S. Summary technical audit of Astano Shipyard, Spain, 1989/1990.

Design, fabrication, installation, and testing of second jack-up training simulator in Aberdeen, Scotland, for Aberdeen Technical College, 1990.

Mooring design assistance to Lambert Eggink Transport Consultants in Holland, 1990.

Comparison of conditions limiting survivability of 4 different jack-up drilling rigs in Gulf of Mexico for Texaco, Inc. on 3 different fields, using STA JACKWAVE, 1990.

Investigation into buckling failure of tank barge for Commercial Marine Services, 1990.

Liftboat leg structural analysis for U. S. Coast Guard. Work is major component of new USCG requirements for liftboat design and construction, 1990/1991.

Rationalization of costs of gas wells in Gulf of Mexico for Booz-Allen and Hamilton, Inc., 1989.

Investigation into chain fracture on semi-submersible drilling rig while deploying moorings in 1600-foot water depth for Diamond M Drilling Company, 1989.

Consulting advice to US Army Cold Region Research Laboratory regarding oil spill cleanup after Exxon Valdez accident, 1989.

Developed program for dynamic shock loading analysis for jack-up legs in transit, subject to loss of shims, 1988/1989.

Research into jack-up instabilities during pre-loading, development of program to analyze pre-loading leaning instabilities, and development of guidelines to avoid leaning instabilities during pre-loading, 1988/1989.

Developed fatigue analysis program for jack-ups and applied it to jack-ups in transit, 1989.

Design of deep water buoy and mooring system (1,500 feet) for power cable support buoy for nuclear submarine installation in Alaska for US Navy.

Developed wave loading and response analysis program for buoy, 1989.

Cost estimation for numerous oil production platforms worldwide, 1988/1992.

Development of buried anchor chain program predicting non-linear soil/chain interaction, chain profile, and tensions, 1988.

Development of suite of jack-up wind, wave, and current loading and dynamic response analysis programs, 1988/1992.

Expert testimony in two collision cases involving anchor marker buoys in the Gulf of Mexico. Mooring analysis for crane barge, 1988.

Hull thickness survey for North Sea dive support vessel, 1988.

Stability evaluation and development of on-board stability software for DP salvage vessel R/V Arctic Discoverer, 1988. (Featured in book "Ship of Gold").

Design methodology and production of design report for thruster sizing for a dynamically positioned salvage vessel. Developed program to size thrusters for DP vessels, 1988.

Design of data measurement, acquisition, and reduction system for North Sea Jack-up for Noble Denton, 1989.

Accident statistics investigation into dropped object incidents offshore, 1988.

Failure analysis involving dynamic analysis and finite element stress analysis of articulated column navigation aids for US Coast Guard. Model testing the NAVAIDs in wave tank, 1988.

Design of 7-ft. x 8-ft. plate embedment anchors for US Navy in Pearl Harbor, Hawaii. Installation is by use of unique tubular steel pile/follower, up to 140 feet below seabed level. All design and analysis including dynamic analysis of driving conditions was performed by STA. Development of program to predict buried anchor chain profiles beneath the seabed, 1987/1988.

Design of large laterally loaded sea bed anchor piles in limestone for mooring of US Navy Nuclear Submarine Tender in King's Bay, Georgia, 1987.

Consultant to Noble Denton and Associates for work related to blowout risk analysis for offshore drilling projects, 1987/1988.

Expert testimony for Houston law firm in case involving barges breaking away from moorings, 1987.

Developed simplified TLP analysis program for Inmar, Houston, for design of novel TLP, 1987.

Design and development of the world's first jack-up training simulator, to train marine personnel in jack-up operations, including both geotechnical (on bottom) stability simulation and floating stability. DNV in Houston now operates this simulator. Copyright to all software and documentation resides with STA, 1987.

Investigation of the reliability of inspection results for a wide range of marine structures, for the USCG. Project included derivation of curves showing probability of detection of defects for different inspection techniques during regular in-service inspections, 1986/1987.

Procurement in US, by STA, on behalf of Veritec, Norway, of a large amount of oceanographic transducers for use in the North Sea, 1986.

Survey of wellhead equipment manufacturer's market in the US for a UK company (name is confidential), 1986.

Marine surveys of numerous private sailing and small motor vessels, for insurance purposes, and for potential purchasers, 1986/1989.

Production of recent blowout statistics in the Gulf of Mexico, for Anadarko Petroleum Co. Project involved use of the MMS and the WOAD accident databases run on STA's computers, 1986.

Provision of expert testimony to Shearson American Express in case of jack-up rigs with claimed design defects. Work included extensive structural review of the rigs, as well as comparison with capabilities of other similar rigs, 1986.

Development of methodology for riser analysis for the first US tension leg platform in the Gulf of Mexico for Conoco, 1986.

Failure mode and effect analysis planning and investigation for ballast system for a Reading and Bates semi-submersible, 1986.

Development of a marine towing manual for Exxon, providing guidance in towing vessel and gear selection, procedures for towing rigs, weather routing, and many other aspects of offshore and nearshore towing of rigs, 1985.

Design and development of unique arctic drilling and production structure (ADAPS). Patent applied for the tension anchoring system, which actively controls the structure's ability to stay on very soft bottom sediments when subjected to very large ice loads. Design of composite steel/concrete/steel ice walls, 6-ft. thick, together with internal steel walls, resulted in an overall weight density of only half that of competing structures, 1985/1987.

Engineering study in cooperation with marine warranty survey, for the dry transport of the semi-submersible, Zapata Concord, on the heavy lift vessel the Ferncarrier, from the west coast of California, via the Magellan Strait, to the Gulf of Mexico. Attendance at loading and unloading, redesign of cribbing, design of additional sea fastenings, 1985.

Development of guidelines for industry, for avoidance of fatigue damage to rigs and other structures during ocean tows, 1985/1988.

Extensive investigation into catastrophic damage to a jack-up rig during a transportation from Singapore to the Arabian Gulf for Pool Co. Work included evaluation of criteria for safe towage, evaluation of actual tow conditions, calculation of fatigue damage, evaluation of fabrication defects, 1985/1988.

Development of deepwater fixed tower (1,500-ft. water depth) using composite steel/concrete/steel legs with D/t ratios less than 5, requiring extruded steel for upper leg sections. This work was performed jointly with the fabrication department of both Brown & Root and McDermott, to ensure that a minimum cost design was achieved, 1986.

Stability analysis of several semi-submersibles for drilling contractors, to ensure compliance with DNV, and NMD requirements, 1983/1986.

Engineering and cost analysis of a tanker conversion to continuously collect oil from an open ocean blowout, for the Minerals Management Service, 1985/1986.

Provision of expert testimony services to Unicorn Lines in the Supreme Court in South Africa. Gave evidence as to the most probable course of events that would have occurred if a collision between a drifting freighter and an oil rig had not been diverted, 1985.

Fatigue analysis of a submerged buoyant pipeline bundle during installation and tow-out, for Mobil R and D. Pipeline was several thousand feet long and suspended 50 feet below the surface by buoys, spaced 500 feet apart, 1985.

Development and management of a series of one-day technical seminars, presenting state-of-the-art analytical techniques for analysis and design of semis, jack-ups, finite element stress analysis, ice mechanics, and one seminar on marine training. The engineering seminars also described how to achieve compliance with DNV Rules, 1983/1986.

Analysis of non-linear motion response of a storage and production tanker for Nordrill, 1984.

Supervision of model tests of North Sea jacket for Phillips Petroleum, at OTC test facility in California, 1982.

Site survey and detailed weight take-off of jack-up rigs for evaluation of operable range within on-bottom stability limitations, 1985.

Geotechnical analysis of mat-supported jack-ups that had experienced

Geotechnical analysis of mat supported jack-ups that had experienced foundation failures, for Seattle First National Bank, 1985/1986.

Provision of expert testimony to Lloyds, in their case against Zapata, when a semi-submersible heavy lift vessel, the Super Servant, was holed and subsequently sank in the Congo River during the unloading of a drilling rig. I provided calculations, which showed the rate at which flooding occurred, and the sequence of events that followed, 1984.

Comparison of hydrodynamic and structural analysis methods for semis, for Exxon Production Research Co, 1985.

Management of most detailed finite element stress analysis ever undertaken on a semi-submersible drilling rig (The Henry Goodrich) for Sonat/Mitsui, 1984/1985.

Management of detailed finite element stress analysis of world's largest jacket launch barge for Barnett and Casbarian/Kaiser Steel. Results allowed design to have smaller midships section modulus than specified by either DNV or ABS normal rules, 1984/1985.

Management of detailed finite element stress analysis of CIDS, the world's first concrete drilling structure for the arctic, for Global Marine Development and Exxon, 1984.

Development of methodology for dynamic analysis of spread mooring systems for very deep (over 1,000 feet) waters. Investigation of previous work on fatigue and other failures of wire and chain mooring lines, including finite element analysis, full-scale testing and field results, 1986.

Comparison of all major international requirements for mooring design and analysis for Canadian government, 1986.

Management of numerous analyses of catenary mooring systems for Sonat, Zapata, and other drilling contractors, to satisfy DNV, Norwegian government, and other code requirements. Analyses undertaken using DNV's software for quasi-static analysis, and using a Norwegian research institute's program for evaluation of extreme transient response of the vessel, when a heavily loaded line is broken in a storm, 1983/1986.

Design review of jack-up for Baker Marine, to ensure compliance with DNV Classification Rules, 1985.

Design review of jack-up for Friede and Goldman, to ensure compliance with DNV Classification Rules, 1985.

Design review of semi-submersible for ODECO, to ensure compliance with DNV Classification Rules. Fatigue problem resolved at one critical joint, 1985.

Weight estimate and stability analysis of new semi-submersible design (Trendsetter) for Santa Fe, 1985/1986.

Commercial evaluation of the worth of Baker Marine Engineering launch on the Singapore stock exchange, 1986.

Design of improved mooring system to minimize second order responses for ships moored at pier in Panama, 1987.

Design and implementation of a project to measure ship motions and wave/wind environment at an exposed pier on the Pacific Coast of Panama. (Work performed partly when with DNV, and completed in the field as STA.) Three

months in Panama, installing equipment and taking measurements. The data was partially processed in Panama, and partly at the STA offices in Houston. Second order wave drift effects caused unusual dynamic responses, 1986/1987.

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