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Subsea Compression Applications– Panel Session

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José L. Gilarranz R. joined Dresser-Rand in 2002 and is currently the Manager for Technology Development and Commercialization of the DATUM ICS and Subsea Product lines within Dresser-Rand in Houston, Texas. Dr. Gilarranz actively participates in new project development and serves as the main technical and commercial contact between Dresser-Rand and its clients in the area of compact compression systems. Previously, Dr. Gilarranz was a Senior Aero/Thermo Engineer and was heavily involved in the design, specification and use of advanced instrumentation for development testing. He has also been engaged in shop and on-site testing of centrifugal compression packages for both dry and wet gas applications.

Prior to joining Dresser-Rand, Dr. Gilarranz worked as a rotating Equipment Engineer for Lagoven S. A. (now Petróleos de Venezuela - PDVSA) where his primary responsibility was performance evaluation and prediction for compression packages utilized by Lagoven in Lake Maracaibo.

Dr. Gilarranz received a B.S. (Cum Laude) in Mechanical Engineering (1993) from the Universidad Simón Bolívar in Caracas, Venezuela and an M.S. (1998) and Ph.D. (2001) in the area of experimental fluid mechanics from Texas A&M University. He is a member of ASME, AIAA and $\Phi K \Phi$.



William Maier is a Principal Development Engineer with Dresser-Rand Company based in Olean, New York. He has been with the company since 1980. His latest activities are centered on advanced subsea compression and separation systems.

Mr. Maier has co-authored and presented papers at numerous technical conferences including SYMCOM, ASME IGTI, and TAMU Turbo-Symposium and currently holds thirty six US Utility Patents. He received a B.Sc. degree from Rochester Institute of Technology in Mechanical Engineering in 1981. He is a member of ASME, TBII, and $\Phi K \Phi$.



Mr. Baumann has a diploma (Mechanical Engineering, 1987) from the Swiss Federal Institute of Technology in Zurich. During his master studies he focused on control systems and strategies as well as on system reliability.

Between 1988 and 1996, Mr. Baumann worked for Sulzer Innotec, the Corporate Research and Development Center of Sulzer Ltd. For several years he was in charge of the machinery dynamics group that is responsible for the development, design improvement and troubleshooting on a wide range of Sulzer products.

In 1996 Urs Baumann joined MAN Diesel & Turbo, Switzerland. During the first four years he was responsible for the mechanical development of the compressors built in Zurich. Since 2000 Urs Baumann is the Manager of the Calculation and Development department of MAN Diesel & Turbo in Zurich. His responsibilities include the aerodynamic and mechanical development of turbocompressors and associated components, as well as the implementation and maintenance of test stands and analytical tools needed to perform this task. His department comprises also a Product Development Group mainly focusing on high-speed motor driven, magnetically suspended compressors.



Stein Jørgensen commenced Subsea division in April 2012, and is focusing on compressor applications for subsea compression systems. In 2012 Stein was managing the Compact Gas Booster Station development project and was responsible for the development concept models for Gas Piston Pumps and the RotoConverter as well as for the selection of liquid tolerant subsea compressors. Stein is currently working in the Ormen Lange Pilot Subsea Project and on general subsea compressor application studies. Stein Jørgensen has a B.Eng. (with honors) degree in Mechanical Engineering, from the Strathclyde University, Glasgow, 1991. Mr. Jørgensen specialized within gas dynamics supersonic flow on turbine blading for his thesis. Mr. Jørgensen has as more than 23 years of relevant experience mainly with rotating equipment as turbo machinery and pumps within Kværner and Norconsult mainly for the offshore oil and gas industry, but also within shipping and power plant systems. Mr. Jørgensen has been working as a consultant on vibration monitoring and analyses as well as having management roles in projects. Stein Jørgensen acted as Mechanical Commissioning Supervisor on the Ormen Lange Onshore plant for Norsk Hydro in 2005-2007, responsible for commissioning activities on mechanical and rotating equipment from plant completion until plant handover to Shell for operation.



Manuele Bigi is responsible for the Subsea Compression development in the Advanced Technology Organization of GE Oil&Gas in Florence, Italy, since 2012. He received a M.S. degree in Mechanical Engineering from University of Florence, Italy and has more than ten years of experience in Oil&Gas turbomachinery design.

He joined GEO&G in 2001 as design engineer for gas turbines in the R&D department, then becoming responsible for the design of hot gas path stator parts. In 2007 he was appointed Engineering Manager for compressor R&D within the Advanced Technology Organization until the current assignment.



Alberto Milani is a Systems Engineer for the Ormen Lange Subsea Motor/Compressor development in the Advanced Technology Organization of GE Oil&Gas in Florence, Italy since 2014.

He received a M.S. degree in Mechanical Engineering from University of Florence, Italy and has more than ten years of experience in Oil&Gas turbomachinery design.

He joined GEO&G in 2003 as design engineer for centrifugal compressor. In 2006 he joined Foster Wheeler UK as a rotating equipment engineer working in refinery and LNG projects. In 2009 he come back to GEO&G as a field project engineer following projects in installation and commissioning phase. In 2014 he joined the Systems Engineering team working on Ormen Lange Subsea Motor/Compressor.



Thom M. Eldridge is a Sr. Rotating Equipment Engineer for the Royal Dutch Shell Company. His principal responsibilities are providing rotordynamic expertise across Shell and its joint ventures, technology qualification for high pressure compressors and subsea pumps, supporting machinery troubleshooting and technical development reviews. He currently works for Shell Global Solutions in Houston, TX USA, but spent two years living in Qatar supporting the start-up and commissioning of QatarGas 3&4 and PearlGTL. Prior to joining Shell in 2006, he worked for the Dresser-Rand Company in Olean, NY USA where he held positions as the Manager of the Aero/Thermodynamics Engineering Design Department, Supervisor of the Rotordynamics group and LEAN leader. He began his career working on bearing development, turbo-machinery modeling, data acquisition systems and high-temperature transducer design as a Senior Engineer and Project Team Leader for Bently Nevada (now a division of General Electric). Mr. Eldridge received a BSME (1991) and MSME (1994) from Washington State University, and an MBA (2002) from the University of Nevada. He is a registered Professional Engineer in the State of California. He holds two patents, has been a lecture leader and short course presenter for Turbosymposium, and has authored several papers on gearboxes, damper seals and hydrostatic bearing applications. He has been a session chair for IGTI over multiple years, and is a former president of the Gas Turbine Users Symposium (GTUS).

ABSTRACT

The use of Subsea gas compression technology for subsea re-injection and/or gas transport boosting represents a new and exciting application for rotating equipment, which will allow new gas/condensate field production opportunities, enhanced recovery of existing gas/condensate fields and cost effective production from marginal gas fields.

This panel session includes short presentations on the benefits of subsea compression, an overview of currently ongoing projects, and recent advances and technologies that are available and/or under development for subsea gas compression.

The panel session includes presentations from Shell Global Solutions, Aker Solutions, MAN DIESEL & TURBO, GE OIL & GAS and DRESSER-RAND. The respective presentation titles are:

- Subsea Processing - Multiphase Boosting and Compression – Shell Global Solutions
- Subsea Compression; Present Status and Experience – Aker Solutions
- HOFIM™ Type Compressors for Subsea Applications – MAN Diesel & Turbo
- GE Oil & Gas Experience in Subsea Gas Compression Technology Development – GE Oil & Gas
- DATUM I Compressor for Subsea Applications: Update on Qualification Efforts- Dresser-Rand