Collaboration Efforts between the Norwegian Energy Industry and the US space industry

Presented

by
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SIMTANO®

at
The
Technology Transfer Space and Energy Conference

organized
by
ARENA IO and Greater Stavanger

Statoil, IB Bygget, Stavanger, Norway
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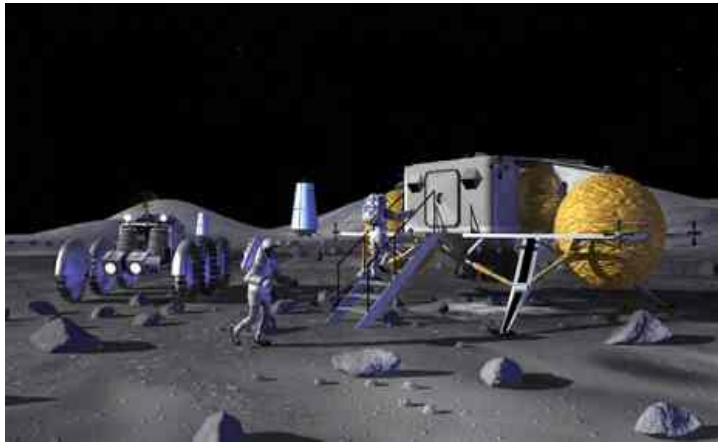
BRINGING CONCURRENT DESIGN DOWN TO EARTH

Space and Energy: the Perfect Match?!



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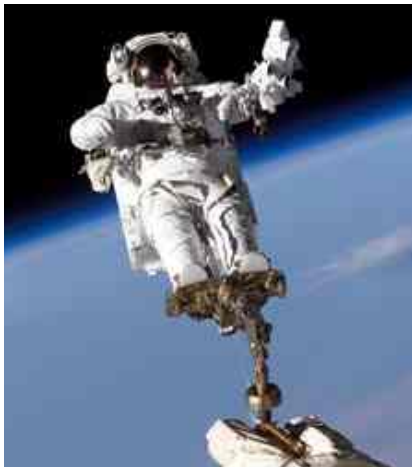
1. Differences or Parallels

2. Extreme Environments



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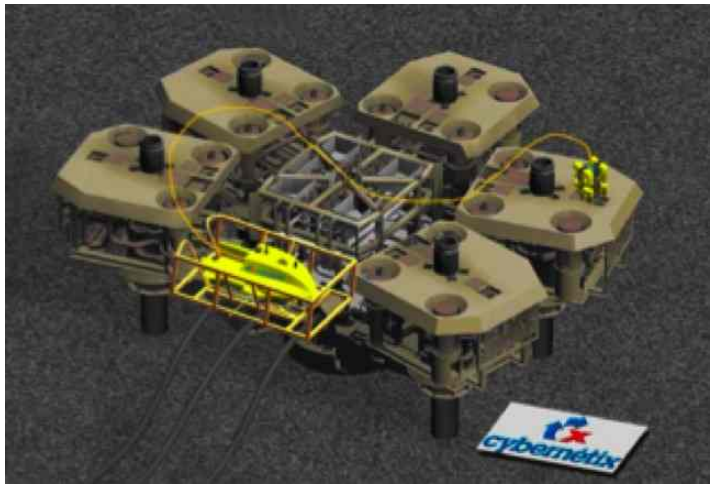

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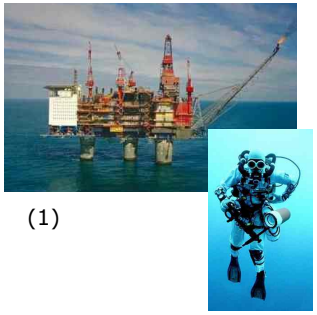
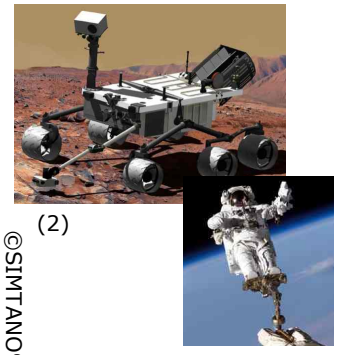
3. Both Areas Technologically Very Advanced

(4)

Images: NASA (1), http://www.autoblog.com/2006/01/04/new-angle-on-ford-reflex/ (2); Cybernetix (3) NASA (4) http://www.aquatec-innerspace.com/pics/axelccr1.jpg

Why Now!

	Strenghts	Collaboration Rationale
Energy, North Sea  (1) (4)	•Innovative •Outside the box thinking •Willingness to test out new technologies •Leading role worldwide, especially in the areas of subsea and drilling	•Dwindling reserves: •Marginal fields, larger depths, under ice, sensitive Arctic areas –> **Extreme Tech Demands** •**Alternative** use of Tech •Wind, tidal, and wave power; and beyond=Space
Space  (2) (3)	•Own development, testing, and operation labs/facilities •Extreme focus on safety, especially in the manned program •Worldleader: Robotics to manned space	•NASA Directive (DARPA model) •Develop **dual-use** technology with industry: Robotics, instrum., material •Space **Shuttle Retires** •Manned space expertise seeking alt. use (risk, safety, and training) •Energy, Nuclear, etc.

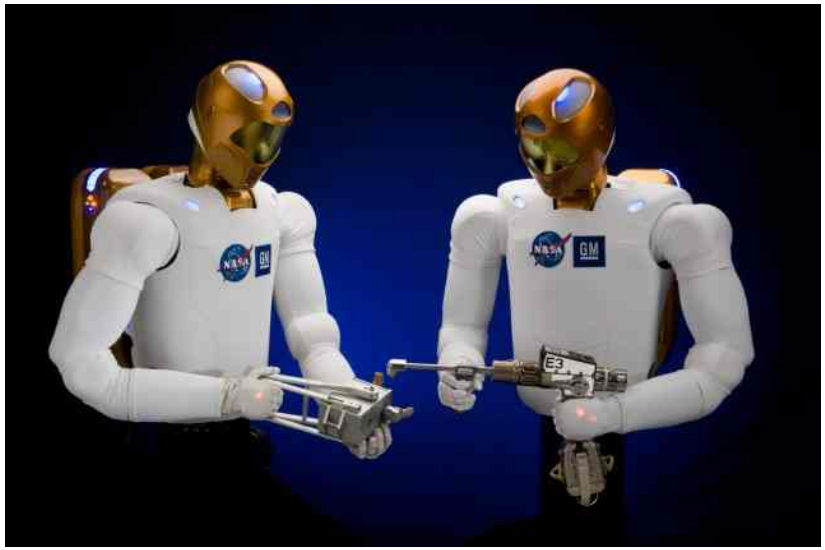
Images: (1) Statoil; (2) Jet Propulsion Laboratory; (3) NASA (4) http://www.aquatec-innerspace.com/pics/axelccr1.jpg

Space and Energy: The Business Case

OCEANEERING®

Annual Report, Early 90's:

One of Oceaneering's strategic objectives is to utilize our expertise in non oilfield markets

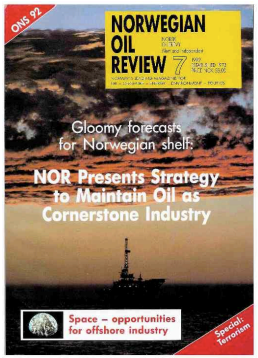


Result

Developed routines and tools for the International Space Station, now also involved in developing numerous other space systems

Photo: NASA and http://www.oceaneering.com/advanced-technologies/space-systems/robotics-and-automation/robonaut-2/

Space and Energy Efforts



1992: Norwegian Oil Review: Parallels between Space & Offshore, Future Opportunities for the Offshore Industry

2001: Facilitated Testing of JPL/NASA Cryobot on Svalbard

2003: Co-Founder of the Arctic Mars Analog Svalbard Expeditions (AMASE)

2009: Report: Potential for Collaboration between the Norwegian offshore oil- and gas industry and JPL/NASA: How to Set up and Implement such a Collaboration

2010: Project to investigate the potential for collaboration between the Norwegian offshore oil- and gas industry and NASA Johnson Space Center

Svalbard, Mars Like Mountains

Svalbard, Glacier

Starting Point

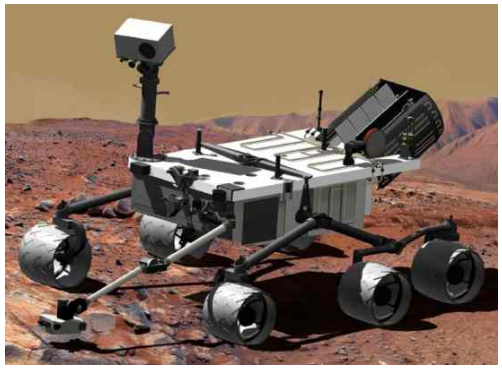
•2009 "Autonomy in Integrated Operations" Conference organized by Norsk Forening for Automatisering – NFA (the Norwegian Society for Automation)

•Initiators: Martin Sigmundstad (ARENA IO), Lars Annfinn Ekornsœter (NFA), Trond Lilleng (Statoil), and Knut I. Øxnevad (SIMTANO)

•**Question**: What concrete steps can we take to raise the level of Autonomy and Automation (Innovation) in Norway

•**Answer**: Open up a technology collaboration **CHANNEL** between the Norwegian Oil and Gas Industry and NASA

Technology Collaboration Channel



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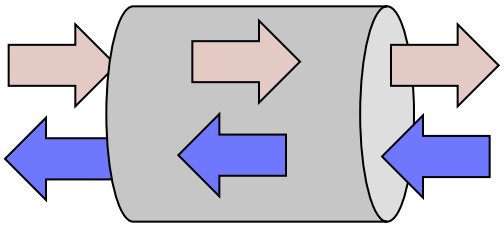

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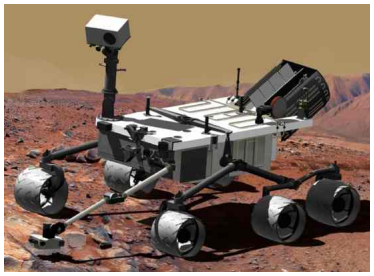
Idea of a Technology Collaboration Channel. Technology Collaboration goes **both ways**. In one project, the space industry may support the energy industry. In another, the energy industry may support the space industry. And, in the most important type of project, both industries work together to develop **technologies with applications in both industries**. The collaboration is not ad-hoc and has a degree of permanency.

Images: (1) MSL, Jet Propulsion Laboratory; (2) Gullfaks C, Statoil

Phase I: JPL



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Objective

- Investigate how to set up and implement a technology collaboration CHANNEL between small and large Norwegian energy companies/organizations and the Jet Propulsion Laboratory - JPL, California Institute of Technology
- Seek out a collaboration project for testing out the required steps for setting up such a collaboration Channel

Strategy

- **Step 1:** JPL provides technology development support to Norwegian entity. Funding by same entity. Norwegian Researcher at JPL
- **Step 2:** Norwegian entity and JPL jointly engage in a technology development project. Potential funding by both Norwegian entity and JPL
- **Collaboration** to start with a USD300K project, and over time, expand to USD3-5 mill, and include multiple projects

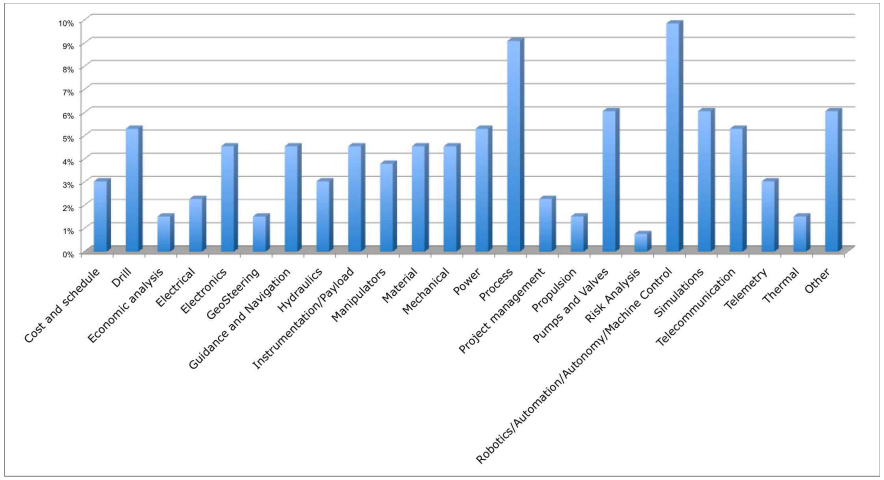
Images: (1) MSL, Jet Propulsion Laboratory

What was Done

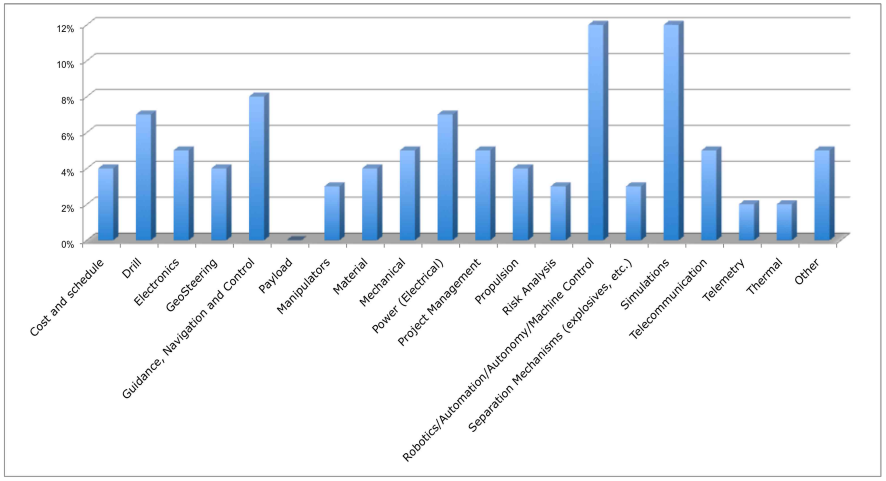
1. Defined Technology Developments NEEDS and OFFERINGS of Norwegian offshore oil- and gas industry; on line survey
2. Defined Technology Development Capabilities at JPL, and potential areas where Norwegian offshore technologies could be of interest to JPL
3. Matched 1 & 2 to find projects of mutual interest
4. Worked with JPL, NASA, and Caltech Lawyers to define the required steps for collaboration, payment procedures, "Space Act Agreement, licensing/royalties, and export control issues (ITAR)
5. Defined a first project. The Seabed Rig (SBR)- JPL/NASA collaboration project. JPL/NASA developed task plans for the project together with SBR
6. Defined research positions at JPL open to Norwegian researchers.

Results
Survey

NEEDS



OFFERINGS



- Locations: Surface, Subsea (Mobile), and Subsea (Fixed)
- Functions: Process, Pumps and Valves, Robotics/Automation/ Autonomy/Machine Control, and Simulation

- Locations: Subsurface and Surface (fixed)
- Functions: Drill, Guidance, Navigation and Control, Power (Electrical), Robotics/Automation/ Autonomy/Machine Control, and Simulation

17 of 194 responded to the survey, small and large companies included

Results

Survey; NEEDS Concrete Examples

1. Multi-joint robots for underwater inspection and maintenance (autonomy relevant)
2. Down-hole instrumentation
3. Embedded, high temperature, rugged, low power electronics
4. Advanced materials

Results
Summary

1. It can be done! There is interest on both sides!
2. Setting up a collaboration project with JPL/NASA takes 4-12 months
3. Projects to be set up directly between each Norwegian Entity and NASA and JPL
4. Space technologies subject to export control (no show stopper)
5. Caltech (JPL) will hold rights to IP technologies developed at JPL
6. Paid licenses for commercial use are available to entity that funded technology development
7. Norwegian projects at JPL can include a part-time Norwegian researcher
8. Norwegian students doing a grad level degree in the US can apply for JPL internships (10 weeks). Stipend of USD 9K required

Results

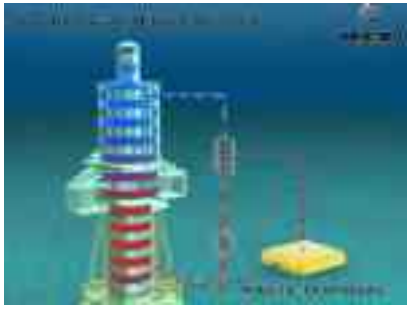
Selected Project

SeaBed Rig Project Selected for First Technology Collaboration Effort

Installation Process

In Operation

SBR-JPL Project Task:
Develop an automatic planning system for converting task goals into an activity schedule, enabling **autonomous** operation of drilling operations



Closed Cleaning

Pipe Handling

Control Room

Installation Process: http://www.seabedrig.com/files/seabed_rig_installation_-_short.wmv
Closed Cleaning: http://www.seabedrig.com/files/closed_cleaning_process.wmv
Pipe Handling: http://www.seabedrig.com/files/pipehandling-med_logo.wmv Videos also located in Knut/Doc/Seabed Rig Folder
Photos: http://www.seabedrig.no

Phase II: NASA JSC + Workshop


(1)

Objectives

Follow-up the SBR – JPL/NASA project, create a technology collaboration forum for smaller and larger Norwegian Energy companies and NASA, and expand the NASA collaboration to include Johnson Space Center (NASA JSC).

Strategy

1. Monitor progress on the NASA-SBR project as it goes through the JPL and NASA approval process.

2. Visit with NASA JSC to learn more about the center and to discuss potential areas of collaboration.

3. Invite representatives from NASA and JPL to workshop and company visits in conjunction with the Offshore Northern Seas (ONS) 2010 event. A first step in creating a technology collaboration forum, a central part of the Technology Collaboration Channel

Image: (1) Astronaut in EVA, NASA

What was Done

1. Defined initial Technology Capabilities (OFFERINGS) at JSC, and potential areas where Norwegian offshore technologies could be of interest to JSC (NEEDS)
2. Matched JSC's OFFERINGS and NEEDS with the Survey results from Phase I
3. Reviewed the NASA "Space Act Agreement" to detect differences between NASA and JPL's approaches to collaboration, IP, licensing, and royalties
4. Followed-up progress on the SBR-JPL collaboration project
5. Conference and visit to Stavanger for representatives from JPL and NASA JSC has been set up
6. No collaboration project with JSC has been defined yet

Results

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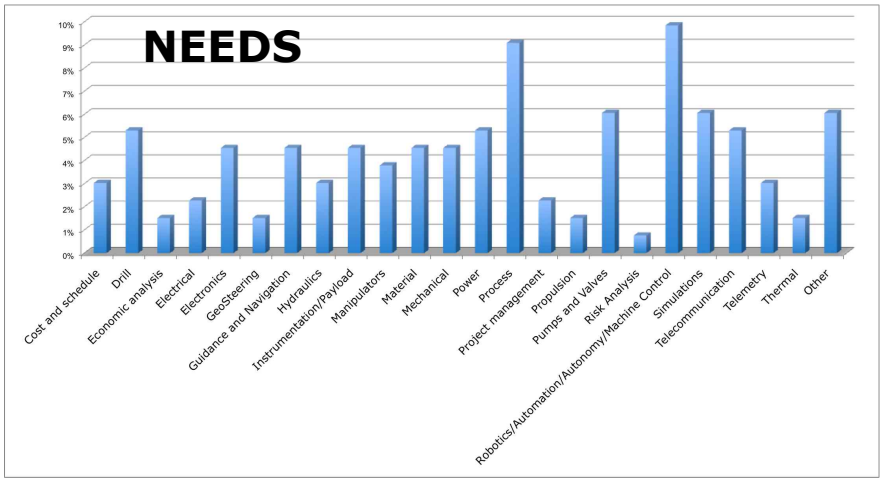

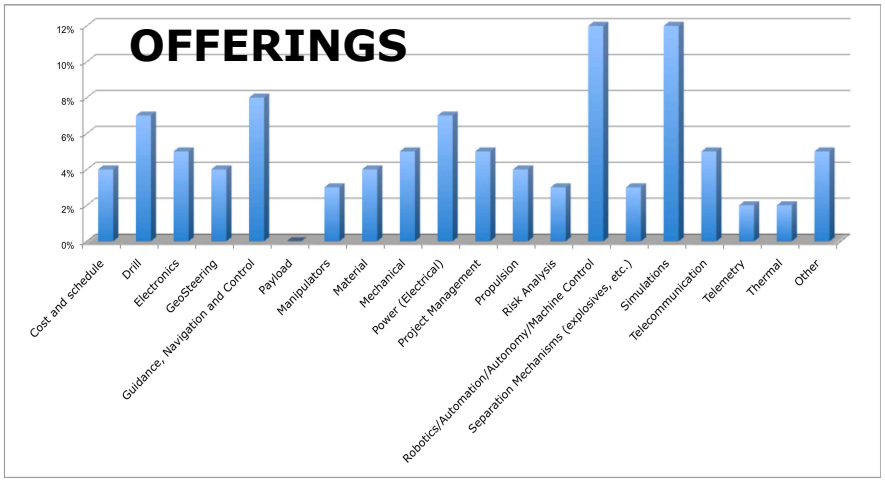

1. JSC has full-size, fully functional space shuttle and space station simulators.
2. Their manned space program has very a strong focus on safety, continuous risk management, training, and decision making processes
3. Simulation and Risk+Pr.Ma.: Defined as **NEEDS** and **OFFERINGS** in the Phase I – Survey of Norwegian Companies

Images - SIMTANO: (1) Space Station Operations Center; (2) Space Shuttle Full Size Mock-Up and NASA: (3) Astronauts STS-133 http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/sts133/index.html

Results

1. NASA Technology Collaboration with private partners has to show direct benefit to the space program
2. NASA and JSC willing to consider providing IP rights to collaboration partners
3. NASA is open to collaboration with foreign partners
4. Opportunities for space related Ms. and Ph.D. internships at JSC
5. SBR-JPL project doing good progress through the JPL and NASA approval process

Next Steps

1. Initiate collaboration with other NASA centers (Ames, etc.) and Norwegian Industry
2. Develop funding mechanisms with Norsk Forskningsråd (Norwegian Research Council), Innovation Norway, and others to enable this type of collaboration
3. Encourage Norwegian companies to provide funds ($9k) + travel for Norwegian Ms and PhD students to participate at JPL summer programs
4. Encourage exchange of researchers between JPL/NASA and the Norwegian Energy Industry
5. Organize conferences and workshops for researchers/engineers from "Energy" and "Space" to develop future joint collaboration projects. Step One, Fist step: Today's Conference
6. Initiate MORE collaboration projects with JPL, and other NASA centers

..... Many a false Step has been Made Standing Still .....

Dr. Knut I. Oxnevad, Founder and CEO, SIMTANO

Oxnevad is the founder and CEO of SIMTANO®, Inc, formerly Concurrent Design Laboratories (CDL). SIMTANO® uses "The Eight Principles of Concurrent Design" and the "People, Process, and Tools – Model" to improve the work-processes for its corporate clients. These methodologies were developed over the last 12 years through Oxnevad's research and implemented and tested at the Jet Propulsion Laboratory – California Institute of Technology.

Oxnevad worked there from 1996 to 2005. During his tenure at JPL, he set up and led state-of-the-art concurrent design teams – Next generation Project Development Teams - the NPDT's both at JPL and other NASA centers. These teams performed advanced studies of space payloads, satellites, and surface/subsurface systems. One of his design teams developed rover and lander missions beyond 2010 for Mars, the Moon and other celestial bodies. From 2005 to 2009, his company SIMTANO supported Norwegian oil and gas companies working smarter in the areas of well planning, field development, and modification projects.

Oxnevad received his Ph.D. from Old Dominion University, Norfolk, VA in 1996, where he proposed a new design approach for spacecraft." In 2000, he defined and published "The Eight Principles of Concurrent Design," enabling radical changes in current design process approaches. He is a graduate of International Space University, chaired the New Design Paradigms Workshops, and ran the Design Process Improvement (DPI) Project within the NASA Engineering Training (NET) office. He has published 10 papers and given more than 30 talks at institutions and conferences in the USA, Europe, and Japan on the topics of concurrent design and design process improvements. He has received international awards for his work, and consults through SIMTANO® national and international institutions on design/work process improvements.

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