

MIT

I M P A C T

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I M P A C T

Emerging Work from the Center for Technology, Policy, and Industrial Development

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CHALLENGE: How can we support Ford's Back-to-Basics strategy?

The nation's economic stress is hitting the auto industry hard and Ford is feeling the pressure. The company's response is a Back-to-Basics strategy, which means forgoing auxiliary business opportunities and concentrating on making great cars. "The focus is on making high-quality vehicles that people want to buy and that we can sell at a profit," said Steven. "That's why powertrain, manufacturing, and management issues are among our priorities."

CHALLENGE: How can we engage parts of Ford that are not directly involved in Alliance projects?

Key questions include how the Alliance can serve a broader audience at Ford in addition to members of the research and the advanced engineering communities. The goal is to make the Ford organization feel like the relationship with MIT is a strategic asset available to anybody who has a problem. "If we can make MIT feel like Ford's right arm, the Alliance would be more credible throughout Ford and we would not have to rely on executive drive to make it successful," said Steven.


CHALLENGE: How can we affect core engineering and not just research or a few programs?

Bringing new ideas into production is the fundamental way of getting value out of Alliance projects, the Schondorfs say, and that means involving people in research, advanced engineering, core engineering, and specific programs. Getting the core engineering team involved is particularly important to spreading new technologies across multiple programs.

CHALLENGE: Communication

The Schondorfs are working to bring Ford people to MIT more often and vice versa. Beginning next year, the vice presidents and executive committee of the Alliance will come to MIT three times a year instead of once. MIT researchers, beyond their research activities, will travel to Ford to share project results with a larger pool of Ford people in an annual Technology Day.

"Communication is really the key," added Alliance Co-Director John Heywood, Sun Jae Professor of Mechanical Engineering and Director of the Sloan Automotive Lab.

"Ford has some very strong needs, so they have their own agenda. Ford wants fresh ideas from MIT, it doesn't want to prescribe what those ought to be. Our experience is that we rarely disagree about the high priority issues and the areas where MIT has expertise, but that has to be preceded by getting to know people. The success of the program depends on not only doing good work but on being able to communicate it." 

Ford's Back-to-Basics Focus Turns Alliance to Powertrain, Manufacturing, and Management

BY NANCY DUVERGNE SMITH

The Ford-MIT Alliance brings industry issues to MIT's research heart. As the Alliance begins a second five-year term, Co-Executive Directors Kristin Schondorf and Steven Schondorf are looking at tightening Ford-MIT connections and expanding into new research areas. At a March 18 CTPID Industry Issues Community Lunch, the Schondorfs, MIT alumni who married shortly after earning graduate degrees in 1992, discussed some Ford pressure points and how MIT can contribute to solutions.

"The future of the Alliance lies in new or expanded research topics that bear on Ford's priorities," said Kristin Schondorf. Applying the results of the long-term projects favored by researchers to daily production cycles means tackling topics such as more efficient powertrains and reducing paint shop expenses. Increasing the flow of students and faculty to Ford will also help strengthen the relationship.

FORD/MIT ALLIANCE INITIATIVES

1997-2002 Research Focus:

- Environment
- Product Development Process Technology
- Active Safety
- Virtual Education

2003-2007 New Research Interests (in addition to ongoing projects):

- Powertrain
- Manufacturing
- Management
- Materials
- Infotronics/Telematics
- Fuel Cells and Hydrogen Storage

Both Schondorfs are using their Ford expertise to connect MIT research with company experts. Kristin, whose work has focused on engines, and Steven, who has worked in both fuel cells and electronic systems, are developing ideas that can be translated into production solutions.

"As projects are ending and new ones starting, we are trying to understand how to apply the research results to production and engage core Ford people," said Steven. "The key is to be persistent and relentless."

The Schondorfs are working with MIT and Ford leaders to tackle four major Alliance challenges:

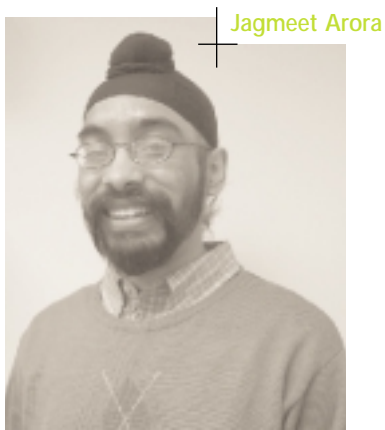
2 MIT Students Mine In-Depth Knowledge at Ford

When MIT students spend a summer working at the Ford Motor Company, the knowledge transfer is in depth and tangible. And Daniel Whitney, CTPID Senior Research Scientist and Ford-MIT Alliance program area manager for Product Development Process Technology, has been sending students to Ford to learn vital lessons for years.

“My attitude toward students and research is basically driven by the model of MIT’s Leaders for Manufacturing program,” said Whitney, who sends MIT students to Ford every summer and most Januaries as part of his Design Structure Matrix and Assembly Advisor projects. “You should put the students out into companies for extended periods of time.”

Jagmeet Arora, who gathered thesis research at Ford as part of the Assembly Advisor project, spent last summer at Ford engine plants and engineering offices investigating engine design related to assembly. His thesis research is helping to untangle a Ford problem.

“The hypothesis proposed by the Ford manager was that the problem he encountered could be solved by improvements in design,” said Whitney. “And we suspected that some of these problems were the result of things that happened in the plant independent of the design. Jagmeet went to the plant to see what actually happened. We found out that the factory was being inconsistent in certain ways and they should look into it further. That’s a good lesson for any student—the difference between what happens in the design office and the factory.”



Jagmeet Arora

“We go to factories not simply for the reality, we go there for the complexity. If your solution does not scale to the complexity, you don’t have a solution.”

Dr. Daniel Whitney

Kristin and Steven Schondorf shared Ford insights at the CTPID Industry Issues Community Lunch March 18. See story on page 1.




Antoine Guivarch

Antoine Guivarch, who is set to earn master’s degrees in Technology and Policy and in Mechanical Engineering in June, spent last summer and January working on Design Structure Matrix research at Ford.

“Direct contact with engineers really helped me realize the number and scope of critical problems that product development faces today,” Guivarch said. “Classes at MIT introduced me to the conceptual issues in product development and showed me methods to address them, together with some practical applications in class projects. But practical experience on a large, real project like the one I conducted at Ford was necessary to translate the class concepts to day-to-day consequences.”

Tackling real projects with real deadlines is a critical educational experience, Whitney believes. “None of these projects could be reproduced by MIT. That’s the point. We go to factories not simply for the reality, we go there for the complexity. If your solution does not scale to the complexity, you don’t have a solution.”

Ford provides a rich learning arena, said Whitney, who has worked with Ford more than 25 years. “My experience with Ford is that they have been tremendously open. They are great partners.” 



Labor Aerospace Research Agenda: Probing the Aerospace Employment Crisis

BY PATRICIA PROVEN

Employment in the global aerospace industry has dropped dramatically since 1990, with United States employment falling from about 1.3 million to 800,000 workers and, in Europe, from about 600,000 to 400,000 workers.

To understand factors involved in this sharp decline and to evaluate appropriate responses, MIT's Labor Aerospace Research Agenda (LARA)—a program based at the Center for Technology, Policy, and Industrial Development since 1998—has embarked on new studies expanding early work on instability in the aerospace industry.

Research about the aerospace workforce has taken on increased urgency, said LARA Co-Director Joel Cutcher-Gershenfeld, given disruptions in the civil aviation sector since Sept. 11, as well as complex shifts in military aerospace.

"We're feeling a crisis in aerospace employment," said Cutcher-Gershenfeld, "and we are only beginning to catalyze action around appropriate responses at the local, regional, national, and international levels."

Over the past year, LARA researchers contributed a white paper, testimony, and informal input to the National Commission on the Future of the United States Aerospace Industry. Their work and that of other researchers culminated in the *Final Report of the Commission on the Future of the United States Aerospace Industry*, issued Nov. 18, which offers recommendations for revitalization of the U.S. aerospace industry.

In highlighting massive consolidation, job losses, and revenue cuts over the past two decades, the report calls attention to faltering underpinnings of the aerospace industry. The report also offers a vision that seeks to catalyze leaders in government, industry, labor, and academia to ensure this industry's future prominence.

Declining employment corresponds to declining sales in both the United States and Europe, he said, but the LARA research findings indicate that changes in employment have been greater than shifts in sales, which may be due to increases in productivity or other factors.

Productivity and offsets issues, complicated by the worldwide economic downturn, make up part of the picture on employment

decline, said LARA Associate Director and CTPID Research Scientist Betty Barrett.

"Workers are more productive and companies are using work organization systems, such as lean manufacturing, to reduce costs," she said. But, when sales are down due to the current global economic slump, high productivity puts more jobs at risk.

Offsets, or foreign production provisions, are controversial, said Cutcher-Gershenfeld. "Employers see offsets as essential to business growth, but unions are critical of 'selling jobs in order to sell planes,'" he said.



LARA researchers are now working with the Aerospace Industries Association (AIA), its employer members, and key union representatives to systematically address these workforce challenges.

In January, members of the LARA team joined industry, labor, and government representatives at the Industrial Relations Research Association (IRRA) national meetings to present a special panel on 21st century challenges facing the aerospace workforce. The panel's success has prompted a request for a special feature on this topic for the IRRA publication, *Perspectives on Work*. This feature, edited by LARA Project Manager Susan Cass, will offer articles from the academic community, industry, government, and labor.

IRRA also accepted LARA's proposal for an enlarged double session at the Association's 2004 national meetings. Such an expanded session is rare and significant, Cutcher-Gershenfeld said. It not only represents a form of outreach to the industry by the association, but also allows for deeper investigation into aerospace workforce challenges.

After LARA's work on the Presidential Commission on Aerospace, the U.S. Department of Labor approached the program with a research grant to examine operations at Boeing/IAM St. Louis, where both union and employer agreed to compress approximately 47 job classifications and numerous sub-classifications into eight integrated categories. The initiative's elaborate just-in-time delivery system for relevant skills training among 3,000 employees allows more flexible utilization of the workforce by the employer and increased worker employability.

This new, flexible job structure is linked to three recent developments: a lean implementation initiative, a High-Performance Work Organization partnership (HPWO) improving labor-management relations between the union and company, and an initiative for just-in-time delivery material flow reaching out into the supply chain. The LARA research team, led by Cutcher-Gershenfeld, Barrett, and new Research Assistant Lydia Fraile, expects to complete the investigation this summer, then publish the work as a case study.


In addition to these initiatives, Cutcher-Gershenfeld has a new working paper underway. The study, entitled "Lean Transformation in the U.S. Aerospace Industry: Appreciating Interdependent Social and Technical Systems," examines the employment and organizational performance implications of lean transformation across the national aerospace industry. A key preliminary finding, he said, is that narrow, technically focused lean initiatives are associated negatively with employment growth. Broader initiatives that focus on both social and technical aspects of lean transformation associate positively with employment growth, he added. The analysis draws upon data from more than 300 U.S. aerospace facilities that responded to LARA's random, national sample survey in 2002, in addition to data from their 1999 facility survey.

LARA Co-Director Thomas Kochan recently completed a working paper, "Out of the Ashes: Options for Rebuilding Airline Labor Relations," written with Andrew von Nordenflycht, Robert McKersie, and Jody Hoffer Gittel. This paper examines labor management relations and employment levels in the U.S. airlines sector. Amidst current labor policy debates in Congress, the paper aims toward building multi-stakeholder support as a foundation for stability and revitalization in the airlines sector.

Meanwhile, Barrett is nearing completion of a case study that describes the efforts of Iowa-based aerospace company Rockwell

Learn more about the Lean Aerospace Research Agenda including case studies, policy recommendations, and ongoing research on LARA's home page: <http://web.mit.edu/ctpid/lara>

Collins and the IBEW, which represents its workforce, to develop new, effective methods for helping workers maintain skills and develop new ones. "They are doing this at a time when the economic situation in the aerospace industry is quite difficult," Barrett said.

The Rockwell Collins study, to be published this summer, adds to LARA's case studies in MIT's digital archive, DSpace. LARA and other CTPID programs are early adopters of the DSpace initiative. Visit <http://hpds1.mit.edu>. 



Lydia Fraile

New LARA Researchers To Focus on Workforce Development, Work Restructuring

Two MIT researchers will join the Labor Aerospace Research Agenda (LARA) team through 2003 to work on projects involving workforce development and work restructuring.

Research Assistant Lydia Fraile's background dovetails with LARA's interest on workforce development and effective institutions. Fraile is completing a PhD in political science this spring. Her dissertation studies Spanish unions' involvement in local partnerships to tackle issues of training and employment, exploring the connection of these new strategies to collective bargaining and government policy. Fraile holds a law degree from the University of Salamanca, Spain, and a MA in political science from the University of Colorado at Denver.

Adam Seth Litwin, a PhD student in MIT's Institute for Work & Employment Research, is a LARA research affiliate. Litwin comes to MIT from the Board of Governors of the Federal Reserve in Washington, D.C., after conducting research at the London School of Economics and in the private sector. With an array of multidisciplinary interests in labor markets, labor policy, and strategic human resource management, Litwin will use the aerospace industry as a lens to gain insight into the causes, correlates, and impact of work restructuring.

Adam Seth Litwin





> Photograph by Patricia Proven

HOLWEG IN PROFILE

Matthias Holweg's career has always been on wheels. Through years of research in logistics and supply chain, he's simply changed lanes.

Before college, Holweg drove ambulances for the Red Cross near his native Hamburg, Germany. Over five years, while training as an industrial engineer at the University of Applied Sciences Wedel, his service as a paramedic evolved into a career drive toward product management of emergency medical equipment.


His course was altered in 1998 when he began graduate work at the University of Buckingham, UK, where his supervisor, who directs the MSc in lean operations at Cardiff Business School, sparked his interest in the auto sector.

"I looked at the steel supply chain and found that most of the problems I had to deal with were originating elsewhere in the system and causing problems upstream," said Holweg.

After graduating in 1999 with a MSc in Operations Management, Holweg continued his supply chain research in Europe's 3DayCar Programme in a more holistic way. "I tried to see the system as a whole, beyond mere manufacturing or the steel supply chain. Considering only subsets of a system yields limited results," said Holweg, who earned a PhD in Supply Chain Management from Cardiff Business School in Wales last spring.

His dissertation, "The Three-Day Car Challenge: Investigating the Inhibitor of Responsive Order in New Vehicle Supply Systems," elaborated factors that keep the supply chain from turning out custom vehicles more swiftly. Last September, amid his continued auto research at MIT, the dissertation won the 2002 James Cooper Memorial Cup for Best PhD from the UK's Institute of Logistics and Transportation.

Since securing an Alfred P. Sloan Foundation Research Fellowship last May, Holweg has focused on the implementation of build-to-order strategies, which could help transform the automotive supply chain globally. "The idea of the fellowship was to investigate not only the U.S., but also Japan, and I am only getting started on this," he said. "I figured that IMVP was the perfect fit for pursuing this international research agenda."

Even in his leisure pursuits, Holweg is in motion. He often bikes from home in Cambridge, Mass. to Kendall Square, where he works as a principal investigator of MIT's International Motor Vehicle Program (IMVP). In winters, he takes breaks to ski the mountains of Massachusetts. And, Holweg recently earned a 'big-boat' skipper license at Boston Harbor Sailing Club. So, this spring he'll cruise the Charles River in one of MIT's Rhodes 19s. 

Streamlining the Way for Custom-Built Cars: An Interview with IMVP-Sloan Industry Center Research Fellow Matthias Holweg

BY PATRICIA PROVEN

Car buyers who customize a vehicle often wait two months from the time of order to delivery. Matthias Holweg, a principal investigator for MIT's International Motor Vehicle Program (IMVP), makes it his prerogative to find out why.

If assembly of a custom-built car occupies only six days, why does it take so long to reach the buyer, asks Holweg, who is exploring this question through a Sloan Industry Research Center fellowship.

He hopes that his findings—to be published in a forthcoming book co-authored with University of Pittsburgh Assistant Professor and IMVP Research Scientist Frits Pil—will help catalyze a streamlined, build-to-order model for production and distribution across the entire automotive supply chain.

They draw their conclusions from IMVP's ongoing Global Assembly Plant Study and a range of process-maps, surveys, and interviews conducted at assembly plants, suppliers, and logistics companies worldwide.

Holweg and Pil recently published on this topic in two *MIT Sloan Management Review* articles, "Exploring Scale: The Advantages of Thinking Small" (Winter 2003) and "Successful Build-to-Order Strategies Start with the Customer" (Fall 2001).

What Do Customers Want?

"When you think about how much you spend on a car, why shouldn't you get exactly what you want?" said Holweg, who holds a PhD in Supply Chain Management from the UK's Cardiff Business School.

Holweg's investigation of car makers began in 1999 with the 3DayCar Programme in Europe. Since last May, as one of five national recipients of an Alfred P. Sloan Foundation fellowship, he's continued this research in the United States. A recent second-year extension of the fellowship gives him the chance to expand the study to Japan.

Ideally, Holweg said, a buyer could get a customized car within 10 days.

Holweg's research pinpoints major obstacles that include long order processing times, factories' inability to adapt to variations, overly complex products, organizational culture, and current incentive structures.

"Car companies have optimized the factory at the expense of customer fulfillment and large inventory in the marketplace," said Holweg.

Assembly lines, for instance, cannot accommodate much variability in demand. Production schedules rely upon a rigid workload balance, in which labor-intensive vehicles, like station wagons, must be followed by one or several less intensive ones, like sedans, to make up for the time.

Under a build-to-order (BTO) model, buyers get satisfaction fast while car makers save money. *Automotive News* reported in 2002 the U.S. industry spent about \$1,800 per car sold, or \$30.9 billion total, on incentives that include zero percent financing, alternative specifications discounts, stock clearances, and free options. Such incentives are meant to compensate customers' settling for less.

"It's just a very costly business," Holweg said.

Taking a Holistic View

Holweg's work is notable for its holistic, rather than reductionist, approach to the automotive industry. Trained as an industrial engineer, he embraces the principles of general systems theory, which holds that studying a subsystem in isolation yields limited understanding of its functioning in its environment.

In the automotive industry, he said, there's a tendency to perfect units of production while neglecting the overall order-fulfillment process. "It's like looking at how muscle tissue works without understanding the network of nerves that makes it move," he said.

The BTO model, first proposed in the 1989 *Manufacturing for the 21st Century Report* as a key challenge for the Japanese motor industry, allows customers to specify car configurations for rapid delivery. Automakers worldwide contend with the same challenge, he said.

"In North America, only one out of every two car customers gets the specifications they want," he said. "And in Europe, it's still only one out of every four."


For more information on the International Motor Vehicle Program, visit <http://imvp.mit.edu>.

Car Buyers Benefit

Car buyers would gain from a streamlined process. "Cars built to order are much cheaper to make – no stock holding, incentives, or discount," he said, estimating savings of \$1,500 per U.S. car purchase.

Car companies hesitate to adopt build-to-order, Holweg conceded, because it requires drastic change and carries risks. "You might not fill up your facility capacity as easily," he said. "You have to work very hard to manage demand. That's something car companies have missed so far."

While European markets have shown signs of accommodating demand-driven manufacture, he said, the transition is generally slow and has yet to transform the United States motor industry. Noting that the UK's ratio of build-to-order cars increased from 10 to 32 percent since 1992, he predicted similar change in the U.S. to take at least five to ten years.

"Changing the computer systems is one thing," he said, "but changing the underlying 'stock-push' mindset is quite a different beast." 

What is the 3DayCar Programme?

The 3DayCar Programme, a joint venture between three UK universities and 21 industrial sponsors, aimed to develop a framework for fulfilling a customer's need for a vehicle in three days, from order placement and manufacture through delivery.

"How we make and sell cars hasn't changed much since Henry Ford," he said. Ford maintained a 60-day inventory; today's inventories are only down to 59 days.

Through 3DayCar, Holweg was responsible for systems research, one of the project's six research streams. His initial approach through survey instruments failed, he said. "Few people understand the whole process and the data I needed were simply not available." So he opted for value-stream mapping, 'stapling' himself to an order and following the process through. This enabled him to measure each step and explore why delays occur.

3DayCar, a three-year project, has become the benchmark for the implementation of BTO. Several major vehicle manufacturers have begun adopting short, specific lead times. For more information, see <http://www.3daycar.com>.

Reading Matters

New books, publications, and web pages by faculty and staff associated with CTPID

PUBLICATIONS

ITC Thesis Examines Broadband Resale

le Tanneur, Erwan. "Residential Resale of Wireline Broadband via Wireless." Technology and Policy thesis, February 2003. Available at http://itc.mit.edu/itel/students/papers/erwan_thesis.pdf.

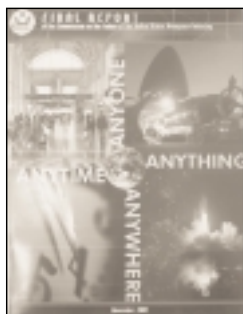
Technology and Law Program

Ashford, N.A. "Pathways to Sustainability: Evolution or Revolution?" in *Innovation and Regional Development in the Network Society*, Marina van Geenhuizen, David V. Gibson, and Manuel V. Heitor (eds.), QUORUM Books: Series on "Technology Policy and Innovation." 2002. Vol. 7. Available at <http://in3.dem.ist.utl.pt/quorumseries/> and <http://hdl.handle.net/1721.1/1588>.

Epstein, S. S., Ashford, N. A., Blackwelder, B., Cohen, G., Goldsmith, E., Mazzocchi, A., and Young, Q. D. "The Crisis in U.S. and International Cancer Policy." 2002. *International Journal of Health Services*, 32(4): 669-707.

Zwetsloot, G. and Ashford, N. A. "Inherently Safer Production, A Natural Complement to Cleaner Production." 2002. *Industry and Environment*, 25(3-4): 84-87, UN Environmental Programme, Paris.

WEB WORK



Labor Aerospace Research Agenda

Electronic copies of the *Final Report of the Commission on the Future of the United States Aerospace Industry*, issued Nov. 18, 2002, are available under Policy Recommendations on the Labor Aerospace Research Agenda website at <http://web.mit.edu/ctpid/lara/>.

Lean Aerospace Initiative

McManus, Hugh L. "Value Stream Analysis and Mapping for Product Development." Conference Paper. Sept. 2002. Available at <http://web.mit.edu/lean> under "Publications."

LAI Plenary Materials on the Web

Workshop presentations from LAI's March 25-26 annual meeting, "Transformation Across Enterprise Boundaries: Pioneering the Future of Aerospace," in Dayton, Ohio, are online at <http://lean.mit.edu/Events/workshops/search.asp>.

Presentations featured the following MIT panelists:

- Rebentisch, Eric, CTPID research associate. "Lean Enterprise Value Simulation Game." Available at http://lean.mit.edu/Events/workshops/files_public/PL03_B2_McManus.pdf
- Murman, Earl, Aeronautics and Astronautics. "Educational Network Panel: Graduate Education (Part 3)." Available at http://lean.mit.edu/Events/workshops/files_public/PL03_B2_3Murman.pdf
- Ferdowsi, Bobak, Aeronautics and Astronautics. "Evolutionary Strategies in Product Development." Available at http://lean.mit.edu/Events/workshops/files_public/PL03_B2_Ferdowsi.pdf
- Spaulding, Timothy J., Aeronautics and Astronautics. "Panel: Putting Spiral Development into Practice (Part 4)." Available at http://lean.mit.edu/Events/workshops/files_public/PL03_B2_Spaulding.pdf

Program on Internet and Telecoms Convergence

These ITC publications are available at <http://itc.mit.edu> under Research, Papers.


Faratin, P., Wroclawski, J., Lee, G., and Parsons, S. "The Personal Router: An Agent for Wireless Access." October 2002. http://itc.mit.edu/itel/docs/2002/Peyman_Faratin.pdf

Gabel, David. "Why is There So Little Competition in the Provision of Local Telecommunications Services?" Presented at TPRC 2002, Alexandria, Va., Sept. 28-29, 2002. Available at <http://itc.mit.edu/itel/docs/2002/LastMileDone.pdf>

McKnight, Lee W., Vaaler, Paul M., and Katz, Raul L. "Innovation and Creative Destruction in Emerging Markets: The Impact of State Commitments on Privatizing Telecoms." Presented at TPRC 2002, Alexandria, Va., Sept. 28-29, 2002. Available at http://itc.mit.edu/itel/docs/2002/creative_destruction.html

McKnight, Lee W., Anius, Diana, and Uzuner, Ozlem. "Virtual Markets in Wireless Grids: Peering Policy Obstacles." Presented at TPRC 2002, Alexandria, Va., Sept. 28-29, 2002. Available at http://itc.mit.edu/itel/docs/2002/virtual_markets.pdf

O'Donnell, Shawn. "An Economic Map of the Internet." Presented at TPRC 2002, Alexandria, Va., Sept. 28-29, 2002. Available at http://itc.mit.edu/itel/docs/2002/Internet_Map.pdf

Weiss, Martin B.H. and Shin, Seungjae. "A Simulation Approach for Internet QoS Market Analysis." Presented at TPRC 2002, Alexandria, Va., Sept. 28-29, 2002. http://itc.mit.edu/itel/docs/2002/QoS_Market.pdf 

News at the Center

MIT IQ Certificate Courses Begin in May

The MIT Information Quality (MIT IQ) Program based in CTPID, in collaboration with School of Engineering, is launching a series of programs to provide the skills needed for job positions such as IQ analyst, IQ manager, and IQ trainer. "With strong support from the U.S. Navy and industry partners," said MIT IQ Director Richard Wang, "CTPID is offering the first sessions of Information Quality Management I (IQM I) on May 19-23 and August 11-15." *More information on the certificate program is available at <http://web.mit.edu/tdqm/www/> or e-mail rwang@mit.edu.*

ITC and IMVP Leaders Address 'Extreme Communications'

Leaders of two CTPID programs gathered support for a new coalition of academic interests at the MIT Industrial Liaison Program's April 15-16 conference on "Extreme Communications: A Radical Rethinking of Business, Technology, and Regulatory Strategies." Sloan School Chrysler Leaders for Manufacturing Professor Charles Fine, IMVP researcher and former co-director, and David Clark, director of the Program on Internet and Telecoms Convergence and a senior research scientist at the Laboratory for Computer Science, framed a new concept about the communication industry's changing business and operating structures. *For more information, visit <http://ilp.mit.edu/ilp/Conferences/Current.html>.*

Widnall Named Among Most Important Women in Science

Professor Sheila Widnall, LAI executive board co-chair and former Secretary of the Air Force, is featured in the November issue of *Discover Magazine* in the "50 Most Important Women in Science." "Blow a smoke ring and notice that in calm air, it undulates gently. Those wiggles are termed the 'Widnall instability,' and, by discovering them, this scientist rewrote the book on fluid dynamics," reported *Discover*. In citing the importance of the scientists' work, *Discover* wrote, "If just one of these women had gotten fed up and quit...the history of science would have been impoverished." *For more information: <http://web.mit.edu/newsoffice/nr/2002/women.html>.*

LARA's Boeing Research Funded by Department of Labor

The Labor Aerospace Research Agenda (LARA) recently received a grant from the U.S. Department of Labor to examine operations at Boeing/IAM St. Louis, where approximately 47 job classifications are being compressed into eight integrated classifications.

This new, flexible job structure is linked to three developments: a lean implementation initiative, a high-performance partnership between the company and the union, and a new material flow initiative reaching out into the supply chain.



General Lester Lyles, Air Force Materiel Command, speaks at the LAI Plenary on the 'Future of Aerospace'

Research will focus on how the company's new system enables flexibility in utilizing its 3,000 person workforce. It will also measure increased organizational effectiveness, improved quality of work life, and greater employability.

A three-person team, LARA Co-Director Joel Cutcher-Gershenfeld, Research Scientist Betty Barrett, and Research Assistant Lydia Fraile, will continue the research through 2003.

Air Force General, Raytheon Head Kick Off LAI's 'Future of Aerospace' Plenary Conference

General Lester Lyles, Air Force Materiel Commander and LAI executive board co-chairman, kicked off the annual LAI Plenary Conference, "Transformation across Enterprise Boundaries: Pioneering the Future of Aerospace," March 25-26 in Dayton, Ohio.

Lyles conducts research, development, test and evaluation, acquisition management, and logistics support to keep Air Force weapons systems ready for war. At the Ohio conference, he discussed the enterprise of government and its transformation.

Raytheon Chairman and CEO Dan Burnham delivered a keynote industry address, sharing leadership insights into Raytheon's corporate transformation strategy and journey.

Snapshots of breakout sessions featuring Air Force, industry, and academic presentations:

- **Experiencing Enterprise Transformation** included Paul Mullenhour, Lean Learning Center, who commented on identifying an organization's operating system as a framework for understanding transformation. George Koenigsaecker, Lean Investments LLC, recommended using productivity as a key metric for lean transformation and continually revisiting lean areas for further improvements.
- **Transition to Production** a joint presentation by Ed Peterson, Aerojet Corp., and Bob Morris, COHESIA Corp., argued for using Value Stream Mapping in product development and Characteristic Lifecycle Management as lean tools.



LAI Keynote Speaker Raytheon Chairman Dan Burnham

- In *Willingness to Change*, Ford-MIT Alliance Executive Director George Roth offered a framework for learning and change that included the use of force field analysis as an exercise for developing common insights.
- The *Creative Approaches to Learning Lean* session featured Hugh McManus, Metis Design, who described how the LAI Lean Enterprise Business Simulation Game uses a sophisticated Lego simulation to teach advanced lean lessons of enterprise integration. Peggy Holly, Boeing Company, described how Boeing IDS has incorporated the game into their Lean Engineering training.
- *Enabling Value to Multiple Stakeholders* offered examples of putting to lean to work: value engineering at Raytheon, improved cash collection at Rolls Royce, and training change agent teams at Lockheed Martin Space and Strategic Missiles.

The LAI Educational Network was introduced by panelists from Rolls-Royce Corporation, MIT, University of Tennessee, University of Michigan, and the Defense Acquisition University. Each described how they included lean in their educational programs from modules in core curriculum to online programs to certificate programs. The group, which welcomed the University of Bath UK, Loyola Marymount University, and the University of Texas, Arlington, discussed a lean systems engineering graduate course, how to catalog resources, and an internship program set to begin this summer at Rolls Royce. *Visit the LAI web site for plenary presentations: <http://lean.mit.edu/Events/workshops/search.asp>*

MSL Plans Move to Amherst Street

The Materials Systems Laboratory (MSL) plans an end-of-semester move from its 238 Main Street headquarters to newly renovated offices on the fourth floor of MIT's Building E40 on Amherst Street. The program's staff includes Director Richard Roth, Administrative Assistant Jamie Sieger, and CTPID Senior Research Engineer Frank Field III. MSL researchers include Principal Investigator and Professor Joel Clark and Assistant Prof. Randolph E. Kirchain, Jr., who both hold joint positions in the Engineering Systems Division.

Industry Issues Talk Probes Air Force Concerns

Lean Aerospace Initiative Stakeholder Co-Director Terry Bryan is slated to discuss the U.S. Air Force's lean efforts at the May 1 CTPID Industry Issues Community Lunch. Bryan, a Raytheon executive on loan, is a retired U.S. Marine Corps lieutenant, a former test pilot, and holds a MS in Aeronautical Engineering from the Naval Post Graduate School in Monterey, CA. His topic is "Transformation: LAI and the Air Force 'Lean Now' Initiative."



LAI Stakeholder Co-Director Terry Bryan

Mattar Explores Infrastructure Funding

Mahdi H. Mattar, a post-doctoral fellow in the Civil and Environmental Engineering Department, is continuing research on privatization issues as a research fellow for the Center for Technology, Policy, and Industrial Development.

Mattar is collaborating with CTPID Director Fred Moavenzadeh, his research adviser since 1997, as well as School of Management Prof. Gordon M. Kaufman and Civil and Environmental Engineering Senior Lecturer Prof. Massood V. Samii.


The team is focusing on new ways of financing traditional infrastructure projects, including ports, rail systems, toll roads, water, and wastewater. These projects have traditionally been funded on a project-by-project basis. Mattar and his colleagues are investigating how to secure funds for several projects bundled together.



Mahdi H. Mattar

Mattar received his PhD in risk management in 2002. His current research should be useful for development banks and multinational institutions like the World Bank since these institutions provide funding for infrastructure projects. "Most players in infrastructure projects would benefit from the increased liquidity to this market," Mattar added. An abstract of Mattar's dissertation, "Private Risk," is available online at <http://web.mit.edu/civenv/html/research/abstracts/const.html>.

IMVP Research Meeting Looks at 2nd Tier Suppliers, Interactive Tools

A global gathering of International Motor Vehicle Program (IMVP) researchers and guests at the University of Pennsylvania's Wharton School, hosted April 2-3 by IMVP Co-Director John Paul MacDuffie, discussed industry changes from Detroit to Brazil. Research reports included Sloan Industry Fellow Matthias Holweg and University of Pittsburgh Assistant Professor Frits Pil's update on their book-in-progress (see story page 5). Case Western Reserve University Professor Sue Helper discussed new research on 2nd tier suppliers. Helper is looking at the impact of factors such as global competition and economic pressures from both auto industry original equipment manufacturers (OEMs) and raw materials producers. The two-day session included demonstrations of Wharton's FutureView, an interactive teaching tool, and a web-based case study of brown field transformation, developed by the MIT Engineering Systems Learning Center headed by CTPID's Joel Cutcher-Gershenfeld. 

Got news? Please email Communications Director Nancy DuVergne Smith, ndsmith@mit.edu.

ITC Offers Perspective on 'Broadband Divides'

BY NANCY DUVERGNE SMITH

Oxford, UK — Inside Balliol College's ancient walls, MIT Program on Internet and Telecoms Convergence (ITC) leaders recently sketched a path toward a broader digital future. ITC Director David D. Clark offered lessons from America's residential broadband deployment experience in a keynote to the international conference, "Broadband Divides," March 27-28, hosted by the Oxford Internet Institute and co-sponsored by ITC and Syracuse University.

Clark's mission was to deliver relevant findings from *Broadband: Bringing Home the Bits*, a 320-page report by the Computer Science and Telecommunications Board (CSTB) of the U.S. National Academies. Clark, CSTB chair, spearheaded the report.

"There are many perspectives on the state of broadband deployment," Clark said. "Is it a success, a failure, a hotbed for a new generation of monopolist, a societal imperative, or a product that has not yet proved its value to the consumer? Can it be all of the above?" The uneven pattern of current deployment makes U.S. national planning difficult, he noted, because market conditions and technological facilities vary radically. In the U.S., urban residents may have several companies competing to sell broadband services while some rural residents have no options.

Yet the U.S. example of delivering high-performance Internet service offers useful lessons. "Broadband deployment may be a patchwork, but a healthier patchwork than some might think," Clark said.

"Broadband deployment may be a patchwork, but a healthier patchwork than some might think."

Dr. David D. Clark

The international conference tackled nagging issues involving equity, economic competitiveness, and policy incentives. Discussion papers by ITC's Sharon Eisner Gillett, Lee McKnight, Carlos Osorio, and others addressed these issues:

- Social Divide: What are the equity implications of the uneven distribution of broadband within and between nations?
- Significance Divide: Is broadband access a luxury bringing easier access to entertainment or a social and economic necessity


providing a gateway to important information, people, and services?

- Policy Divide: Will competition deliver market-led developments that break down the divide or must the public sector lead through policy initiatives, regulation, and investment?

The economics of broadband distribution raise key questions that have powerful implications for competition and industry structure. Who has the money to spend? Who will make

money? How are the two linked? "It is money, not technology, that gates broadband," Clark said.

Clark sees a new role for local government leadership since municipalities are most familiar with deployment patterns and problems. Public initiatives can foster market entry by reducing the business costs of entering a market, local rules can encourage new service, and communities can increase local infrastructure capacities. Conference participants were particularly enthusiastic about one recommendation: establishing a clearinghouse for best practices. Promoting deployment is the highest priority, Clark says, and national policies on universal services should wait until broadband capacities and impact are more apparent.

For more information on ITC, please visit: <http://itc.mit.edu/>. 

IMPACT

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