UNIVERSITY OF MINNESOTA

Technological Leadership

CENTER FOR THE DEVELOPMENT OF TECHNOLOGICAL LEADERSHIP / INSTITUTE OF TECHNOLOGY

Inside:

Our Interdependent Critical Infrastructure

From the Director
CDTL contributing on many fronts

On behalf of the Center for the Development of Technological Leadership (CDTL), it is a privilege for me to offer an update on our progress toward CDTL's goals during the last six months.

Massoud Amin

H. W. Sweatt Chair
in Technological Leadership

Director, Center for the
Development of Technological
Leadership

Professor of Electrical and
Computer Engineering

Greater reach and impact

Collaborations with Nile University: In the last issue of Technological Leadership, we announced the January 2007 launch of our joint graduate Management of Technology (MOT) program at Nile University in Cairo, the first formal collaboration between the University of Minnesota and a North African or Middle Eastern country.

From June 5 to 17, Dr. Lockwood Carlson, James J. Renier Visiting Land Grant Chair in Technological Leadership, and I traveled to Egypt for the first class in the program. Dr. Carlson taught "New Product Development and Innovation" to 19 high-performing working professionals from industry and government.

Prof. Tarek Khalil, Nile University's executive vice president, provost and acting president and president of the International Association for the Management of Technology (IAMOT), hosted us and kicked off the course. All involved had positive experiences at every level, strengthening connections between our universities and bridging to future collaborations. Additional MOT courses will be delivered in December 2007 through October 2008.

International MOT Project: For the first time, MOT students completed their international MOT project with a trip to India, visiting Delhi and Bangalore from

April 14 to 28. Corporate visits included Maruti Udyog Ltd., Jubilant Biosys, Wipro, Honeywell, GE, IBM, LG, SAP, Philips, and other indigenous or transnational companies and factories, as well as government agencies and universities. In Delhi, we were graciously hosted by the Indian Institute of Technology (IIT-Delhi), with meetings and presentations from the Ministry of S&T, UN development for India and Pacific, Security and Exchange Board of India, Bharat Sanchar Nigam Ltd., HAL/NAL, Technology Innovation, Forecasting and Assessment Council, and infrastructure companies and experts, National Buildings Construction Corp. Ltd., Larson & Toubro Ltd., and Autometers Alliance Ltd.

Our class focused on established and emerging areas in IT, pharma/biosci, aerospace/defense, and agribusiness. My students and I were unanimous in our admiration of India's beauty, rich history and potential for increased collaborations with Minnesota.

India is poised to become the next super center for business, not only because of her wealth of highly talented and educated people, but also because of her sheer size and internal market capability. The state of Minnesota will establish partnerships in four key trade initiatives: food processing and distribution, IT, medical technology, and renewable energy. In preparation for the Governor's and Minnesota delegation's trip to India in October, Mr. Tony Lorusso, executive director of the Minnesota Trade Office, also attended the final MOT class presentations on May 5.

New endowed chairs: We are very pleased to welcome Prof. Dennis Polla as the new Honeywell/W.R. Sweatt Chair in Management of Technology, and Mr. Kirk Froggatt as the newly established Gemini Chair in Technology Management (see story on page 11).

Many thanks to the superb search committee, which consisted of Prof. Doug Ernie, search committee chair, associate dean of the Graduate School, and director of UNITE; Dr. Lockwood Carlson, Renier Chair; Prof. Alfred Marcus, Honeywell/Edson Spencer Chair; Ms. Connie Garrahy, CDTL associate director of finance and administration; and MOT alumnus Dr. Greg Widin from 3M. The search committee and CDTL were unanimous in the selection of the candidates.

Prof. Amin and MOT Class of 2007 at the Taj Mahal,
April 19, 2007.

Our Interdependent Critical Infrastructure

Just after 6:00 p.m. on Aug. 1, Prof. Massoud Amin was at work in his office on the University of Minnesota's West Bank, where he heard and watched the unthinkable happen—the collapse of the I-35W bridge about 100 yards away.

"As an individual, it was shocking and very painful to witness it from our offices here in Minneapolis," says Amin, director of the Center for the Development of Technological Leadership (CDTL) and the H.W. Sweatt Chair in Technological Leadership. Amin also viewed the tragedy from a broader perspective as a result of his ongoing work to advance the security and health of the nation's infrastructure.

In the days and weeks that followed, he responded to media inquiries from the BBC, Reuthers, and the CBC, keeping his comments focused on the critical nature of the infrastructure. He referred reporters with questions about bridge design, conditions, and inspections to several professional colleagues, including Professors Roberto Ballarini, Ted Galambos, Vaughan Voller, and John Gulliver in the Department of Civil Engineering and the National Academy of Engineering Board on Infrastructure and Constructed Environment.

For Amin, Voller, and many others, the bridge collapse puts into focus the importance of two key issues—the tremendous value of infrastructure and infrastructure systems that help make possible indispensable activities such as transportation, waste disposal, water, telecommunications, and electricity and power, among many others, and the search for positive and innovative ways to strengthen the infrastructure.

Recent events bring the critical nature— and challenges—of the infrastructure front and center.

An Unbalanced Scorecard

Information from the American Society of Civil Engineers (ASCE) offers a picture of the current state of the nation's infrastructure, says Voller, who also serves as director of graduate studies for the Master of Science in Infrastructure Systems Engineering (ISE) program.

The nation's infrastructure receives an overall failing grade of D+ from the ASCE, which estimates that it would take $1.6 trillion over the next five years to bring the infrastructure back to good condition.

While a sizable investment, it is not too far away from the investment that Americans are making in their own personal infrastructure, says Voller.

In 2005, Americans spent $210 billion on residential remodeling for their homes, with a projected increase of 13.2 percent, according to the National Association of Home Builders. Projecting a 13.2 percent increase over the next five years coincidently amounts to about $1.5 trillion.

The visible infrastructure, such as roads and bridges, is not the only area of concern. "The hidden infrastructure, such as water, sewer, wastewater, most people don't really see or consider," says Voller. "Some sewer systems are more than 100 years old and reaching their end life."

Approach: System's Perspective

Because of the complexity and connections among infrastructure elements, the actions of everyone influence the way the infrastructure operates.

"From a system's perspective, designers, builders, operators, and maintenance personnel are obviously inside these infrastructure networks and can have direct and sometimes real-time effects on them," says Amin.

"But users of a transportation, electric power, telecommunication or pipeline system also affect the behavior of those systems, often without conscious intent. The amounts, and often nature, of demands put on the network can be the immediate cause of conflict, diminished performance, and even collapse. Long transmissions from a few users create Internet congestion. Simultaneous lawn watering drops everyone's water pressure. No one is 'outside' the infrastructure."

The ISE program embraces the broader systematic perspective in examining the infrastructure and innovations to improve infrastructure systems. CDTL administers the ISE program in collaboration with the Civil Engineering department.

At the heart of the ISE program is the desire to train civil engineers to become effective managers capable of the complex tasks involved in operating and sustaining the civil infrastructure, says Voller.

"The whole idea of ISE is to move away from the notion of fixing the worst first and fixing it only when broken, to the concept of managing the infrastructure and recognizing the importance of a well-run system as a whole," says Voller.

As such, ISE students learn about tools that can help them better monitor such systems. These tools include the application of geographic information systems (GIS) and other information technologies, which make it easier to locate and manage infrastructure, and asset management systems to better monitor existing infrastructure and identify future needs.

ISE students also complete a capstone project, which pulls together knowledge from all aspects of the program, says Voller. They often apply what they learn in the classroom on the job—during and after school—to complex infrastructure problems, including contributing to the construction of a new bridge (see ISE graduate Terry Ward's story on page 5).

Solutions: In New Places

The work of CDTL also offers some cutting-edge application to the many challenges of designing, operating, and protecting complex interactive infrastructure systems.

While at the California-based Electric Power Research Institute (EPRI), Amin led the creation and management of the Complex Interactive Networks/Systems Initiative as a response to the growing concerns about the vulnerability of national infrastructures. The three-year, $22 million Government-Industry Collaborative University Research Program received funding from the U.S. Department of Defense and EPRI.

The six research consortia that resulted from the project developed a mathematical basis and practical tools for improving the security, performance, and robustness of critical energy, finance, communications, and transport infrastructures, as well as 24 technologies transferred to industry.

"Complex adaptive systems and other emerging sciences provided an attractive

Applying knowledge to the benefit of the infrastructure

Terry Ward

When Terry Ward entered the Master of Science in Infrastructure Systems Engineering (ISE) program at the Center for the Development of Technological Leadership, he was looking for a challenge.

"I was at a point in my career where my day-to-day work activities were becoming routine," says Ward, who works for the Minnesota Department of Transportation (Mn/DOT). His wife recommended that he pursue the ISE program, and he also wanted to set an example for his sons about the importance of education.

His ISE experience also helped prepare him for his current challenge. Mn/DOT recently selected Ward to serve as a member of the project management team for the St. Anthony Falls (35W) Bridge design-build project.

"I feel my selection was based on my ability to view things from a broad-based perspective, my abilities to be a strong team player, and my abilities to deliver high-quality products and services with limited resources and information," says Ward, who serves as deputy project manager for construction on the team. "These were all skills that I strengthened through the ISE program."

While in the program, Ward led the ROC 52 design-build project in Rochester, Minn., as its project manager. "This was a major urban reconstruction project that represented some historic milestones for Mn/DOT," he says. The ROC 52 project was the first Mn/DOT project to use design-build, where both the design and construction are completed by a contractor, and at the time, the largest project in the department's history.

Although challenging, attending school while working brought rewards.

"The ISE program is very practical and directly related to my role as project manager," he says. "I was able to complete many of the class assignments by solving problems that I was currently facing at work. I was also able to apply what I learned directly in my daily work on a regular basis."

The ISE program also offered Ward a deeper understanding of infrastructure as a whole and of the ways that his job fit into the bigger picture.

"The ISE program really helped me take a much broader perspective on the day-to-day issues and problems," he says. "I have a much stronger skill set and am able to perform at a much higher level. I gained much more confidence in my problem-solving and teamwork abilities and am much better equipped to address the challenges that I face on a daily basis."

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bottom-up paradigm for modeling, simulation, control, optimization, and protection of operations—both financial and physical—in complex networks," says Amin. "We showed that practical methods, tools, and technologies based on advances in these fields are allowing power grids and other interdependent infrastructures to self regulate, including automatic reconfiguration in the event of failures, threats, or disturbances."

Additional applications included development, application and use of distributed intelligent sensor technologies and control methodologies in the monitoring, management, and maintenance of critical infrastructure.

The results were incorporated into other programs, such as the Consortium for Electric Infrastructure to Support a Digital Society, the Electricity Infrastructure Security Initiative, and in five resultant energy and defense programs.

Another area that holds promise in addressing the design, control, and protection of complex infrastructure systems is complex adaptive systems (CAS), says Amin.

"The overall behavior of CAS, such as interlinked national infrastructures, emerges through the independent behavior of simple, but adaptive and interacting components—a phenomenon known as self-organized complexity," he says. "The global behavior of a CAS can be influenced by the actions or experiences of individual components."

The whole combined infrastructure is a CAS that consists of many individuals and frequently autonomous components, says Amin. CAS models are attractive because they can produce complex emergent phenomenon from a small set of relatively simple rules, constraints, and relationships. Two CDTL faculty members are exploring CAS as part of their work and in the classroom (see story on page 9).

Spotlight for the Future

CDTL has proposed an all-University interdisciplinary symposia series on security science and

Vaughan Voller

technology, which includes a look at complex networked systems such as energy and the electric power grid. Also in the planning stages is a new all-University master's and Ph.D. interdisciplinary program in security technologies.

All these efforts help continue the search for new answers to complicated infrastructure concerns. Keeping those discussions visible also helps increase awareness about just how vital the infrastructure is to everyone, not just to those who work to maintain and advance it.

"We only seem to notice the infrastructure when it fails or causes delays or disruptions in our activities," says Amin. "We expect it to be in the background and not to interfere with our wishes and activities.

"Considering the tragedies of recent years, as we plan ahead, I hope that we don't take our nation's critical infrastructure for granted; and I hope that as a nation we'd dedicate increased resources, risk-assessed and judiciously prioritized, to our nation's critical infrastructure to mitigate risks and even prevent similar tragedies in other infrastructure and corresponding human capital."

Adaptability at Work

In this second in a series of articles, Management of Technology (MOT) and Infrastructure Systems Engineering (ISE) alumni share their strategies for managing work, school, and family

The format of the MOT and ISE programs—one day of class per week, four-semester degree completion, and the ability to continue working full time—is appealing to students. But what does the addition of classes, team meetings, and course work really mean, and how do MOT and ISE students adapt?

Comrades in arms

Dan Good entered the MOT program as part of its first class cohort. He joined IBM after receiving his undergraduate degree, and as he moved into management, he wanted to earn a graduate degree. "I wanted to understand the whole business, not just the technical side," he says.

The MOT program fit his needs, he says, but as a new program, it was harder to really know its impact. "I really didn't know what I was getting into," says Good. "I knew it was going to be a commitment."

Fortunately, he was not alone. His fellow students proved an essential part of his survival, he says.

"You can't do this by yourself, and the students within your study group are very important not only for the collaboration with colleagues from different backgrounds, but to help you get through the program."

With two small children at the time, Good and his wife, Jayne, thoroughly discussed the pros and cons before they agreed on the decision. Along the way, there were adjustments, says Good, including no vacations, less volunteering, and less travel for work.

Instead, Good took the trip from Rochester to Minneapolis to attend classes, and he found that he could not always accommodate every request. "You have to set your priorities and learn to say 'no' sometimes."

Through the program, Good gained a set of tools that he continues to use in his current position as vice president of new business initiatives at Seagate. Demonstrating the flexibility that helped him through the program, he also integrates a busy schedule of on-the-job travel in his life.

Students should enter the program with a desire to learn, he says. "I tell them to make sure that they are doing it for the right reasons and make sure that they have full buy-in from their family and boss."

Communication and flexibility

When Kate and Warren Plaisance share their experience with incoming MOT students and their spouses, they mention one practical piece of advice: Hire a housekeeper.

After Kate entered the MOT program, the Plaisances decided to make life a little easier around the house by using cleaning services, which they continued after the program ended.

But the Plaisances offer a larger lesson, the importance of communication and flexibility. Both Kate and Warren worked while Kate pursued her MOT degree. They built a plan around their already existing schedule.

As manager of the prepress department at Gleason Printing, Warren arrives at work by 7 a.m. "When I leave at 3 p.m., I use that time to run family errands and take care of dinner." He also was home when their two boys arrived from school. When Kate came home, she and the boys both hit the books for some joint study time.

Returning to school was important to Kate. "I really wanted to do this and needed to do this." The decision helped open new directions for her. After finishing the program, Kate landed a job at Cargill, where she recently received a promotion to innovation development manager.

Warren and Kate Plaisance

During the program, Kate worked as a researcher in a University lab. "I had a very flexible job, and my boss was very supportive of my going back to school," which gave her more room to manage her time at work, at school, and at home. "For me, the whole experience of work and school was integrated," she says.

She knew that Warren would support her decision to return to school, and they would work out the details. "We always had a 50/50 split of the household responsibilities," says Warren. "During school, I assumed closer to 75 percent of the responsibilities."

The two kept the lines of communication open and revised the plan as necessary. Even so, Kate found letting go a little challenging at times. "It was about releasing control," she says. "You learn more about time constraints and what you can really accomplish."

Different day

Gary Noel has a full house. With six children, ranging in age from 13 to three and responsibilities as release systems engineering manager for simulation systems at Medtronic, he has some firsthand experience with integrating the many aspects of life.

> Students should enter the program with a desire to learn and for the right reasons. "They should have full buy-in from their family and boss."

Gary Noel

Involvement in the program stimulates your intellectual juices. "Your mind is in overdrive."

His participation in the MOT program also heightened his ability to successfully weave the different threads of his life. In 2001, with four younger children, it seemed the right time to pursue his master's degree.

"I remember that I probably was junior high age when my father began an MBA program," says Noel, ironically one of six children himself. With teenagers who were involved in many activities, it was difficult for his father to devote enough time to his studies and his family, so he decided to stop his studies. "I knew that I didn't want to repeat that, so I wanted to complete a graduate program when my kids were younger."

Noel did his pre-program homework, talking to MOT alumni and observing a class. He received advice from an alumnus about the 24-hour day that continues to ring true.

"He told me that 24 hours in a day are no longer going to fit into the perfect buckets of eight hours at work, eight hours of family time, and eight hours of sleep," says Noel. "Instead, he suggested looking at the day as 24 hours and asking what is the best use of that time."

His return to school would not have been possible without the support of his spouse, he says. Noel vowed from the beginning that he would try to impact his children's lives as little as possible. As a result, he set his study time from 9 p.m. to 1 a.m., sacrificing sleep and some one-on-one time with his wife, Kris.

His study group members stayed focused and organized, meeting one night a week and helping each other share the load through the inevitable peaks and valleys that each team member faced.

During his time in the program, Noel met another challenge. He entered the program as a principal engineer, but received an offer to manage his group. The program spurred him in unexpected ways.

Involvement in the program stimulates your intellectual juices, he says. "Your mind is in overdrive."

Focus and discipline

As she considered professional growth and personal development opportunities, Val Svensson liked the structure and content of the ISE program.

With two children at home, Svensson maximized her time by setting and maintaining a schedule.

"I kept a very detailed calendar so I could plan time for family, school, and work," says Svensson. "It was very important to get things in the works right away and not procrastinate."

The schedule is not the only important factor: Attitude, team support, and acceptance of limitations also were significant contributors to her successful integration of the program.

"It was a lot about attitude and the use of *quality* aspects rather than *quantity* aspects of any activity," she says. "There is a need to balance a lot of things and this at times means you have only small amounts of relaxation and less sleep than you would like."

Svensson spent a little less time with her children, but the time away also helped them to "spread their wings a bit. This gave me something worthwhile to focus on while I was letting them grow up and need me a little less." She also felt it was good for her children to see her completing homework.

Val Svensson

"Life is short— you should take opportunities to enjoy what you can."

Incorporating short periods of relaxation, such as "a half hour for a good cup of coffee" or "a picnic in the living room," is a practice that she started while in the program and continues today.

She also worked hard to manage her on-the-job load and took vacation time to finish school projects. "My supervisors, peers, and staff were extremely supportive and made it relatively easy to have limited challenges in balancing my work schedule," says Svensson, who recently assumed a new position at the Minnesota Department of Transportation as metropolitan district resource engineer.

"Life is short—you should take opportunities to enjoy what you can," she says. "You can make anything fun if you enjoy those participating with you."

The study of complex adaptive systems stands to enhance the management of technology

Rich Ground

Dr. Lockwood Carlson has spent much of his career in the search to understand and marshal the potential of new technology. In his work, Prof. Karl Smith has explored ways to build knowledge management systems that provide the foundation for future innovation.

When Carlson and Smith began talking about the concept of complex adaptive systems (CAS), they found exciting and fertile ground to investigate and share with students who are pursuing their Master of Science in the Management of Technology (MOT) at the Center for the Development of Technological Leadership (CDTL).

"As a physicist, I'm always looking for robust ways to apply the scientific tools of the MOT," says Carlson. "I am very skeptical of any concept or business application that promises easy answers. CAS starts to acknowledge the complexity of the unexpected."

Carlson knows firsthand the challenges of pursuing breakthrough technology. A former 3M corporate scientist, Carlson continues to advise technology companies as president of Carlson Consulting LLC. As the James J. Renier Visiting Land Grant Chair in Technological Leadership, he teaches innovation, product development, and technology forecasting courses in MOT, as well as short courses for CDTL.

Lockwood Carlson

In his project management class, Smith takes a survey to gain an understanding of his MOT students' knowledge of key topic areas. In a recent survey, he found only a few students reported any familiarity with CAS, but to Smith that provided an opportunity to enhance the learning of his MOT students.

A Morse-Alumni Distinguished Teaching Professor and civil engineering professor at the University of Minnesota, Smith leads project and knowledge management courses in MOT. Smith has made his mark in advancing engineering education and project and knowledge management. Smith also holds an appointment as Cooperative Learning Professor in Engineering Education at Purdue University.

"This is the sort of area that faculty in MOT should think and talk about," says Smith. "It may seem a little bit out there, but it is promising in its potential impact."

Only a few decades ago, scientists at the Santa Fe Institute used the term complex adaptive systems to describe the cases of diverse and interconnected complex systems that have the ability to change and adapt from interactions and experience. Examples of CAS include the stock market, the ecosystem, cells and other biological systems, and work teams, to name a few.

Karl Smith

The CAS framework looks at the behavior and interactions within systems that are acting and reacting and changing and adapting. CAS ideas and models relate closely to both systems theory and the Darwinian principles of evolution.

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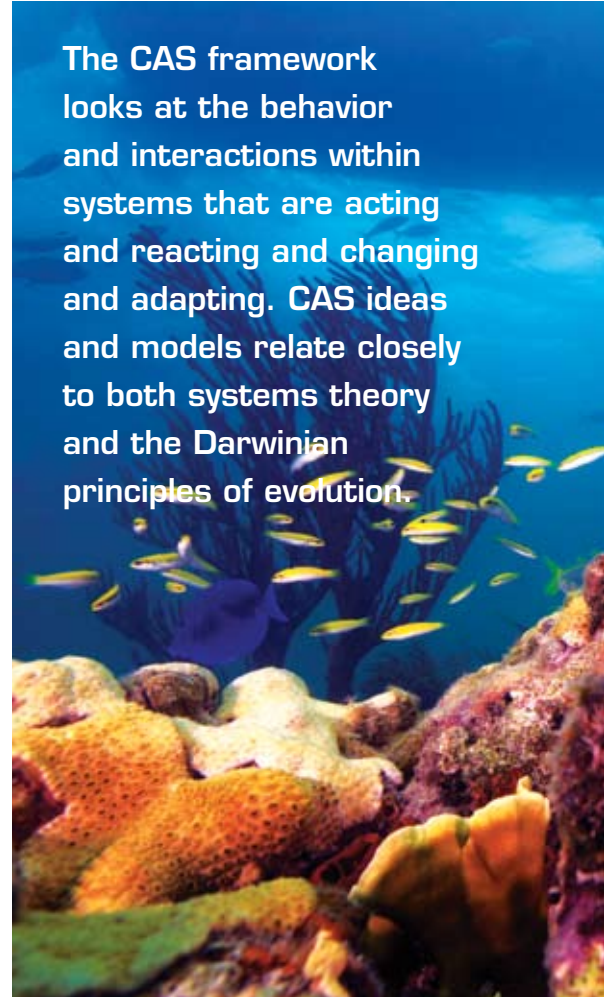
Reading List

Complex adaptive systems (CAS) offer a framework for understanding the systems that impact the management of technology, as well as many other aspects of life and work. A CAS exhibits a number of essential properties and mechanisms:

• Emergence of complex, global behavior from the aggregate interactions of many individual, relatively simple agents

• Strategic learning and adaptation of components, groups of components, or the CAS as a whole in response to changes in its environment

• Nonlinearity and a potential for chaotic behavior, for example, behavior that is more than the sum of its parts, which makes it very hard to model and forecast behavior

• Feedback, both negative and positive, such as the multiplier effect in economics or George Soros' theory of reflexivity

For a quick primer, CDTL faculty members Lockwood Carlson and Karl Smith suggest the following resources:

Harnessing Complexity: Organizational Implications of a Scientific Frontier, Robert Axelrod and Michael D. Cohen, The Free Press, 2000

Nobody in Charge, Essays on the Future of Leadership, Harlan Cleveland, Jossey-Bass, 2002

The Leader's Handbook: Making Things Happen, Getting Things Done, Peter R. Scholtes, McGraw-Hill, 1998

Complex Adaptive Systems: An Introduction to Computational Models of Social Life (Princeton Studies in Complexity), John H. Miller and Scott E. Page, Princeton University Press, 2007

How does knowledge about CAS apply to the management of technology? Carlson and Smith see a convergence in many areas.

"All organizations have complexities," says Carlson. "Those complexities start to explain why you can't always take an idea—even a good one—on its own and expect that something will happen. Other factors, the environment of the organization, the interactions among work groups, all impact the outcome."

Engineers are often trained well in formulas that lead to concrete answers, says Smith. Those formulas fall short when dealing with CAS, but when dealing with leadership, in this case, technological leadership, the concepts of CAS make perfect sense, says Smith.

The first dean of the Hubert H. Humphrey School of Management, Harlan Cleveland, examined the influence of CAS on leadership, says Smith. His work helps to demonstrate the interdisciplinary power of the concept.

"It's the idea that context matters," he says. "Learning how something works in one way could be different in another context."

CAS also fits well with the practice of knowledge management, he says, as interactions among experts add to the wealth of available information. "It's the idea that context matters," he says. "Learning how something works in one way could be different in another context."

Carlson is interested in using CAS tools to track technology as it grows and adapts. In class, his technology matrix helps map that development. "It's really a first step in appreciating technology evolution as complex interactive systems," says Carlson, and CAS adds another dimension.

Carlson and Smith are discussing opportunities for incorporating CAS as part of the MOT and CDTL offerings, including co-teaching the topic as part of their existing classes, encouraging students to select an aspect of CAS for their final capstone projects, and possibly identifying some areas of CAS for their own research.

"It's just so universal in applications," says Carlson. "As a fundamental principle, it helps us examine the diversity of business." Understanding the dynamics of CAS opens new perspectives, says Smith. "It's really looking at a new way of thinking," he says.

Preparing students to look at technological leadership with the most helpful lens is an important part of MOT, says Carlson.

"What we are teaching them we want to be useful for the rest of their careers," he says. "I feel this is a very rich area to begin applying to MOT."

Two New Chairs Join CDTL

In August, the Center for the Development of Technological Leadership (CDTL) welcomed two new chairs: Prof. Dennis Polla as the Honeywell/W.R. Sweatt Chair in Management of Technology (MOT) and Mr. Kirk Froggatt as the newly established Gemini Chair in Technology Management.

Polla joined DARPA in 2004 as a program manager in the Microsystems Technology Office. He also held joint academic appointments at the University of Minnesota in the Department of Electrical and Computer Engineering, Department of Laboratory Medicine and Pathology, and the Department of Biomedical Engineering as the Earl E. Bakken Endowed Chair. His previous positions

Dennis Polla

"I am excited to have the opportunity to join CDTL and look forward to working with MOT students on technology assessment strategies," said Dr. Polla.

include director of the Microtechnology Laboratory, director of the Biomedical Engineering Institute, and founding head of the Department of Biomedical Engineering. His current research interests are in nanotechnology and microelectro-mechanical systems (MEMS).

Polla will be responsible for teaching in the MOT program, coordinating MOT capstones, conducting research and consulting, and contributing to the community. Polla will teach sessions in two courses this fall, Pivotal Technologies and Science and Technology Policy, as well as coordinate MOT capstones and the international MOT project.

Froggatt most recently served as senior director of organizational effectiveness at Agilent Technologies, a multinational test and measurement company. He began his career at Hewlett Packard, where he spent five years in a variety of training and development and human resource planning roles. He then moved to Silicon Graphics, Inc., as the company pioneered 3D graphics and scalable supercomputing technology, and was promoted to vice president of human resources. Before joining Agilent, he was vice president of global human resources at Yahoo.

Kirk Froggatt

As Gemini Chair, he will teach in the MOT program, and will lead a newly created undergraduate course MOT 4001, Technology Leadership Development: Leadership, Professionalism, and Business Basics for Engineers. The course was developed in coordination with Carlson School faculty. A generous endowment supported the establishment of the Gemini Chair, as well as the course that is designed to broaden the leadership capabilities, business knowledge, and entrepreneurial skills of engineers.

"After 22 years working for high tech multinationals, it's very clear to me that graduating engineers and scientists will benefit by complementing their technical expertise with broader business and entrepreneurship skills," stated Mr. Froggatt. "It's wonderful that our donor recognized and funded this need, and that CDTL is committed to turning his vision into a reality for our students. I'm excited and honored to be leading this important initiative as part of the CDTL team."

On the Move

Congratulations to the following Management of Technology (MOT) and Infrastructure Systems Engineering (ISE) alumni on their most recent positions.

Iqbal Ahmed (ISE '04): Assistant Project Management Engineer, Mn/DOT.

Dave Anderson (MOT '92): CEO, Express Point Technology Services.

Rick Arnebeck (MOT '94): Division Director, Engineering Services, Mn/DOT.

Gerald Auge, Jr. (ISE '01): Project Manager, Ramsey County.

Ryan Bluhm (ISE '01): Manager, Clark Engineering Corp.

Tim Burquest (MOT '99): Engineering Program Manager, Polar Semiconductor Inc.

Jon Carlson (MOT '99): President, Braun Intertec Corp.

Debbie Christensen (MOT '05): Director, Schwan Food Co.

Becky Dolan (MOT '95): Program Director, Medtronic Inc.

Steve Gort (MOT '04): Research Director, Guideline Inc.

Jeff Janey (MOT '07): Vice President, American Defense International Inc.

Cris Krizan Muckerheide (MOT '04): Engineering Manager, Medtronic Inc.

Tracy Lam (MOT '06): Lead Software Engineer, Thomson Corp.

Lori Lorenz (MOT '04): Vice President, Lori Principle LLC.

Ken Merdan (MOT '05): Director, R&D, Boston Scientific Corp.

Gary Noel (MOT '03): Engineering Manager, Medtronic Inc.

Kate Plaisance (MOT '03): Innovation Development Manager, Cargill Animal Nutrition.

Alex Portnoy (MOT '98): Vice President, Jumpnode Systems.

Joe Schroeder (MOT '00): Project Manager, 3M Co.

Dale Setterholm (MOT '99): Associate Director, University of Minnesota.

Nancy Soderquist (MOT '07): Director, Cray Inc.

Valerie Svensson (ISE '06): Metropolitan District Resource Manager, Mn/DOT

Jon Turner (MOT '99): Vice President, Cool Clean Technologies Inc.

Lee Vetter (MOT '92): President, Integrated Guidance Systems LLC.

Chee Leong Wong (MOT '05): Director of Technology, Thomson Corp.

New program development

Our strategic plan emphasizes four new areas that build on CDTL's core strengths and add value to Minnesota's economy. I'm pleased to report that our pre-proposal submitted in May has been well received and the Graduate School invited us to submit a full proposal for development of new graduate programs in security technologies. These will include technological management and security and safety of energy, cyber, telecom, food supply, and other critical infrastructure. In the near future, we will also explore technological management of biosciences and medical devices, energy and environment.

Other highlights

- CDTL successfully offered the ninth annual CDTL/University of Minnesota Rochester (UMR) *Signature Series* at UMR's new University Square location.

- *Foresight After Four* seminars: In May, CDTL hosted Dr. Alok Das, chief scientist for design innovation at the Air Force Research Laboratory (AFRL) in Ohio. AFRL is a $3B enterprise with more than 3,500 scientists and engineers. Dr. Das spoke about AFRL's focus to become a more agile and innovative R&D organization, to stay relevant in a world of unparalleled opportunities combined with irregular and disruptive threats. In July, Prof. Sushil, Department of Management Studies, IIT-Delhi, presented on flowing stream and blue ocean strategies, a flexible strategic framework to manage the different continuity and change combinations in today's global, business and technology climate.

- Please visit www.cdtl.umn.edu for the December 11, 2007 *Foresight After Four* event details.

The future looks bright. At CDTL, we are working on core capabilities to strategically enhance security and quality of life, and serve our society in Minnesota and beyond. Thank you for your commitment and support of CDTL's mission.

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