AUTO21 NETWORK OF CENTRES OF EXCELLENCE

Auto INNOVATIONS

WINTER 2006

VOLUME 4 • NUMBER 1

Compostable components

Spiraling oil prices affect more than just the fuels we burn in our vehicles. Petroleum is also the key ingredient in the various types of plastic that have come to replace metal in so many automotive parts. The light weight and durability of such materials has made them increasingly attractive, but they represent a continuing dependence on fossil fuels that manufacturers and legislators would like to minimize.

"We found out very quickly that by using agricultural fibre or wood fibre, you can have a performance-oriented material," says Dr. Sain

By way of replacing plastic with more attractive alternatives, University of Toronto forestry professor Mohini Sain is examining the use of fibres derived from sources such as wood pulp, hemp, flax, jute, or corn. Pressed into strong mats that can then be moulded, this material demonstrates a strength and versatility comparable with the fibreglass that now makes up so much of a typical automobile.

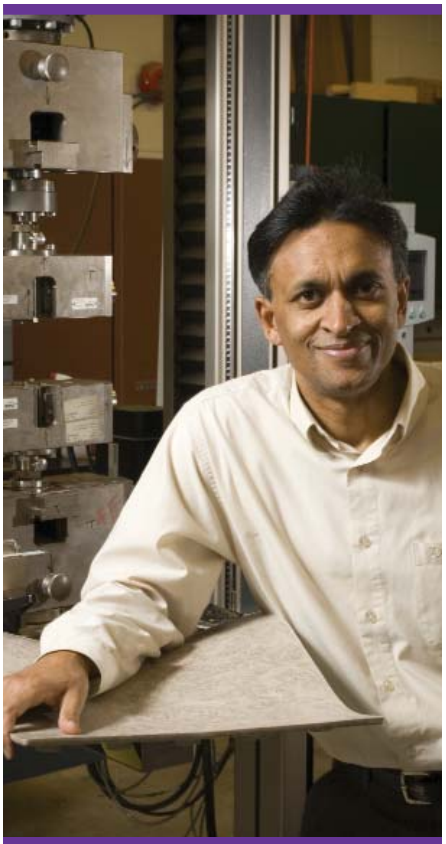
"We found out very quickly that by using agricultural fibre or wood fibre, you can have a performance-oriented material," says Dr. Sain, the leader for AUTO21's *Renewable Biofibres and Biomaterials for Interior Parts* project.

Whether that performance matches the current crop of plastics for the right price, however, is another question.

Dr. Sain notes that a different set of cost calculations set the priorities of auto manufacturers in Europe, where end of vehicle life regulations make these firms responsible for the ultimate disposal of their products. If much of a car is made of biofibres, that disposal could take advantage of biodegradation, so that rather than paying to deposit car parts in landfills, these companies could instead ship this material to compost heaps for little or no expense.

North American and Asian manufacturers have no comparable incentive to consider these new materials, which would therefore compete with plastics only on the basis of cost. That might still be possible, observes Dr. Sain, although an efficient supply chain of raw materials must first be established.

"Our short term approach would be to use the existing fibre production facilities which are in Canada and throughout the world," he says, referring to the well-developed natural fibre processors and pulp and paper industry. ■



Professor Mohini Sain of the University of Toronto is leading the project *Renewable Biofibres and Biomaterials for Interior Parts.*

IN THIS ISSUE

Board of Directors Update

*Three new members were elected to the **AUTO21** Board of Directors at the Network's Annual General Meeting in September 2005*

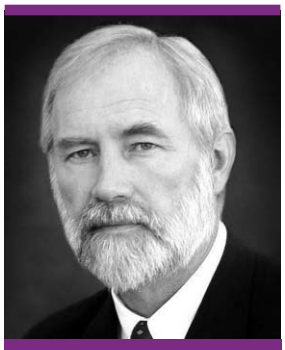
Gerald Fedchun

Gerald Fedchun

Gerald Fedchun has been an active member of the Research Management Committee since its inception in 2001. He is currently the president of the Automotive Parts Manufacturers' Association (APMA), the Canadian association of original equipment producers of parts, equipment and suppliers to the global automotive industry. For the last several years, Mr. Fedchun has actively promoted Canadian foreign trade, participating in missions to China, Eastern Europe, South America, Japan and several other countries. Mr. Fedchun is a member of the Society of Automotive Engineers, Society of Automotive Analysts, the Canadian Bar Association and chairman of the Board of Directors of Georgian College's Centre for Automotive Parts Expertise.

"The APMA has been an active and enthusiastic supporter of AUTO21 since the initial call for proposals to establish an automotive research network. Through my involvement with the Research Management Committee, I have brought forward the concerns of Canada's vibrant parts sector, a major automotive stakeholder to the Network's research program. I look forward to expanding my participation as a member of the Board of Directors."

John Mann



John Mann

John Mann is the director of engineering and regulatory affairs for DaimlerChrysler Canada Inc., with responsibilities for all technical matters in Canada including research and development, facility engineering, product and quality engineering, materials engineering, vehicle safety, fuel economy and emissions, the environment, and product regulatory affairs. Dr. Mann is also the private sector co-chair of the Canada Revenue Agency's SR&ED Partnership Council, and past chair of the Board of the University of Windsor/DaimlerChrysler Canada Automotive Research and Development Centre. He also serves as a member on several other boards, and participates on many committees relating to, or on behalf of, Canada's automotive industry.

"The future of Canada's automotive industry and indeed the Canadian economy itself depends in large part on innovation. AUTO21 connects Canada's university researchers with the needs of the auto industry and also provides valuable training for the bright young minds that will someday lead it. It is my sincere hope that I can use my experience and my knowledge of this incredible business and its needs to help further strengthen the link between academia and industry to the benefit of Canada and all of its people."

John McLaughlin

John McLaughlin

John McLaughlin is the president and vice-chancellor of the University of New Brunswick (UNB), a role he has held since 2002. Previously, he was the vice-president academic and vice-president research and international cooperation at UNB. Dr. McLaughlin is a leader in the Canadian geomatics industry, and is recognized globally as an expert in land administration. Dr. McLaughlin currently serves on the Maritime Provinces Higher Education Commission, Service New Brunswick, the GEOIDE Research Network and numerous other boards and committees. He received the Champlain Award in 1999 and has been appointed a Fellow of the Instituto Libertad Y Democracia in Peru and the Canadian Academy of Engineering.

"I am pleased to join the Board of AUTO21. Given the issues of today's global economy, Canada's capacity for engineering and other research and development is vitally important to ensure the country remains competitive. Being involved with AUTO21 is a tremendous opportunity to gain a deeper insight into how we can best meet these challenges and respond accordingly." ■

AUTO21 appreciates the work and dedication of its three retiring Board members:

Mr. Jim Miller, executive vice-president, Honda Canada Inc.

Dr. Ms. Jan Miller Polgar, associate professor, occupational therapy, University of Western Ontario

Mr. Ron Watkins, director, Automotive and Industrial Materials, Industry Canada

From the *Program Leader*

Dr. Peter Frise

The AUTO21 community consists of multiple stakeholders that at first glance, may not appear to have much in common. Yet university researchers and graduate students from the applied and social sciences, auto industry executives and technical staff, and representatives from federal and provincial government departments and agencies all work within the AUTO21 network to accomplish one key goal: to enhance the automotive industry, one of Canada's most important economic sectors.

For over four years, the success of AUTO21 has relied on the cohesiveness of this diverse group. It has validated the vision articulated in the AUTO21 original proposal: that by combining the expertise of these groups, Canada's automotive sector can advance and succeed. Since the Network was founded in 2001, it has helped to further a substantial number of research careers including Canada Research Chairs and other prestigious appointments. We have helped to educate hundreds of students who in the process have created a large amount of new knowledge that has helped our partners in Canada's automotive sector to prosper in what has otherwise been a daunting business environment. Assisting the economy is one of the key purposes of NCE's and our mid-term review in 2004 revealed that AUTO21 has done extremely well in these challenging tasks.

However, we can't afford to rest on our laurels. As a federal Network of Centres of Excellence, AUTO21 is funded in seven-year cycles. Our first cycle will conclude March 31, 2008. This coming year marks the start of our preparations to ensure AUTO21 is successfully funded for a second seven-year term. Throughout 2006, AUTO21 will meet with stakeholders from industry, the public sector and academia to help review current policies and procedures and direct the on-going strategic plan. Members of the AUTO21 Board of Directors, the Research Management Committee, the Scientific Advisory Committee, Administrative Centre staff, and most importantly, the research community will participate in special strategy sessions to ensure that our efforts are aligned and will help create even better results for Canada in the future.

As we move through this process, we at AUTO21 are especially excited to have the assistance of a leader in the Canadian research community. Dr. Tom Brzustowski, RBC Professor at the School of Management at the University of Ottawa, will be working with AUTO21 to ensure we are commercializing our new knowledge as effectively as possible. Dr. Brzustowski is the former president of the Natural Sciences and Engineering Research Council and served as chair of the NCE Steering Committee. We look forward to working with Dr. Brzustowski on these key issues and benefiting from his wisdom and wide experience.

I look forward to speaking with you in 2006, and working with you on AUTO21's continued success. Happy New Year! ■

Dr. Peter R. Frise

Save the Dates!

AUTO21 2006 Scientific Conference

"Leveraging Partnerships for Sustainability"

June 13 & 14, 2006
Sheraton Wall Centre,
Vancouver B.C.
Check www.auto21.ca
for registration in late January

AUTO21 2006 HQP Conference*

May 15-17, 2006
Georgian College
Barrie, Ontario

* Please note the HQP Conference is an internal event for AUTO21 project leaders and student researchers.

Auto INNOVATIONS

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Member of the Networks of Centres of Excellence of Canada
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OCE and AUTO21 Team Up for Research Excellence

While the Ontario Centres of Excellence (through the Centre for Materials and Manufacturing) has been an active supporter of AUTO21 since its creation in 2001, the partnership between the two organizations was elevated to a new level during the 2005 call for proposals.

With a focus on materials and manufacturing research in Ontario, OCE pledged a total of $500,000 to co-fund five new AUTO21 projects, which explore materials such as high strength steels and biofibres and enhancing manufacturing processes.

"OCE is delighted to be working more closely with AUTO21 in areas where we find synergy," said Geoff Clarke, managing director for OCE's Centre for Materials and Manufacturing. "In funding the Ontario-based portions of the projects, we are supporting the growth and competitiveness of the automotive industry."

Dr. Peter Frise, AUTO21 program leader and CEO notes the assistance from OCE meant AUTO21 could expand the number of projects funded for the next two years. "The response to the call for proposals was enthusiastic but a lack of available funds meant some worthwhile projects just couldn't be supported. This partnership with OCE allowed us to support more projects than we would have been able."

ONTARIO CENTRES *of* EXCELLENCE

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Together, the two organizations share approximately 52 researchers at Ontario universities. ■

Projects Receiving OCE Support

High Efficiency Machining Processes	Project leader: Dr. M. Elbestawi, McMaster University
Renewable Biofibres and Biomaterials for Interior Parts	Project leader: Dr. M Sain, University of Toronto
Hydroforming of Advanced High Strength Steels	Project leader: Dr. M. Worswick, University of Waterloo
On-Board Fuel Cell Powered Auxillary Power Units	Project leader: Dr. B. Peppley, Royal Military College
Neuro-Fuzzy Systems for Inspection in Manufacturing Processes	Project leader: Dr. B. Surgenor, Queen's University

Sitting safely while sitting comfortably

Drivers spend countless hours of their lives trying to stay alert in seats that also have to be built for a few crucial seconds' worth of devastating force in the event of a collision. These distinctly different goals meet in AUTO21's *Advanced Automotive Seat Design project*, which is seeking the best trade-off between these sometimes conflicting priorities.

"A lot of the auto manufacturers will design a seat, have some employees sit in it for a couple of seconds, and then choose what they think is more comfortable," says University of Waterloo kinesiology professor Jennifer Durkin, one of the project's two leaders. "We're really more concerned with prolonged driving and what the relationship is between the driver and the seat."

Toward that end, she and her colleagues simulate long drives in the laboratory with a real automobile seat and a dashboard made up of a Sony Playstation driving program. They monitor such details as posture and muscle activation in subjects who spend several hours at a time in this facility.

Meanwhile, in the department of mechanical engineering at the University of British Columbia, Dr. Douglas Romilly is simulating much more drastic conditions that could affect drivers. As the other project leader, he and his colleagues are creating computer models for different types of collisions, and using these to conduct parametric analyses of the seat structure and its behaviour, which can then be compared with various compliance requirements associated with vehicle crashworthiness and the potential for occupant injury.

"If you start changing the design of the seat, whether it be adding components to the seat or changing the geometry and structure of the seat, then you have a variety of different issues to investigate," he says.

Dr. Jennifer Durkin of the University of Waterloo is co-leading the project *Advanced Automotive Seat Design.*

For example, lumbar support systems may improve a driver's performance during an extended stint behind the wheel. But this additional hardware could prevent the driver's body from "pocketing" securely into the seat during a rear-end collision, perhaps leading instead to the undesirable prospect of "ramping" upward toward the vehicle's roof.

"There's always been the question of whether or not you wanted to make seats stiff or yielding," says Dr. Romilly. "The reality is that you want a bit of both – stiff and strong enough to resist failure yet compliant to reduce the dynamic loading on the occupant."

The team led by Dr. Durkin and Dr. Romilly also includes researchers from the University of Waterloo, University of Western Ontario, University of Michigan and Wayne State University. ■

Engines au natural

Dr. Steve Rogak of the University of British Columbia is leading the project *Clean Gas*.

"We've already found that by blending hydrogen with natural gas – about eight per cent by energy content – you can reduce the hydrocarbon emissions and the particle emissions by about a factor of two," he says.

Among the crop of most promising alternative vehicle fuels, hydrogen has a lot going for it. However, the costs of production make it much less attractive as an exclusive source of energy.

In contrast, natural gas is far more abundant and easily obtained, but is not perfectly clean, and an engine running on it might require the same exhaust treatment needed for conventional fuels.

Natural gas and hydrogen, on the other hand, may turn out to be a blend that can compete well with anything you will find at a filling station today.

This prospect is one of the central themes of the AUTO21 project dubbed CLEAN GAS, which stands for *Combustion of Low-Emission Automotive-Tailored Natural Gas*. According to project leader, Dr. Steven Rogak, an associate professor of mechanical engineering at the University of British Columbia, some hydrogen can go a long way toward improving the viability of natural gas.

"We've already found that by blending hydrogen with natural gas – about eight per cent by energy content – you can reduce the hydrocarbon emissions and the particle emissions by about a factor of two," he says.

Dr. Rogak is interested how particles form in compression-ignition natural gas engines. The problem is that ignition is coupled to other aspects of combustion including pollutant formation.

CLEAN GAS has assembled a sizable team of researchers from universities across Canada, including the University of British Columbia, University of Toronto, and University of Waterloo. Together the research team is examining simulations, fundamental experiments, and engine testing, using a variety of laboratory and computational methods.

The work even includes a first-hand look at pollutant formation through the windows of shock tube, which simulates the engine combustion chamber. The information from the high-speed imaging complements the practical results from the engine. "The engine is comparatively like a black box," says Dr. Rogak. "We know that a little bit of hydrogen reduced our emissions a lot, but until we know why it has this effect, we cannot be sure that hydrogen-natural gas blends will be so beneficial to a broad class of engines and operating conditions." ■