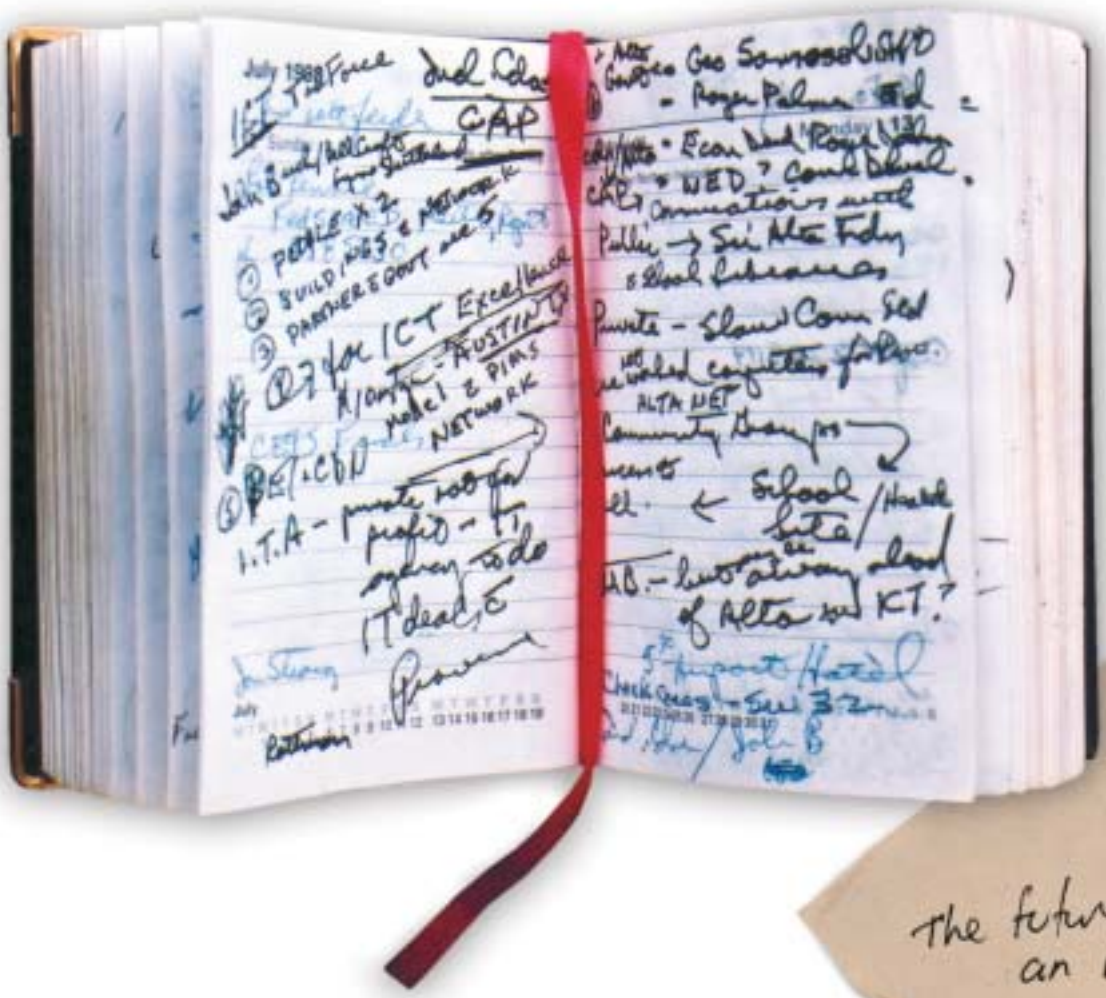

CAP
ALTA NET
The future is
an idea

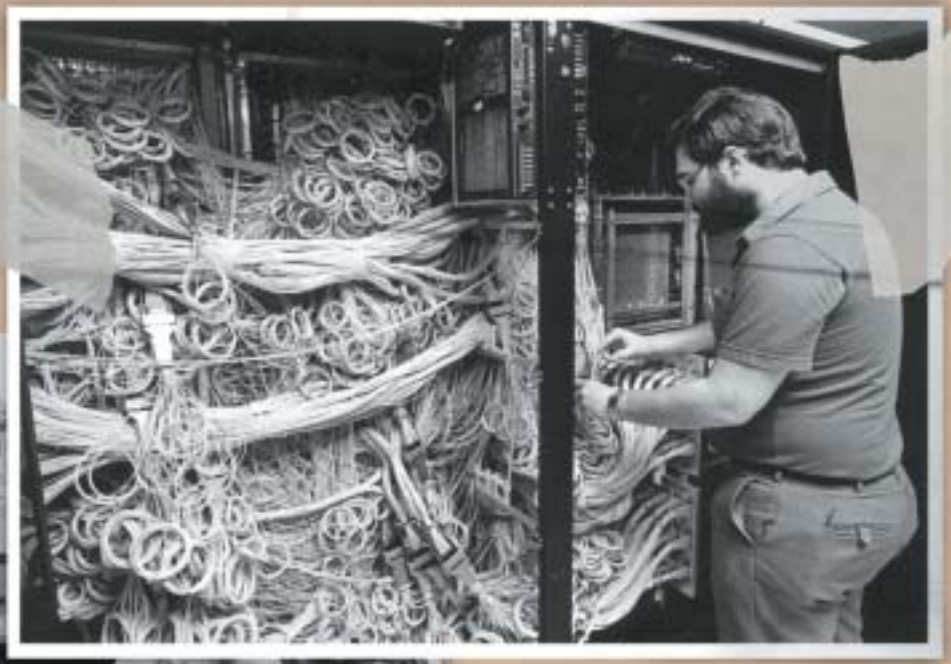
1977

why can't computers fit on a desk? ↓ (or in my hand?)

why don't machines think more like we do?

1983

1978



1991

↑ we dream of a future without wires.

why can't computers talk to each other? like we talk to each other?

none of these things was possible until someone had the insight, drive and determination to make them real.

The future is an idea.

1998

In 1998, the Government of Alberta developed an Information and Communications Technology (ICT) strategy for the province.

In 1999, the Informatics Circle of Research Excellence (iCORE) was created to establish and support teams of world-class ICT researchers in the province.

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MESSAGE FROM THE CHAIR

The business of ideas might seem like an oxymoron. But for iCORE, one can't exist without the other. It's important that we focus on nurturing great scientific minds and ideas in the information and communications technology industry. At the same time, we must also apply the business acumen needed to sustain a setting where new ideas can become reality. Finding balance between staying focused yet remaining open to opportunities is our greatest challenge.

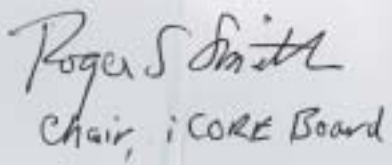
Like any good idea, iCORE is a work in progress. In two short years, the organization has been successful in drawing leaders in ICT research to Alberta. Clearly we're on the map as a place that purposefully acts to support research leaders. We've attracted a number of outstanding new people to the province, and enabled some of the very best already here to stay.

But we have more to do. Maintaining focus in a world with competing needs, rich opportunities and limited funds is a continuing challenge. To help iCORE stay true to its vision, in February 2002 we initiated the ICT Research Advisory Committee (IRAC). The committee includes of some of the best minds in the industry, people like: Dr Jim Gosling, VP and Fellow, Sun Microsystems; Dr David Jefferson, Senior Scientist, Hewlett Packard; Dr William Pulleyblank, Director of IBM Exploratory Server Systems, IBM Research; and Nobel Laureate Dr Richard Taylor, Physicist, Stanford University. It's an initiative intended to help ensure iCORE remains aware of where the ICT industry is heading, and to provide advice and counsel on how to strengthen or redirect current initiatives.

Our goal is to position Alberta as an intellectual centre where established research leaders, professors just starting out and graduate students looking for the best education possible come to develop their ICT careers. As well as attracting top talent, we also want to see results stemming from the research. We want to see ideas become tangible results – new businesses and wealth-generating jobs – that stay in the province. It's already happening, and we're confident it will continue.

We can't achieve these results alone, so we're focused on building strong partnerships with industry and government. These relationships benefit everyone. Together, we can continue to attract and retain top people. We can create a self-sustaining momentum that allows us to progress. And we can build an environment where commercialization is possible and research stays on the leading edge.

iCORE began with an idea for ICT excellence. We've made immense progress in our first two years. We're energized by what we've accomplished, and buoyed by what is possible.



MESSAGE FROM THE PRESIDENT

In the world of ideas, thoughts rarely run in straight lines. Especially when you're pursuing something new and untried. It may be risky, but major innovation often involves a non-linear leap of faith.

iCORE is more than a leap of faith. It is the implementation of a carefully crafted idea designed to support Alberta universities in building a critical mass of top researchers in information science and engineering – recruiting and supporting people who create and foster remarkable ideas that have the power to change Alberta and the world. iCORE has taken this idea and is actively working to make it real.

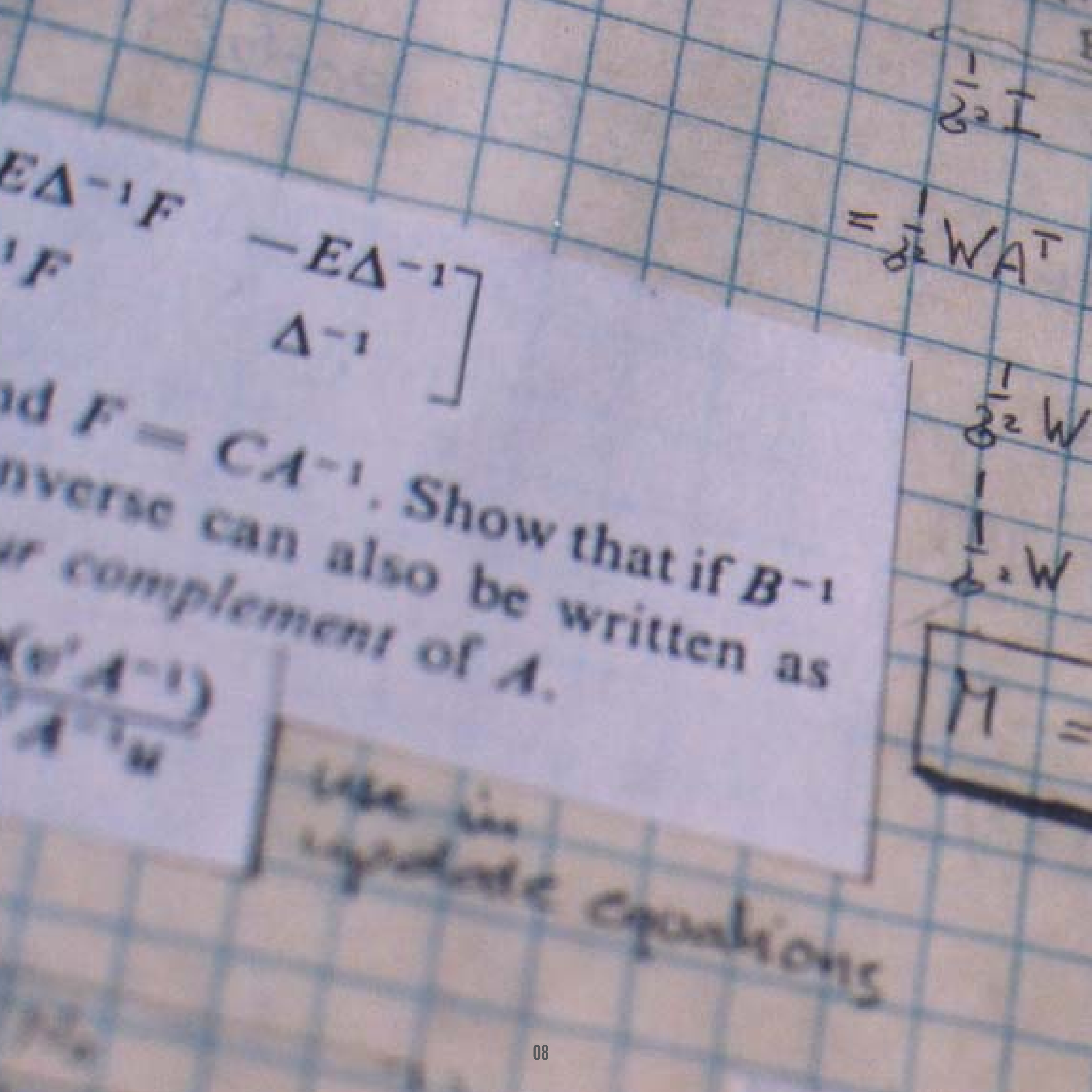
In just over two years, our strategy to attract some of the most extraordinary minds in the information and communications technology (ICT) industry is already paying dividends. This year, iCORE has added four research chairs and professors to the six we already fund at Alberta universities. We have also increased the number of graduate students supported from 60 to nearly 90. It's an investment in people that is generating results in diverse areas like wireless communications, nanotechnology and cryptography.

iCORE's ability to recruit some of the most creative thinkers in the industry is one of our greatest strengths. The research chairs, professors and students we fund, and the new ideas they develop, are helping to build a knowledge-based economic sector that is globally competitive. These people are putting Alberta on the ICT map.

iCORE now supports 10 research chairs and teams – by 2005, we hope to have doubled this number. If we are to sustain our goal of four to five new chair awards each year through 2005, we must leverage our annual budget beyond the current $10 million. This requires us to think creatively, to build more and stronger partnerships with industry, other levels of government, and universities, and to manage the healthy tension between what is possible and what is practical.

While there is power in ideas, there is also power in translating them into practice. We are already seeing the tangible benefits that iCORE's programs have brought to Alberta. We are beginning to develop a deep talent pool in the information science and engineering research community. We are building links with industry, government and the academic community. We are creating a world-class research climate. As we move forward, iCORE will continue to proactively recruit talent within Canada and abroad. We will also work on strategies to keep those bright minds here in Alberta. The momentum is building, and we're confident that this idea is going to work.

President & CEO, iCORE


EΔ⁻¹F
−EΔ⁻¹
Δ⁻¹
nd F = CA⁻¹. Show that if B⁻¹
nverse can also be written as
r complement of A.
= 1/δ² WA^T
1/δ² W
M =
equations

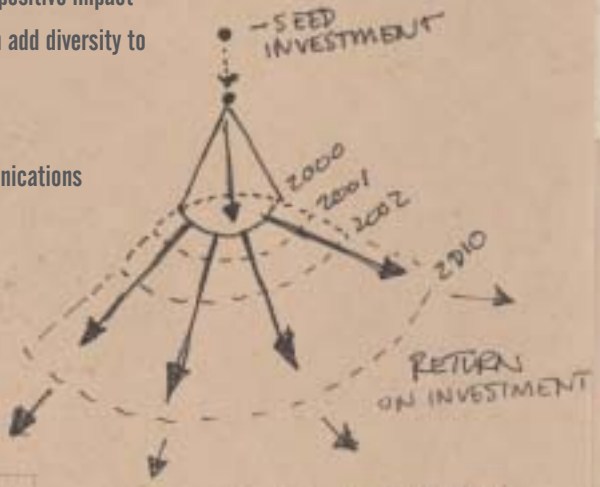
iCORE's Mandate

Alberta needs to balance its traditional dependence on the natural resource sector by strengthening the information and communications technology sector

Information technology is environmentally friendly, can have positive impact on health care, education, business and government, and can add diversity to employment, social and cultural options for Albertans.

Alberta has set specific goals for the information and communications technology sector to be achieved by 2010:

INFORMATION AND COMMUNICATIONS TECHNOLOGY WILL CONTRIBUTE $30 BILLION TO ALBERTA'S GROSS DOMESTIC PRODUCT.

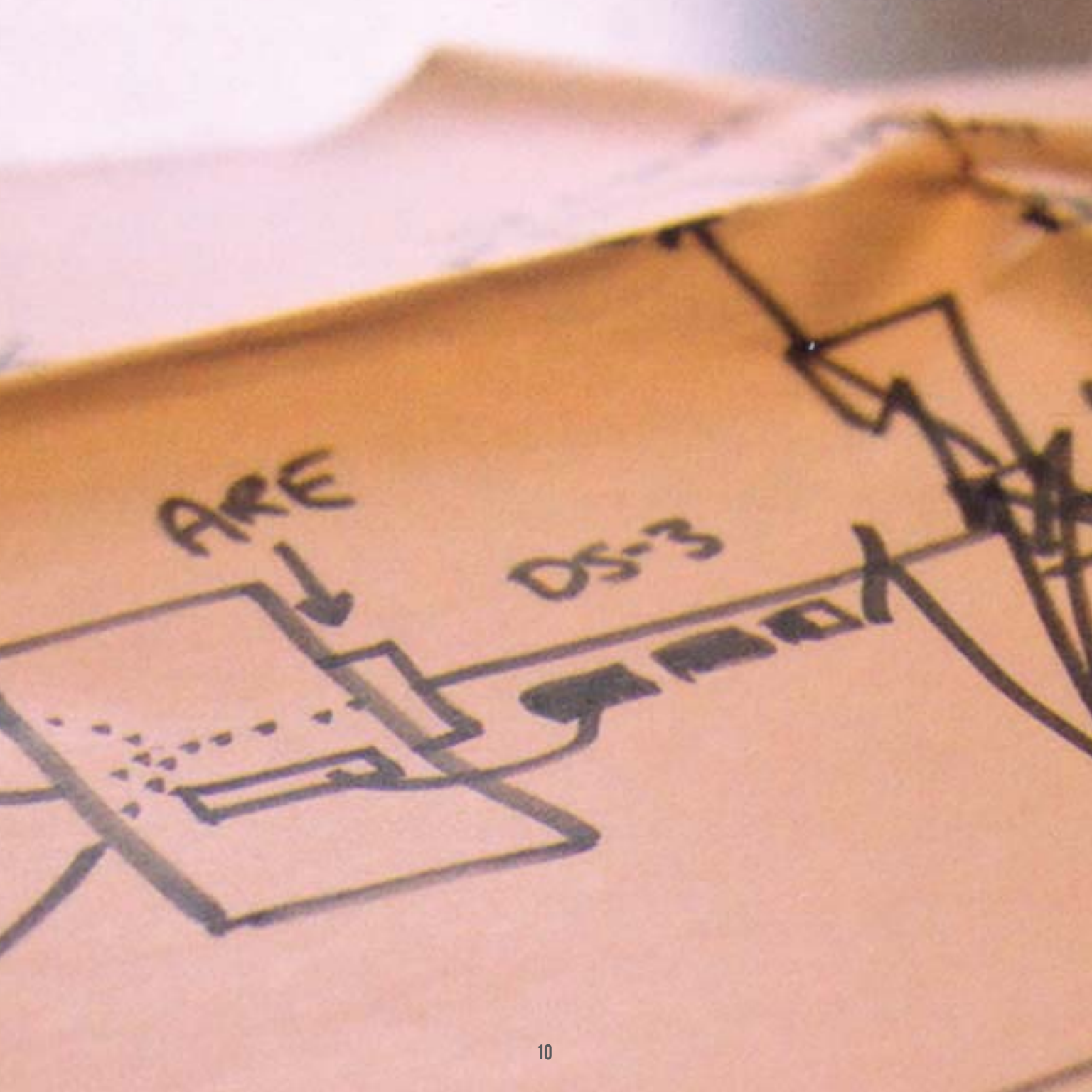


$1.5 BILLION WILL BE SPENT ANNUALLY ON RESEARCH AND DEVELOPMENT THAT FUELS THIS SECTOR.

THERE WILL BE 140,000 ALBERTANS WORKING IN THIS SECTOR.

To achieve these goals, experts are essential – and a critical mass of them – with the right training, experience and expertise in high growth areas. Insufficient expertise can cripple initiatives, and insufficient numbers of high quality people can throttle the high growth rates required.

Someone needs to lead this charge. That is iCORE's primary task.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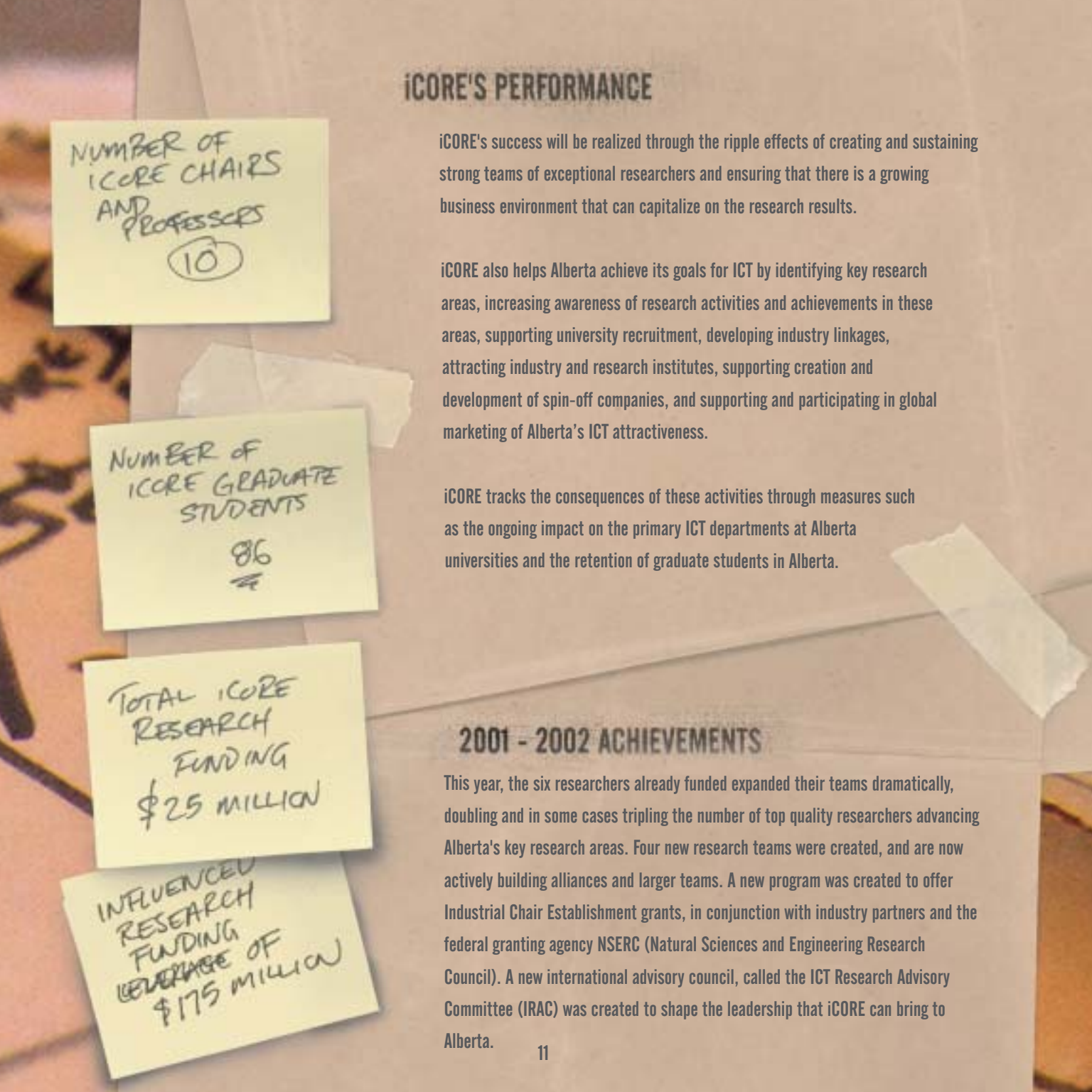


iCORE'S PERFORMANCE

iCORE's success will be realized through the ripple effects of creating and sustaining strong teams of exceptional researchers and ensuring that there is a growing business environment that can capitalize on the research results.

iCORE also helps Alberta achieve its goals for ICT by identifying key research areas, increasing awareness of research activities and achievements in these areas, supporting university recruitment, developing industry linkages, attracting industry and research institutes, supporting creation and development of spin-off companies, and supporting and participating in global marketing of Alberta's ICT attractiveness.

iCORE tracks the consequences of these activities through measures such as the ongoing impact on the primary ICT departments at Alberta universities and the retention of graduate students in Alberta.

2001 - 2002 ACHIEVEMENTS

This year, the six researchers already funded expanded their teams dramatically, doubling and in some cases tripling the number of top quality researchers advancing Alberta's key research areas. Four new research teams were created, and are now actively building alliances and larger teams. A new program was created to offer Industrial Chair Establishment grants, in conjunction with industry partners and the federal granting agency NSERC (Natural Sciences and Engineering Research Council). A new international advisory council, called the ICT Research Advisory Committee (IRAC) was created to shape the leadership that iCORE can bring to Alberta.

EXISTING iCORE RESEARCH TEAMS

Norman Beaulieu

Michael Brett

Mark Freeman

Gérard Lachapelle

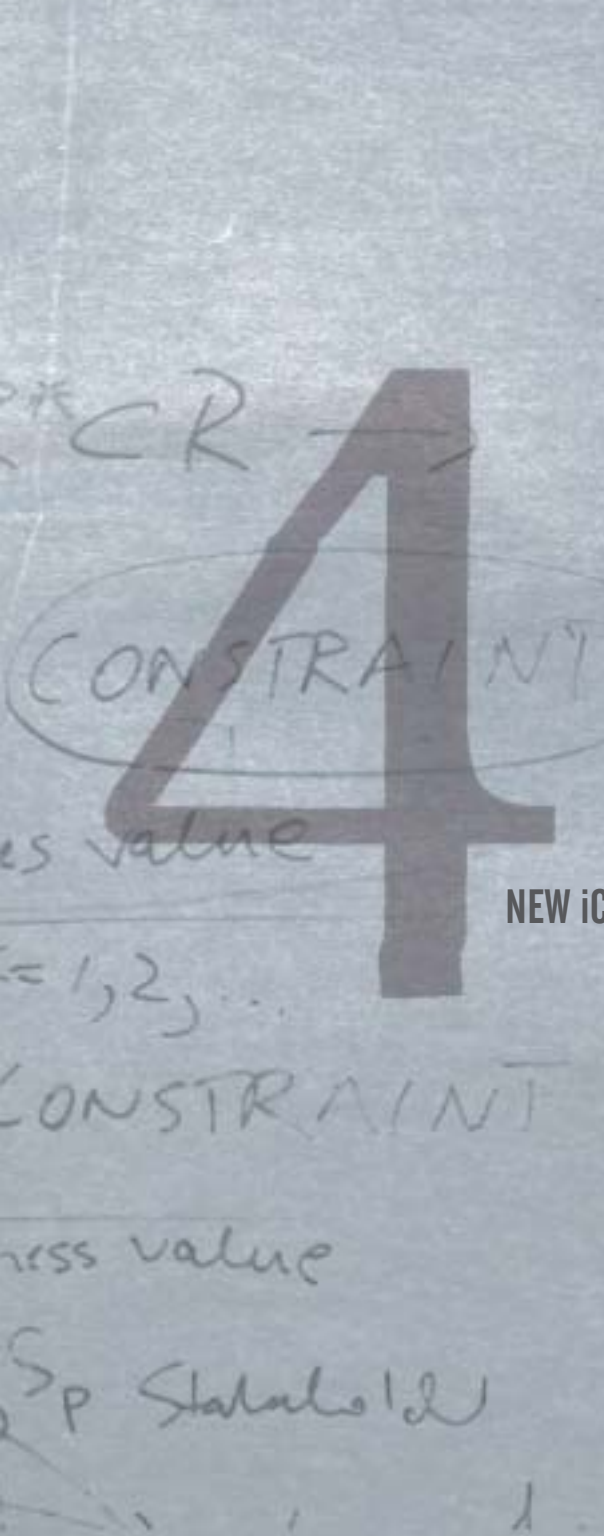
Graham Jullien

Jonathan Schaeffer

86

iCORE FUNDED GRADUATE STUDENTS

Nicholas Aleksiuk Jonathan Backer Kristen Beaty Andrej Bona Steven Bromling Claudine Couture Brad Davis Carolina Diaz-Goano Kathleen Dohan Robert Elliott Michael G. Forbes Tyler J. Foster Janice Friedman Anne Gildenhuys Markian Hlynka Mathew Hopkins Scott Irvine Padam Lal Kafle Sandra Lorraine Kennedy John C. Koob Dion Leung Michael William Lynch Cameron Macdonell Glenn MacGougan David Matthew MacLeod Geoffrey Messier Kyle O'Keefe Patrick Pantel Chrisopher A.C. Parker Mark Petovello Michael James Pyrcz David Schibli Ryan Schneider Jeremy Sit Raymond Sung Roberto Villanueva Robert Walton Michael S. J. Wojcichowsky Trevor Allen Julie Andreotti David Ballantyne Jason Blackstock Cyril Botteron David Chang Colin Cherry Scott Clark Michael Colgan David Cooke Don Dansereau Carla Davidson Brian Dick Barbara Marie Djurfors Srdjan Dragic Morris Flynn Georgia Fotopoulos Trevor Fox Martin Fuhrer Bogdan Georgescu Christian Giasson Kenneth Harris Alexander Anthony Holden Jonathan Holzman Paul Joss Scott Kennedy Cameron Kiddle Christine Lacasse Simon Leonard Daniel Lizotte Allan MacDairmid Jeffrey Mahovsky David Morgan Lora Neilson Daniel Neilson Jack Newton Christopher O'Brien Sean Peacock Christopher Pinchak Tim Poon Robert Randall Matthew Reid Terence Schauenberg Ajit Paul Singh Ross Stirling Kerry Tomlin Anthony Van Tol Ryan Watson



Having an idea is one thing. Making it happen is quite another. Yet turning ideas into real life applications is the common thread that ties together iCORE's researchers and some very different areas of ICT research.

It's all part of a master plan – a calculated effort to broaden Alberta's skill base in high-growth areas like software engineering, cryptography and wireless technology. iCORE already has six burgeoning research teams in place. Now four more researchers are injecting their energy, creating partnerships and adding to the province's ICT critical mass. Together with iCORE, they are taking the province one step closer to a sustained and globally competitive ICT research infrastructure.

NEW iCORE RESEARCH TEAMS

It's an exciting idea with endless potential. Look at how iCORE's newest researchers are making it work.

Carey Williamson

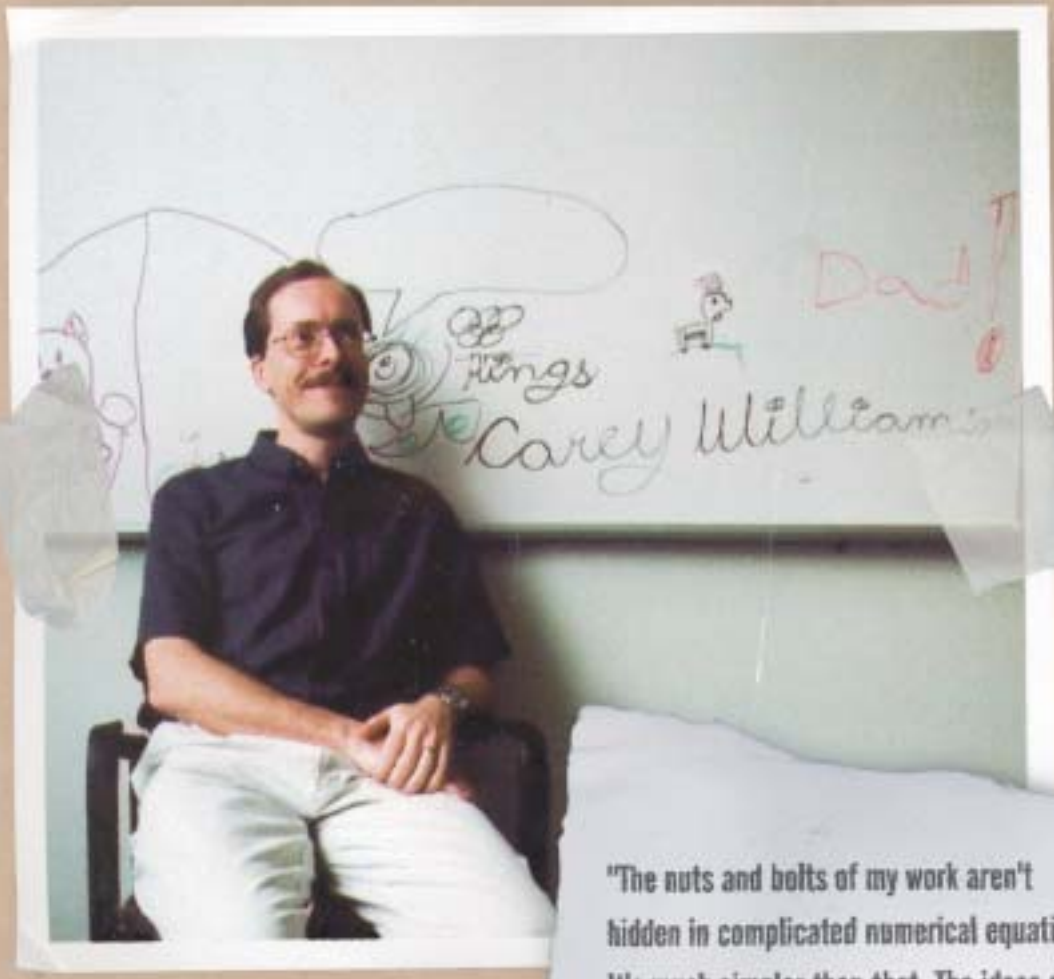
Guenther Ruhe

Hugh Williams

Christian Schlegel

CAREY WILLIAMSON

iCORE PROFESSOR, BROADBAND WIRELESS NETWORKS



"The nuts and bolts of my work aren't hidden in complicated numerical equations. It's much simpler than that. The ideas can be pure and simple. It's testing them that can get complicated."

Dr Carey Williamson believes equations are just numbers on a board if they can't be tested. He likes to make things happen, especially if it means building bigger, better, stronger, faster and more reliable computer networks. Now, as professor in iCORE's Broadband Wireless Networks research group, Williamson is getting that chance. iCORE has committed $1.75 million over five years to establish a research team and an experimental Internet testbed at the University of Calgary.

Williamson describes himself as an Internet mechanic who likes to dig into various network protocols. What are protocols? "Think of them as rules for communicating between two devices," he explains. "I describe it as a logical handshake between computers – sort of like deciding who talks first, who says the most, and how the conversation is interpreted by the other."

His work is especially relevant as technology moves more and more towards wireless and mobile Internet applications. "People want instant access anywhere, anytime," says Williamson. "We have the physical capacity to do that, but we haven't caught up in terms of service and service support." He compares it to building highways that are ready to handle cars, even though people are still riding bicycles. His goal is to find ways to deliver high performance all the way up to the end user.

iCORE is providing Williamson with the infrastructure and budget to help make this happen. "Our job is to generate ideas, refine them and weed out the ones that are a waste of time," he says. "We want to take the best ones beyond the whiteboard and translate them into working prototypes with commercial potential."

Like any good idea, Williamson cautions that the work he and his iCORE colleagues are doing will take time to build. But it is happening. He's had no problem drawing top people to his team and has more applications than available spaces for graduate students. He also received $1.2 million from the Canada Foundation for Innovation this year to build the Experimental Laboratory for Internet Systems and Applications (ELISA).

The trick is to keep the momentum going. "We need to remember iCORE is a very young organization," Williamson says. "We've planted the seeds and put down roots, and the roots are beginning to spread. Ideas, like plants, need time to grow."

GUENTHER RUHE

iCORE PROFESSOR, SOFTWARE ENGINEERING DECISION SUPPORT

"Of course there are things I am missing particular to Germany or Europe. But it's a trade-off. In Calgary, I'm drawn to the space, the wonderful landscape and the openness of the people. iCORE's support is also a major factor. Now I have the chance to explore my ideas in a dynamic and supportive environment with tremendous potential for industrial partnerships. I truly believe Alberta is one of the best places in the world to be. I don't regret my decision."

Dr Guenther Ruhe doesn't make decisions lightly. Not that you'd expect anything else from a man who has built a career around knowledge management and decision support in software engineering. But once the decision is made – whether it's a new country, a new job or a new idea – he's all business. It's this focused energy that Ruhe brings with him to his role as professor with iCORE's Software Engineering Decision Support Laboratory. iCORE has guaranteed $1.75 million over five years to establish the research team at the University of Calgary.

"Software influences all aspects of our daily lives," says Ruhe. "So it makes sense that we want reliable, predictable, cost-effective products and services." But theory and reality are often worlds apart. Developing software is an ambitious undertaking that involves complex, incomplete, sometimes inconsistent and often fuzzy factors such as quality, design, budget and timeline. That's why Ruhe's research focuses on the complete life cycle of software development and evolution.

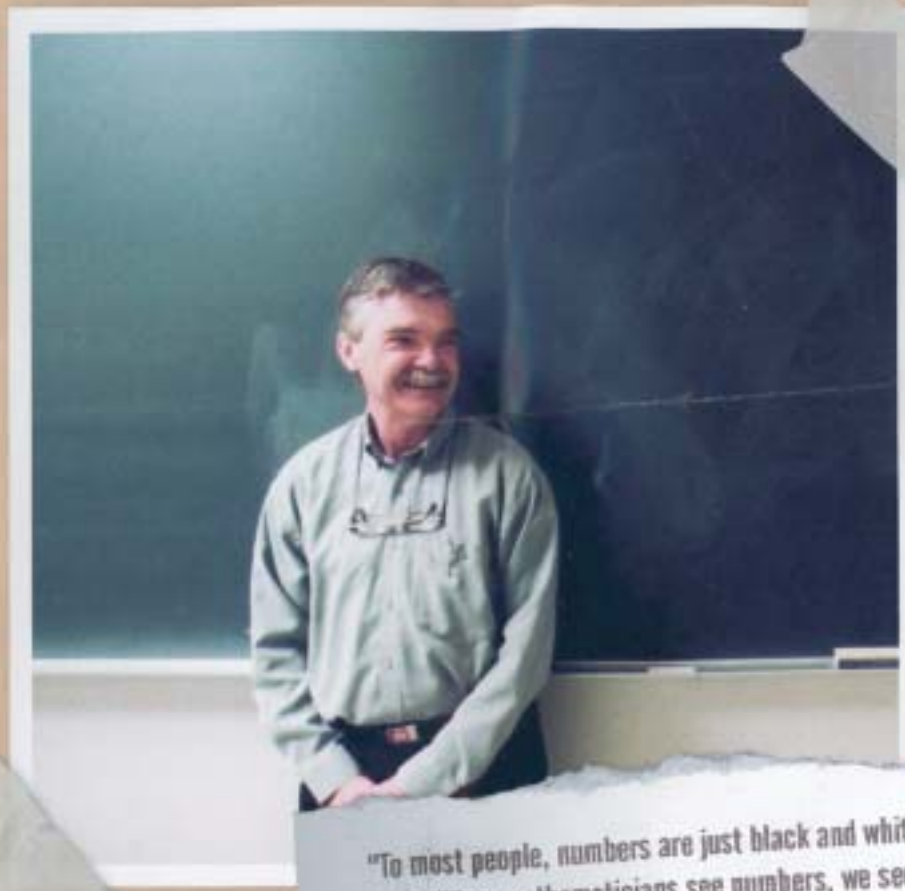
"I approach software development from a systems perspective," says Ruhe. "I see it as a very complex, large-scale and team-based endeavour." In fact, Ruhe hopes to create a centre in Alberta that brings together researchers in software engineering as well as other areas such as computer science, engineering principles, management science, cognitive science and mathematics. The goal is to build an interdisciplinary team that looks at the complete software life cycle from basic through applied research until it can be transferred into application areas. If this happens, Ruhe says there is huge potential to make something really extraordinary and outstanding succeed.

"We're not trying to develop the 75th programming language or the 43rd operating system," he adds. "What we want to do is make software development a white box instead of a grey or black one." This means developing a better understanding of the different mechanisms inside, as well as how the mechanisms are related and influence each other. Ultimately, this will help people make better decisions about processes and products as well as tools and techniques.

With iCORE's support, Ruhe is excited by the opportunity to make Calgary one of the really outstanding software engineering research centres in the world. "It's a new culture here, and I've been impressed by so many things," he says. He applauds iCORE's goal-oriented, straightforward approach as well as the lack of bureaucracy and red tape. "There's an openness here that I find refreshing, as well as a feeling that anything is possible."

HUGH WILLIAMS

iCORE CHAIR, ALGORITHMIC NUMBER THEORY AND CRYPTOGRAPHY



"To most people, numbers are just black and white images on a page. When mathematicians see numbers, we see a spectrum of colour and possibility. But it's difficult to generate and act on ideas in isolation, particularly when you're dealing with something as abstract as mathematics. I need to be around other people who can see that same spectrum of colour and possibility, who understand and speak the mysterious language of numbers."

Ideas – countless and complex – fuel Dr. Hugh Williams' passion for numbers. It's a passion he's had since youth, and one he's eager to pass on to new generations of students in his role as chair of iCORE's Algorithmic Number Theory and Cryptography research group. iCORE has committed $3 million over five years to establish the group at the University of Calgary.

Williams specializes in the development of cryptographic techniques for ensuring the security of data transmissions – taking information, transforming and then transferring it so would-be interceptors can't make sense of it. Security issues affect everything from medical record databases and cash machine withdrawals to electronic fund transfers between countries. "Whether we like it or not, our whole life is sitting on the Internet," he says. "My job is to find ways to protect that information."

The tragic events of September 11th have only served to heighten government and corporate preoccupation with information security. But Williams says there's still much work to be done to bridge the gap between theory and practice. "We can develop marvelous cryptographic systems in our minds. But there's a big difference between having the idea and actually embedding it into something that works."

It's taking these ideas and making them real that challenge Williams and his team. For Williams, success hinges on the strength of his people. People like Renate Scheidler, who was part of Williams' original proposal and came from the University of Delaware to be part of the group. Williams' role is to provide the education, knowledge, and skills that allow students and fellow researchers to translate ideas into practical applications for industry and government.

Williams knows ideas don't flow in just one direction. Finding smart solutions happens when innovation finds a home. When he builds links with industry, government and other universities, he increases the probability of finding paths to those solutions. "It's happening, and it's growing. If we can create more industry within the province that's not focused around resource extraction, then we help diversify the economy. And that improves our way of life. At the end of the day, that's what we're all here to do."

CHRISTIAN SCHLEGEL

iCORE PROFESSOR, HIGH CAPACITY DIGITAL COMMUNICATIONS

"There are lots of ideas out there. People write papers about them. The papers sit on shelves, and then people move on to the next idea. I don't believe in stopping there. Too many ideas don't go beyond pencil and paper. They aren't followed through. But following through is where the fun begins. As a researcher, my job is to take basic ideas a step further - to turn them into something real."

But translating ideas into working prototypes isn't easy. For Dr Christian Schlegel, it means attention to detail. Copious notes. Teamwork. And old-fashioned tenacity and perseverance. Schlegel specializes in digital communications systems. More specifically, he looks at what happens to information when it moves across channels ranging from fibre optic lines, cable and wireless links to plain old phone lines.

"Think of these channels as pipes – each with a different width," says Schlegel. "Some are very narrow, others very wide. We have all these types of pipes, and we're sending more and more information through them. Obviously a lot can happen during the transport – everything from bottlenecks and traffic jams to decreased efficiency."

Schlegel's research focuses on pushing the limits of existing pipes while ensuring the integrity of the data being transmitted. He compares it to a conversation between two people where they don't need to hear every word to understand the message. "Our job is to apply this concept in a technological sense," says Schlegel. "We look at how much redundant information is in a message and ask ourselves what we can take out or what needs to be added back in."

Thanks to iCORE, Schlegel now has the support he needs to take his ideas and actually implement, verify and measure them, something he says is difficult to do in a regular university setting. "Obviously I will continue to work on the theoretical side, but iCORE's funding allows me to make my ideas work not just on paper, but hopefully in practice," he says. Schlegel adds that if he can build prototypes that work, then the potential is there for rapid commercialization. And that, to him, is an exciting option. iCORE has committed $1.75 million over five years to help Schlegel develop a research group at the University of Alberta.

"I've always looked at things differently. So does iCORE," says Schlegel. He adds that it's exciting to see the exuberance, energy and pride of everyone involved – from iCORE's board and management to researchers and graduate students. "It's an infectious spirit that I haven't experienced before. Our challenge is to maintain the momentum, leverage our successes, and stay focused. If we can do that, the sky's the limit."

MEET THE FACE OF THE FUTURE.

iCORE FUNDED GRADUATE STUDENTS

wants to reach the "summit" of his profession

wants to develop a completely wireless world

wants to make computer technology mainstream in the biological sciences

UNIVERSITY OF ALBERTA

wants to build the next big computer game

hopes to one day create true artificial intelligence

wants and dreams of a completely wireless world

wants to create an uncrackable form of computer encryption

is developing software that actually wants to users

Is building computers out of computers

UNIVERSITY OF CALGARY

plans on becoming a well-respected researcher and hopes to make a significant contribution to society.

dreams of performing a trillion calculations in a nanosecond.

wants to build intelligent nanodevices that can fight cancer

ICT Models for ...

Partners = industry NORTEL etc

Partnership funding c NSERC & NRC

"NCE" like CENTRE OF EXCELLENCE

appoint Univ. of Coll...

... like structure

or AUSTIN, TX * model — blank cheque to hire a ... of

need a CHAMPION to drive it

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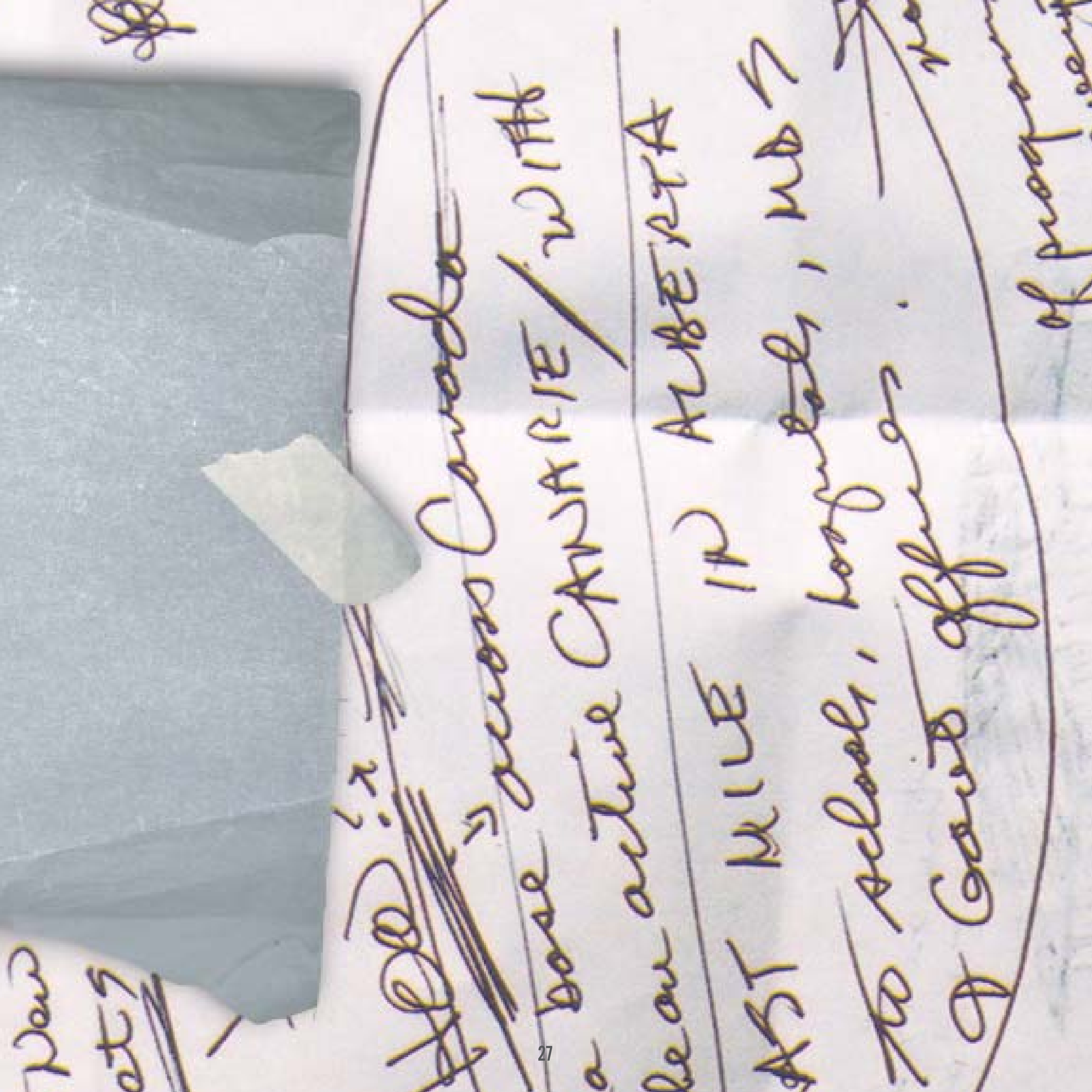
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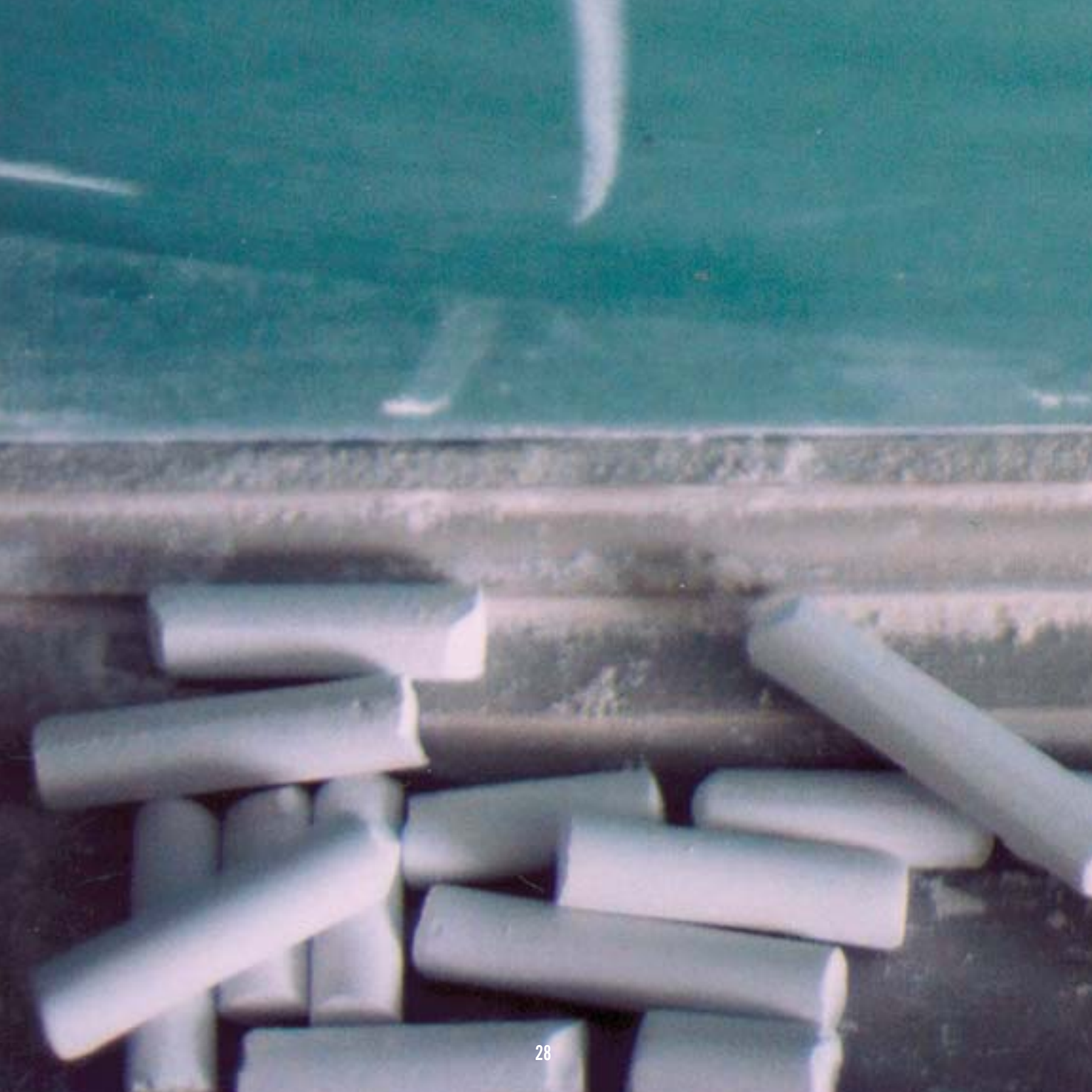
to schools, hospitals, MDS
& Govt offices.



GRANT PROGRAMS

Chair and Professorship Establishment Grants (CPE Grants)

Funding is available to establish research positions in information and communications technology (ICT) at Alberta universities through Chair and Professorship Establishment (CPE) grants.

Industrial Chair Establishment Grants (ICE Grants)

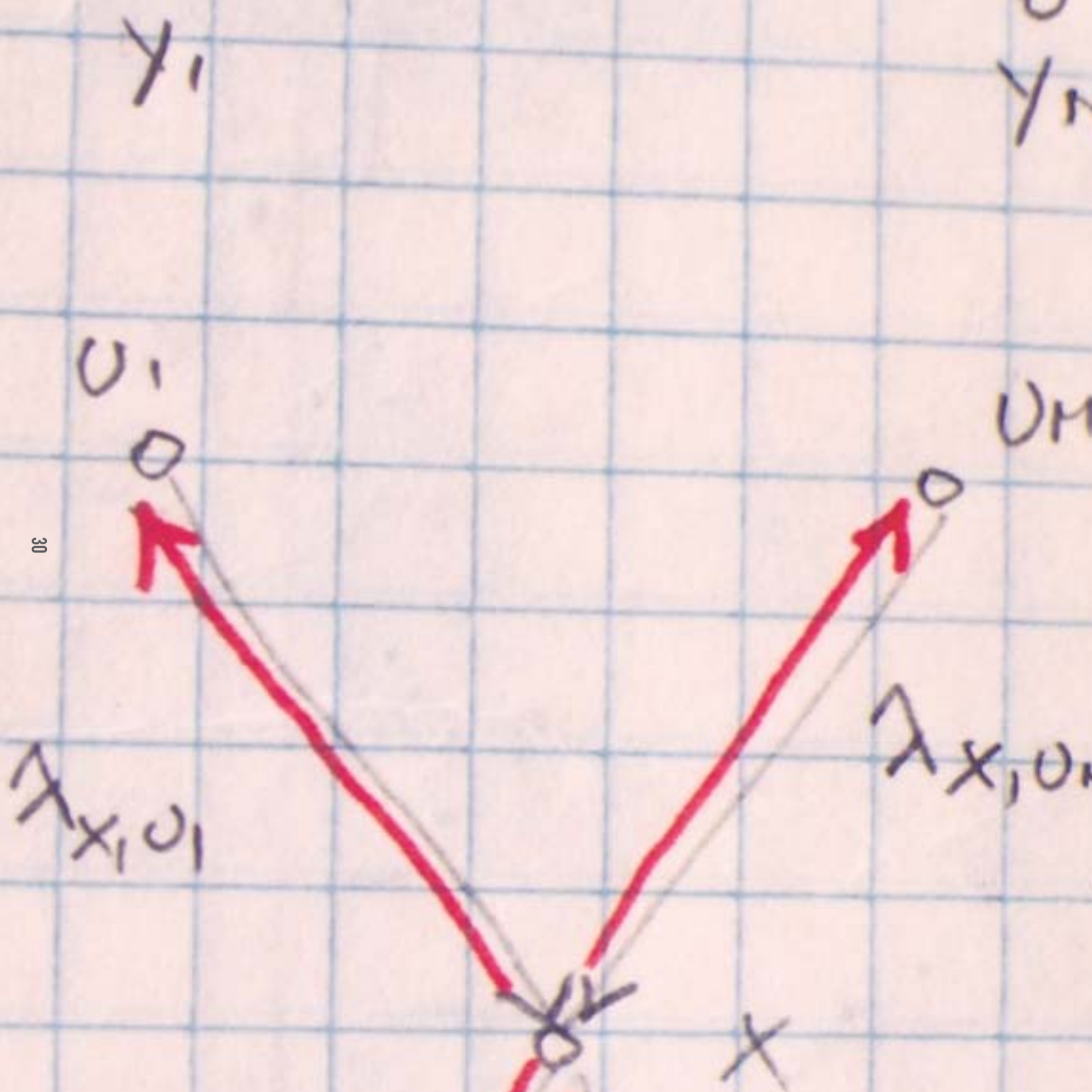
Funding is available to establish Industrial Chairs and associated research teams in ICT at Alberta universities.

Recruitment Grants (ISPR Grants)

Grants of up to $10,000 are available for university faculty members in Alberta to participate in the ICT strategy, planning and recruiting process.

Graduate Student Scholarships

Funding is available to support graduate students in computer science, electrical and computer engineering, and other ICT-related areas, who hold an NSERC Post Graduate Scholarship, or are of equivalent calibre.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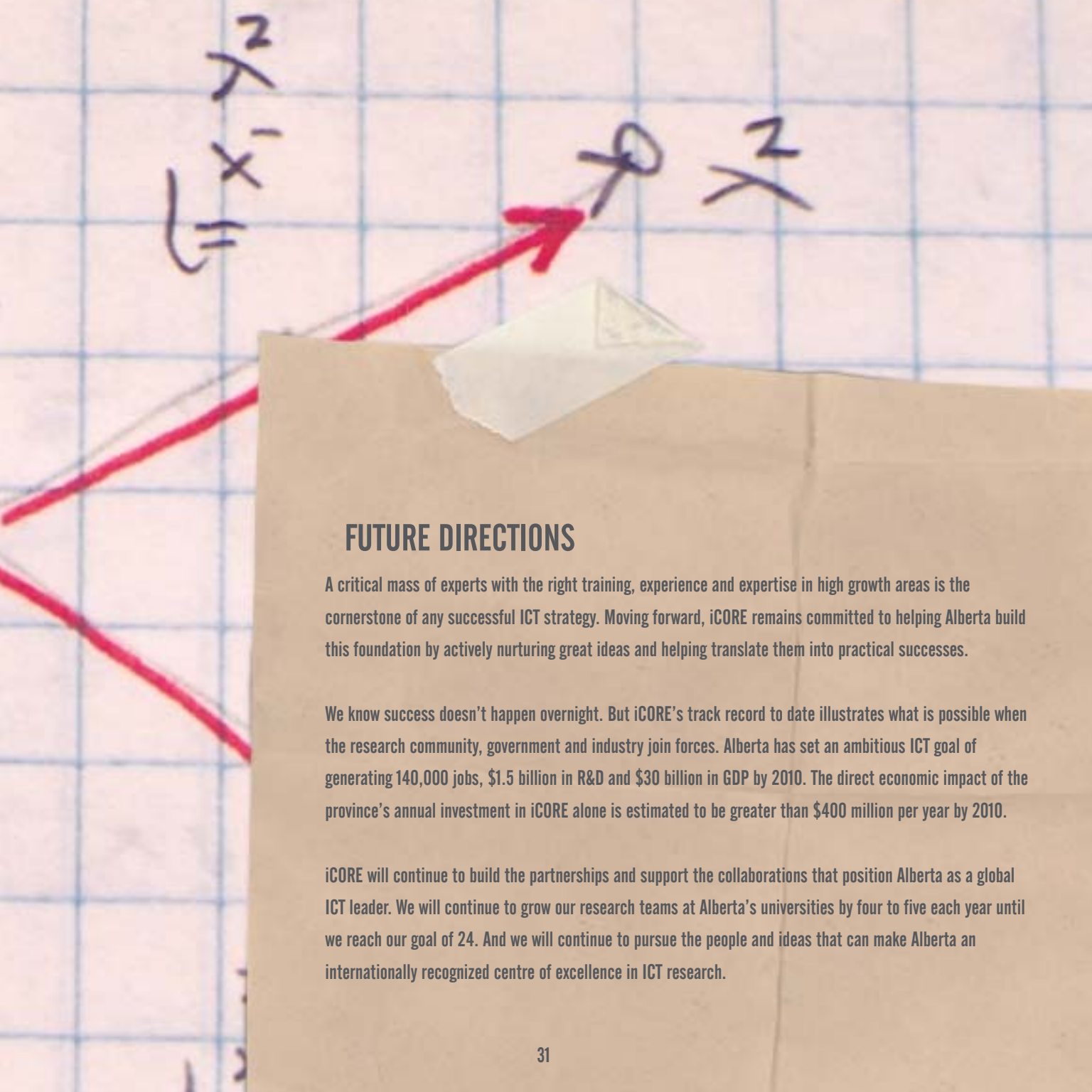

FUTURE DIRECTIONS

A critical mass of experts with the right training, experience and expertise in high growth areas is the cornerstone of any successful ICT strategy. Moving forward, iCORE remains committed to helping Alberta build this foundation by actively nurturing great ideas and helping translate them into practical successes.

We know success doesn't happen overnight. But iCORE's track record to date illustrates what is possible when the research community, government and industry join forces. Alberta has set an ambitious ICT goal of generating 140,000 jobs, $1.5 billion in R&D and $30 billion in GDP by 2010. The direct economic impact of the province's annual investment in iCORE alone is estimated to be greater than $400 million per year by 2010.

iCORE will continue to build the partnerships and support the collaborations that position Alberta as a global ICT leader. We will continue to grow our research teams at Alberta's universities by four to five each year until we reach our goal of 24. And we will continue to pursue the people and ideas that can make Alberta an internationally recognized centre of excellence in ICT research.

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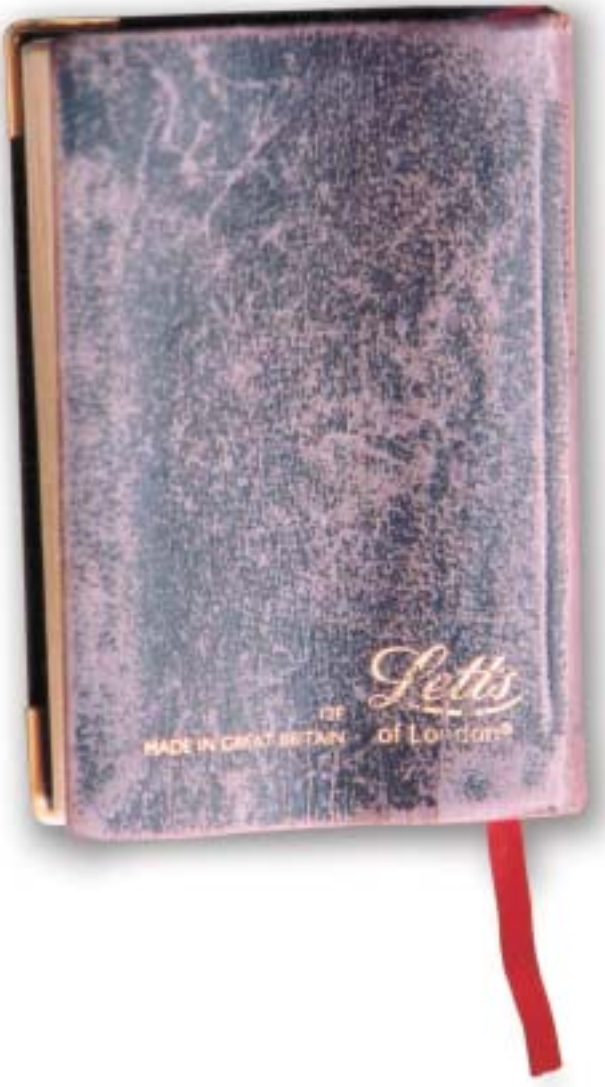
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