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World's Largest Machine begins Epic Scientific Journey

(Vancouver, B.C.) — History was made this morning as scientists started operation of the world's largest scientific project, the Large Hadron Collider (LHC) in Geneva, Switzerland. Canadian scientists and engineers at the scene held their breath as sensors indicated that the high energy proton beam was transported successfully around the 27-km in circumference particle accelerator. This morning's success marked the first operation of all accelerator systems working together, setting the stage for the giant discovery machine to tackle some of the most compelling questions in modern science.

Canada has been closely involved in all aspects of this global undertaking with pivotal contributions to the LHC accelerator itself, the massive ATLAS detector that will record the results, and the Worldwide LHC Computing Grid that will distribute the data around the world for collaborative analysis. The team of more than 150 Canadian scientists from the ATLAS-Canada collaboration, which includes the University of Alberta, the University of British Columbia, Carleton University, McGill University, l'Université de Montréal, the University of Regina, Simon Fraser University, the University of Toronto, TRIUMF, the University of Victoria, and York University, celebrated the news of this morning's success. Spokesperson Rob McPherson, a research scientist at the Institute of Particle Physics and a professor at the University of Victoria, remarked, "This milestone is a victory stemming from years of effort and thousands of people working together. Canada should be particularly proud as many of our contributions were critical to today's spectacular success."

As Canada's national laboratory for particle and nuclear physics, TRIUMF (based in Vancouver, B.C.) has been shepherding the project along with the ATLAS-Canada team. TRIUMF director Nigel S. Lockyer said, "This is as a real accomplishment and the threshold of a new era. Breakthroughs are just around the corner. It is through critical participation in global projects like this that Canada remains connected to---and relevant in---the modern world of science and technology." TRIUMF contributed key technical expertise and designed several of the most complex parts of the LHC accelerator.

Starting up such a machine is not as simple as flipping a switch. Achieving this milestone required full integration of every system of the accelerator, not unlike the launch of a space mission. Although the test this morning was predicted to go well, everyone involved was quite nervous. To commemorate this achievement, the Canadian community organized a number of celebrations across the country.

The LHC collides protons, which form the nuclei of hydrogen atoms, together at the highest energies yet achieved in the laboratory, mimicking energy densities believed to exist in the early universe. Scientists will use these collisions to probe fundamental aspects of matter such as mass and will be searching for clues to exotic phenomena such as dark matter and extra dimensions.

After this morning's success, two more milestones will complete the triple crown and launch the LHC into full physics operation. On October 3, the Worldwide LHC Computing Grid will celebrate the start of its crucial data challenge: the analysis and management of more than 15 million Gigabytes of data every year, produced from the hundreds of millions of subatomic collisions expected inside the LHC every second. On October 21, the LHC and its detectors will be formally inaugurated by the participating countries including Canada.

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TRIUMF is operated as a Joint Venture by:
The University of Alberta
The University of British Columbia
Carleton University
l'Université de Montréal
Simon Fraser University
The University of Toronto
The University of Victoria
via a contribution through the National Research Council of Canada

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FOR EDITORS:

CERN, the European Organization for Nuclear Research, is the world's leading laboratory for particle physics. It has its headquarters in Geneva. At present, its Member States are Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO have Observer status. Canada has made important contributions to CERN's flagship accelerator, the Large Hadron Collider and one of its associated particle physics detectors, the ATLAS experiment. http://cern.ch and http://lhc-first-beam.web.cern.ch/.

The Large Hadron Collider **or LHC** is a particle accelerator which, at 27 kilometres in circumference, will be the world's largest and most complex scientific instrument when it switches on in fall 2008. The LHC is the world's most powerful particle accelerator, producing beams seven times more energetic than any previous machine, and around 30 times more intense when it reaches design performance, probably by 2010. It relies on technologies that would not have been possible 30 years ago. The LHC is, in a sense, its own prototype.

ATLAS is a worldwide collaboration comprising over 2500 scientists and engineers from 178 institutions in 35 countries and regions. These are Armenia, Australia, Austria, Azerbaijan, Belarus, Brazil, Canada, China, Czech Republic, Denmark, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Japan, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom and the United States of America.

ATLAS-Canada comprises about 150 faculty members, post-doctoral fellows and students from eleven Canadian institutes:

the University of Alberta, University of British Columbia, Carleton University, McGill University, Université de Montréal, University of Regina, Simon Fraser University, University of Toronto, TRIUMF, University of Victoria and York University. See http://www.atlas-canada.ca

TRIUMF is Canada's National Laboratory for Particle and Nuclear Physics. Physically located on the south Campus of the University of British Columbia, TRIUMF is owned and operated as a joint venture by a consortium of the following Canadian universities, via a contribution through National Research Council Canada and supported by the Province of British Columbia: University of Alberta, University of British Columbia, Carleton University, l'Université de Montréal, Simon Fraser University, University of Toronto, University of Victoria. See http://www.triumf.ca

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Canadian involvement in ATLAS and the CERN LHC

Canadian involvement in ATLAS and the LHC has placed us in a prominent position in the forefront international science project of the decade. In total Canada has invested **$70 million of the $8 billion total** in equipment that is now a crucial part of the CERN LHC accelerator complex and the ATLAS particle physics experiment. Canadian researchers have received an additional **$30 million** to fund graduate students, postdoctoral researchers and their research on ATLAS. **TRIUMF** has provided staff and technical support to make these contributions a reality. As a result of these investments and the resulting scientific and technical expertise Canada is a respected partner at CERN and in the international science community.

No single country could afford to build the $8 billion LHC project on its own. ATLAS has been built by researchers from more than **150 universities and laboratories in 35 countries**. **150 Canadian scientists** (faculty, lab staff, postdoctoral researchers and graduate students) from **eleven institutions** across the country work at CERN, alongside 2000 other scientists from every corner of the globe, on the ATLAS experiment. Canada has made important contributions to the LHC, ATLAS and the world-wide computing grid now primed to digest the ATLAS data.

In 1995 TRIUMF was given the mandate to act as Canada's main connection with CERN. It was provided with **$42 million** of federal funding over ten years to develop and construct components for the LHC. These projects were completed on time and in budget in close collaboration with Canadian industry. Over 90% of our LHC funding has been spent in Canada. There have been a number of spin-offs from this activity. I.E. Power, Inverpower and Digital Predictive Systems in Ontario gained expertise in high current power supply design and fabrication and have competed successfully for an additional $10M in contracts from major international labs. ALSTOM-Canada, in Tracy, Quebec improved assembly tolerances for LHC magnets benefiting their main business, the fabrication of hydro generators. Canadians were instrumental in the construction of the ATLAS detector. ATLAS construction was supported by a **$12 million** grant from the Natural Sciences and Engineering Research Council of Canada (NSERC). Canadian contributions to the ATLAS detector were completed on time and on budget, are now installed in the ATLAS experiment where they are being commissioned and will be ready for first LHC particle collisions in autumn 2008.

ATLAS will produce several Peta-bytes (millions of Giga-bytes) of data per year. Canada has constructed a Tier1 computing centre at TRIUMF funded by the Canadian Foundation for Innovation (CFI) and the BC Knowledge Development Fund (BCKDF) at the levels of **$12 million** and **$4 million**, respectively. The primary role of the Tier1 centre is the processing of raw ATLAS data which will be used by physicists to understand what is going on in the high energy proton collisions. The final analyses will be performed largely on the Tier 2 computing centres located at university sites, funded by the CFI National Platforms Fund. The combined Canadian Tier1 and Tier2 centres give us “made in Canada” physics analysis ability, positioning ourselves to be leaders in extracting the first ATLAS physics over the coming years.

Particle physics studies the universe at its most fundamental level. Outstanding questions that we are on the brink of answering include:

- How do the elementary particles get masses?
- What is the nature of the cold dark matter observed by astronomers?

Excitingly, these seemly disparate questions may even be part of the same puzzle. The LHC will provide the next step to answering these questions and may provide insight into a much deeper understanding of the nature of the universe.

For further information: see http://www.atlas-canada.ca