STRATEGIC ASSESSMENT OF SOUNDING ROCKETS AS VEHICLES FOR SCIENTIFIC STUDY IN CANADA

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ABSTRACT

The Canadian Space Agency has a strong history of participation in science experiments and science instrumentation on sounding rockets, and has also been a strong player in the early development of sounding rocket technology. In 1959, Canadian company Bristol Aerospace launched the first Black Brant rocket from the Churchill Manitoba rocket launching complex. Since that time, Canadian scientists have been involved in a number of sounding rocket experiments exploring the ionosphere and aurora borealis, as well as tests of technology for global positioning and technology for tethered sounding rocket payloads. Material science research on the sounding rockets GEODE and CSAR I/II revealed properties of micro-crystal formation affected by microgravity. NEQUISOL, a European Space Agency project, further develops this area of research by looking at alloy microstructure changes during non-equilibrium solidification. Hani Henein of the University of Alberta is involved in this project. The potential for future science benefit from sounding rockets is strong, and the potential use of sounding rockets for investigation of fundamental biological questions has perhaps been underexploited in the past. The Canadian Space Agency is currently assessing the role of sounding rockets in the Life and Physical Science and Solar-Terrestrial programs in a strategic context, as one of many tools that can be used to meet scientific goals, and to meet Government of Canada Science and Technology targets.

1. ROCKETS AND BALLOONS AS PLATFORMS FOR CANADIAN RESEARCH

Canadian research in space essentially began in 1957 and 1958 through a collaboration with the US Army to launch rockets from Churchill Manitoba [1]. The objectives of these launches, held as part of the International Geophysical Year, included study of the atmosphere and ionosphere.

Then, in 1959, the first Black Brant rocket was launched from Fort Churchill, with a continuing research objective of study of the ionosphere. This rocket was designed by Albert Fia, a Canadian from Alberta. This Black Brant rocket, and subsequent rockets in the same family was in the Bristol Aerospace facility in Winnipeg. This family of rockets continues to be used for scientific research, particularly by NASA.

During the 1960 to 1984 period, the Churchill Rocket Range was active in scientific research, mainly focusing on research on the ionosphere and the aurora borealis. During this time stewardship of the range was transferred from the US Army to the National Research Council (Canada), and rockets were also launched from Resolute Bay, Nunavut. The University of Saskatchewan was particularly active during this period, for example studying electric fields in the ionosphere using rockets [2].

In 1984 the central mandate of the National Research Council was modified, and the Churchill Rocket Range was closed. In 1989 the Canadian Space Agency (CSA) was created through an Act of the Canadian Parliament, and this agency supported research on rockets at several instances between 1989 and 2009. For example, in 2000 GEODESIC launched in a Black XII rocket from the Poker Flats Rocket Range in Alaska. This CSA-NASA collaboration contained instruments contributed by Canadian and US scientists to study plasma in the ionosphere.

Since 2006, Canada has been a member of ELIPS, the European Life and Physical Science Program. This program has allowed Canadian scientists to become involved in rocket experimentation. For example, Hani Henein of the University of Alberta, through his participation in the NEQUISOL (Non-equilibrium solidification, modelling for microstructure engineering of industrial alloys) team, took part in a sounding rocket experiment in winter 2008. This experiment used the TEM Electomagnetic-Levitation Module-2. NEQUISOL is part of the ELIPS Microgravity Applied Program.

The CSA also holds continuing interests in the use of balloons for scientific research. For example, in 2006, Canada, the US, and UK partnered in the BLAST balloon mission [4], wherein a 2-metre telescope was mounted on a balloon that flew above Antarctica for eleven days.

2. CSA STRATEGY DEVELOPMENT

In recent years strategic planning at the CSA has focused on alignment with the Government of Canada Science and Technology Strategy [3]. The framework

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of this strategy is built on the following targets: Entrepreneurial, People, and Knowledge Advantages. In turn, these strategic components are guided by four core principles: world-class excellence; priority definition; partnerships; and accountability. The Canadian Space Agency is developing a strategic plan that will guide the agency and its activities in the future, and that is coherent with the Science and Technology Strategy.

The Life and Physical Sciences (LPS) group, within Space Science, is developing a strategic approach to planning within the overall CSA strategy. This is built upon a 'Push/Pull' concept, wherein traditional scientific 'questions' are answered through the Push side, and more focused, directly applied questions are addressed through research solicited on the Pull side. The two sides are not completely separated, as many LPS research questions within traditional 'fundamental' space life and physical sciences research hold considerable practical importance. For example, the fundamental cause of bone loss in microgravity is incompletely understood, and the resolution of this cause may well open up new avenues for prevention or treatment of space osteoporosis.

The LPS program is currently focused on scientific utilization of the International Space Station. However, all divisions of the CSA Space Science Division (LPS, Solar-Terrestrial and Atmospheric Science, and Planetary Exploration and Space Astronomy) continue to be aware and interested in research that can be efficiently and exploited using rockets and balloons.

3. REFERENCES

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