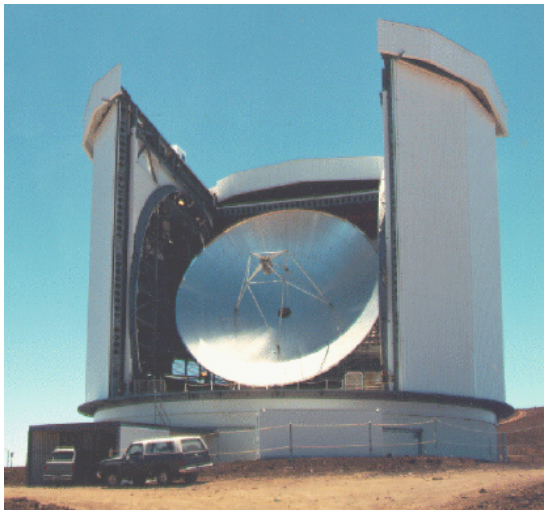
# The James Clerk Maxwell Telescope



## A Report for the Long Range Plan Mid-Term Review Committee

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**(1) Status of the project, both internationally and in Canada, in the year 2000, i.e. shortly after the release of the original LRP report.**

The JCMT is operated by the United Kingdom, Canada, and the Netherlands. Under the terms of their tripartite agreement, operations, maintenance, and development of the JCMT are undertaken jointly by the three partners, and are overseen by the JCMT Board. Resource contributions are fixed at the levels 55% (United Kingdom), 25% (Canada), and 20% (the Netherlands). The facility is managed by PPARC at the JAC in Hilo. Observing time is divided between the partners in the above proportions apart from a 10% allocation set aside for the University of Hawaii. The JCMT Board has four members appointed by PPARC, two appointed by NRC, two by the Netherlands Organization for Scientific Research, and one by the University of Hawaii. The Board has established a JCMT Advisory Panel (since disbanded) to advise on the development and scientific operation of the JCMT. Two of its ten members are (were) Canadian. There is now a system of non-voting community representatives who participate in relevant Board discussions. There is one representative from each of the three partners.

Canadian participation in the operation and development of the JCMT is financed and managed by NRC through the JCMT Group (since renamed the Millimetre Astronomy Group) at the Herzberg Institute of Astrophysics. In 2000, the JCMT Group consisted of five staff astronomers, two of whom were stationed at the JAC, and a millimetre-wave

instrumentation team of five engineers/technicians. Under the terms of the tripartite agreement, NRC funds three additional positions at JAC by means of cash transfers. The JCMT Group supports and manages the CANSERV service observing program and provides funding for CTAG and for the Canadian participation on the JCMT Board. The bulk of the work of the instrumentation team in 2000 was directed towards supporting JCMT instrumentation.

The facility science instruments at JCMT in 2000 were the RxA3 (230 GHz) and RxB3 (345 GHz) heterodyne receivers (both available for total power and polarimetric spectroscopy), SCUBA (available for total power and polarimetric continuum) and the RxW (460 GHz and 690 GHz) heterodyne receiver. All JCMT heterodyne receivers used the DAS autocorrelator spectrometer back end.

**(2) Developments on the international scene for the project since 2000.**

The basic participation and funding model for the JCMT tripartite partnership has remained unchanged since 2000. However, the decision of the United Kingdom to join ESO necessitated savings on their ground-based astronomy program. Beginning in 2006, the United Kingdom will decrease its funding for the JCMT and Canada and the Netherlands have decided to follow suit and maintain their relative stakes in the project. Around the year 2000, the JCMT began a transition from its previous mode of operation to its new future as a more tightly-funded facility with a software and operations programme designed to result in fully-flexible queue-scheduled operation with an increased emphasis on data pipelining. On the instrumentation side, the development of what is expected to be the final wave of facility instruments began. These new instruments, ACSIS, HARP-B, and SCUBA-2, will give the JCMT wide-field fast mapping capabilities in the submillimetre continuum and spectral lines. Preparations for the interferometric connection of the JCMT to the Submillimetre Array (SMA) in the so-called eSMA, are also underway.

It is intended that the advent of these new instruments will permit the JCMT to run in a much leaner fashion in a mode with a significant fraction of observing time being dedicated to large survey-type programmes. Beginning with the availability of SCUBA-2 in 2006, JCMT will operate in survey mode for much of the time. No major technical developments are planned post-delivery of ACSIS, HARP-B, and SCUBA-2.

**(3) Developments in Canadian contributions toward the project since 2000.**

Since 2000, the JCMT Group has undergone changes affecting its support of the JCMT. Apart from a name change, the Group has grown to seven staff astronomers. The Millimetre Astronomy Group continues to support NRC's commitments to the JCMT, CANSERV, CTAG, and Canadian JCMT Board activities, and supports Canadian astronomers by contributing observers to the CANFLEX flexibly-scheduled time blocks. It is also active in preparations for the scientific exploitation of the upcoming ACSIS/HARP-B and SCUBA-2 instruments. However, the activities of the Group are increasingly becoming focused on support for Canadian participation in ALMA, and

pressure on NRC for greater involvement is likely to increase as ALMA begins the ramp-up in 2004-05 towards Early Science Operations beginning in late 2007.

The technical staff of the former JCMT Group has been transferred to HIA's Astronomy Technology Research Group Victoria, and resources have been fully committed to development of the "Band 3" suite of receivers for ALMA (see Dr. Christine Wilson's ALMA report). Resources for an oft-mooted replacement for RxA3, for example, are no longer available. Canada is involved to varying degrees in all of the major instrumentation suites currently under development for JCMT, but this participation has largely shifted away from the former JCMT Group's technical staff.

The design and construction of the ACSIS multibeam spectral line correlator system is a project of HIA's Astronomy Technology Research Group Penticton. It is due to be delivered to JCMT in 2004. It will replace the DAS and will be necessary for the operation of HARP-B. The HARP-B 16 pixel 345 GHz spectral line receiver is a collaborative project between HIA, MRAO in Cambridge, and the UKATC in Edinburgh, with HIA Victoria responsible for the high level control software, the computing hardware, and the local oscillator system. HARP-B is currently scheduled for delivery to JCMT in 2005. HIA staff in Penticton and Victoria will be involved in the commissioning of ACSIS and HARP-B.

Overall direction to the SCUBA-2 project is provided by the SCUBA-2 Project Management Board established by PPARC. The prime contractor of the SCUBA-2 advanced wide-field submillimetre continuum camera is the UKATC, with the detector arrays being provided by NIST in Boulder and the University of Edinburgh. NRC is not funding the development of SCUBA-2 except indirectly through its financial contributions to the JCMT Development Fund under the tripartite agreement. The university-based Canadian SCUBA-2 Consortium has received a CFI grant to contribute a polarimeter and FTS (plus software and electronics) to SCUBA-2. The Canadian Consortium nominates the Canadian member on the Project management Board. See Dr. Michael Fich's SCUBA-2 report for more information on this project.

**(4) Approximate amounts of LRP funds spent, and how distributed (e.g. staff, contracts, equipment) up to now, and projections to 2005.**

There are no LRP funds assigned to projects associated with the JCMT.

**(5) Approximate amounts of non-LRP funds spent and how distributed over the same period.**

Under the tripartite agreement, NRC funds JCMT operations at the 25% proportion. The grand total of Canadian contributions (operations, staff, development) is roughly CAD $ 1.5M per year.

**(6) Anticipated status of the project, internationally and in Canada, in 2010 with continued support from LRP funds, and the amounts of funds needed over 2006-2010 to achieve this goal.**

It is currently forecast that Canada's contribution will drop to roughly CAD $ 1.3M per year beginning in FY2006-07.

The tripartite JCMT agreement can be terminated without penalty on any date from 26 May 2009 onwards provided that two year's notice of termination has been previously provided by one of the three parties. The earliest date of the serving of such notice is thus approximately three years from now. The agreement automatically extends until two years have elapsed since notice has been given. Barring an extension to the current agreement or the establishment of a new agreement, JCMT could potentially cease operations in May 2009.

It has been recommended by the Long Range Plan panel that NRC funds saved by the closure of JCMT be redirected towards ALMA. ALMA will be well into its Early Operations Phase by 2009, and given the ramp-up to early operations beginning as early as 2004-05, money saved from JCMT would not be immediately available for ALMA and in any case would not be sufficient on its own to cover our anticipated ALMA contribution. The most likely motivation for keeping the JCMT open past May 2009 would be to maximize the scientific return from the final suite of facility instruments, ACSIS/HARP-B and SCUBA-2, particularly if there are significant delays in their delivery or commissioning.

**(7) Estimate of ongoing annual support required beyond 2010 to permit an effective ongoing Canadian contribution to the project and/or its operation.**

If the JCMT were to continue operating beyond May 2009 under the conditions of the current agreement, it is reasonable to expect a cost to NRC of approximately CAD $ 1.3M per year. The costs might be different however in the hypothetical situation of a new operating agreement for JCMT post-May 2009.