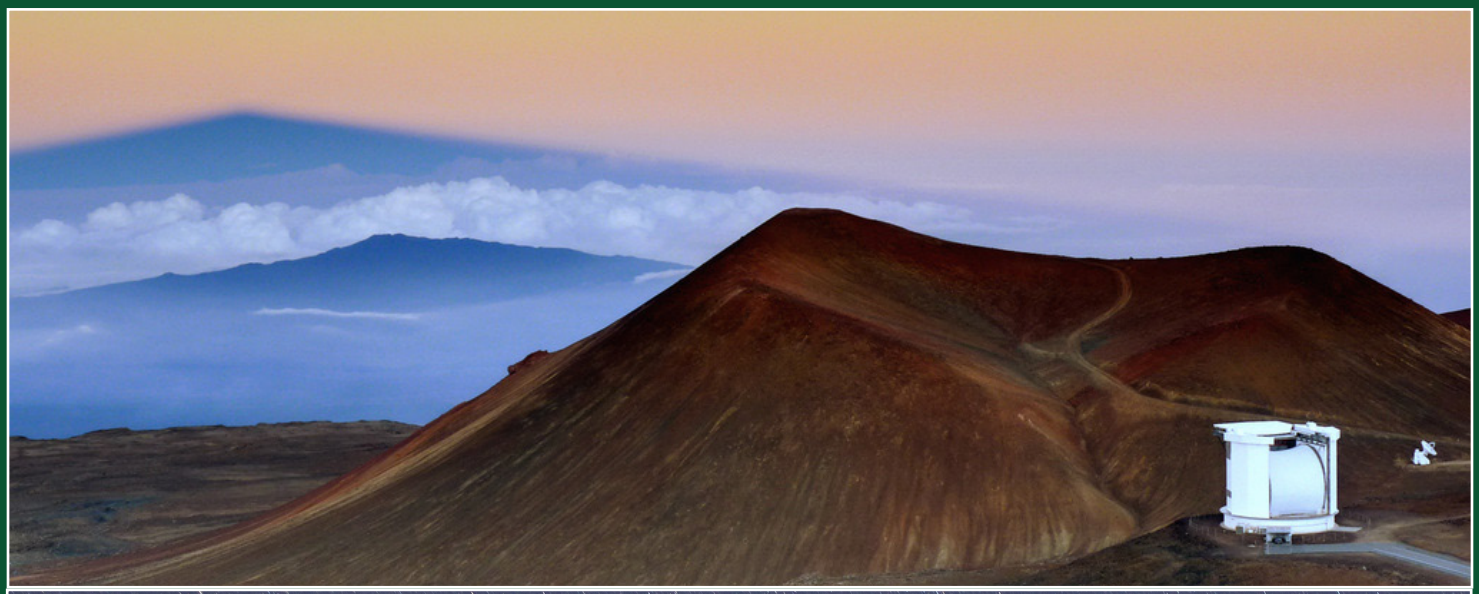
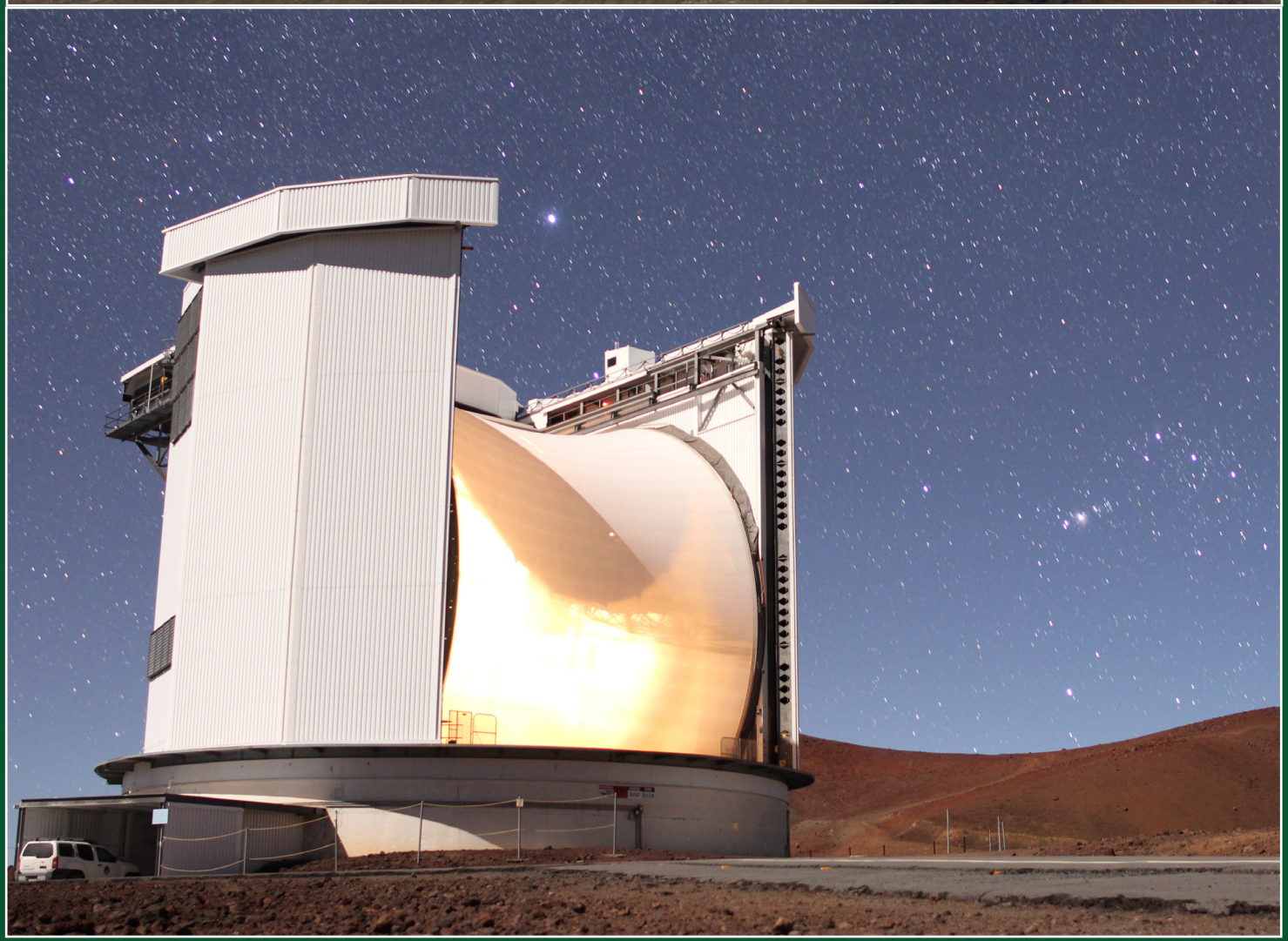
JCMT Newsletter

James Clerk Maxwell Telescope





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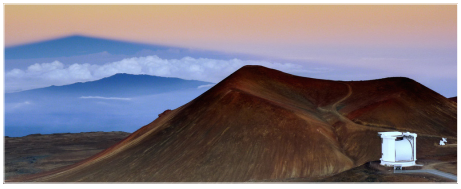
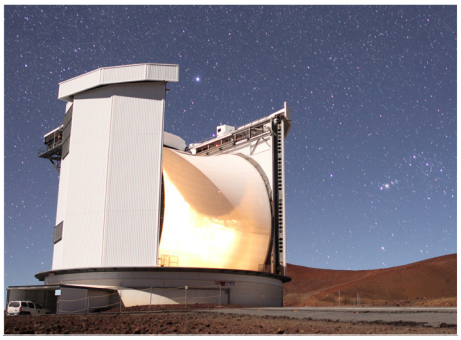
#36 January 2015

JCMT Retrospectives

Observatory News

The Future



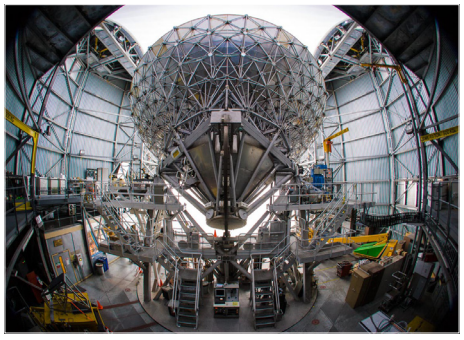


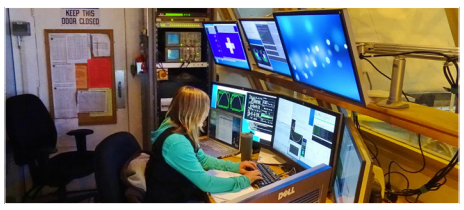
◄ FRONT COVER: (top) Sunrise from the summit with Mauna Kea's shadow seen beyond both Pu'u Poliahu and Hualalai. Image credit - Tom Kerr.

(Bottom) The JCMT open for a night of observing; Orion and Sirius are seen in the sky overhead. Image credit - William Montogemerie.

► BACK COVER: (top) Fish eye image of the JCMT's observation floor. The backing structure provides support for each of the 276 individual lightweight aluminum panels. Together, these make up the 15 metre diameter primary mirror of the JCMT. Image credit - Antonio Chrysostomou.

(Bottom) The JCMT control room during a night of observing; operator Callie Matulonis.





The Joint Astronomy Centre (JAC) is based in Hilo on the Big Island of Hawaii and operates the James Clerk Maxwell Telescope (JCMT) on the summit of Maunakea. With its clear, dark skies, Maunakea is a world-class site for astronomy and the JCMT sits at an altitude of 4092 metres, putting it above much of the water vapour in the atmosphere. With a 15 metre dish, the JCMT is the largest single-dish telescope in the world designed specifically to operate at submillimetre wavelengths.

The JCMT is supported by the United Kingdom's Science and Technology Facilities Council (STFC).

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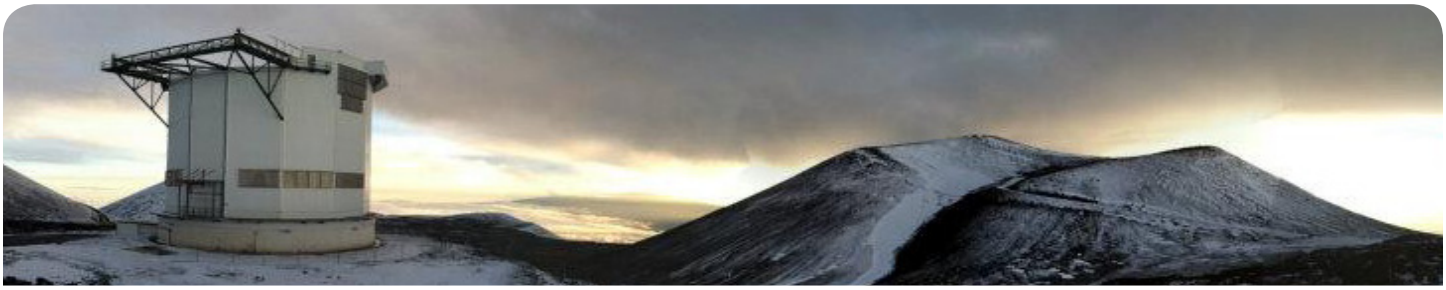
The JCMT Newsletter, is designed and edited by Iain Coulson and Harriet Parsons.

From the Desk of the Director



Professor Gary Davis, Director JAC

Welcome to this transitional issue of the JCMT Newsletter – the final newsletter to be issued under UK ownership of the observatory. Momentous changes are upon us. The good news is that the telescope will continue to operate under new East Asian management, potentially for many years, and will continue to deliver the excellent and high-impact science that has been its hallmark to date. Given the decision of the historical UK-Canada-Netherlands partnership to withdraw its support for the observatory, this is the best outcome that could possibly have been achieved. This issue contains a number of retrospective articles and the usual update of observatory news; in addition, an article from Paul Ho, the incoming Director, highlights his ambitions for the future.

The dissolution of the partnership began with the withdrawal of the Dutch agency NWO in March 2013 (see previous newsletter). NRC Canada then withdrew on 30th September 2014, and I would like to record my thanks to NRC and the Canadian community for their financial, technical, scientific and personnel contributions to the JCMT over more than 27 years. The JCMT has unquestionably been a stronger and more successful telescope over this period because of Canada's participation. It is extremely gratifying to observe that Canada is now a partner of choice in submillimetre astronomy missions and experiments – Herschel, ALMA, BLAST and ACT to name a few – and this is a direct consequence of the experience gained with the JCMT. The last NRC-funded observing run took place in August (see picture).

Confronted with these decisions from the Netherlands and Canada, the UK funding agency STFC decided in May 2012 that it could no longer support the operation of the JCMT beyond the date of Canadian withdrawal. It is a tautology to say that this was a profoundly disappointing decision for everyone associated with the observatory. In retrospect, however, it is a clear consequence of the funding pressures occasioned by mega-projects: although the details in the two cases are different, the withdrawals of both the Netherlands and Canada were driven by their commitments to ALMA.

Todd McKenzie (UBC), Doug Johnstone and the Director in the JCMT control room during the last NRC-funded observing run on the telescope.

My mission since then has been to find a new entity to take over the operation of the telescope. In the previous Newsletter I reported that an Announcement of Opportunity had been issued in June 2013, and that four Expressions of Interest had been received: one each from the UK and Canadian communities, one from Purple Mountain Observatory, and one from the East Asian Core Observatories Association (EACOA), an umbrella organisation representing astronomy research institutes in Taiwan, China, South Korea and Japan. These were eventually consolidated into a single proposal, which was accepted by the University of Hawaii (UH) in June 2014. The actual transfer is now firmly scheduled to take place at midnight on 31st January 2015: the legal ownership of the facility will transfer from STFC to UH, and the telescope will be operated by EAO in partnership with the UK and Canadian communities. EAO is the East Asian Observatory, a non-profit corporation set up by EACOA in the State of Hawaii. All of the legal arrangements for this transaction are now being put in place, and I am grateful to STFC for their flexibility around the timetable to ensure the optimal outcome, and to UH for stepping forward to enable this unprecedented transfer of ownership to take place.

In parallel with the legal arrangements, we have been working with EAO to ensure as far as possible a seamless transition of observatory operations. For example, we recently asked all users for permission to transfer their

OMP profiles from STFC to EAO (as required by data protection legislation). It is inevitable, though, that users will notice some changes. We will endeavour to keep these to a minimum, and to keep the community informed.

The transfer of the JAC's two world-leading telescopes to new management is, as far as I am aware, unprecedented in the history of observational astronomy, and is heading for a successful conclusion. This is, however, only part of the story: in reality, my primary objective throughout this process has been to look after the staff of the JAC. I am absolutely delighted to report that although all locally-hired staff will be laid off by the JAC on 31st January 2015 (with the exception of the finance staff, who will be kept on for another two months to complete the final transactions and wrap up the accounts), plans are in place for almost all of them to be hired by EAO. This is a fantastic outcome. In fact, following the initial wave of resignations in 2012 prompted by the funding decisions, the staffing situation at the JAC has been extremely stable: in the 13-month period from 30th September 2013 to 31st October 2014, there were no resignations at all. This would be exceptional even under normal conditions: it is absolutely extraordinary at a time when the future was uncertain and one might expect morale to be low. The staff have remained professional and fully committed to the observatory throughout this difficult period, and I am enormously grateful for, and continually amazed by, their continuing dedication.

Having said that, three people left us quite recently. Doug Johnstone, Associate Director, was seconded to the JAC from NRC for a fixed term that expired on 30th September. I am extremely grateful to Doug for agreeing to take on this challenging but vital position for two years, and for splitting his time between Hilo and his permanent residence in Victoria. His primary responsibilities were to oversee the JCMT Legacy Survey (JLS) and the JCMT Science Archive, both of which he fulfilled admirably, and I think he even enjoyed the experience! Doug has now returned to his position as a staff scientist in the Radio Astronomy Programme at NRC Herzberg.

Linda Gregoire and Holly Thomas both left us on 31st October. Linda's title was Executive Project Assistant and she filled several important roles at the JAC, one of which was as my PA. Linda was a pleasure to work with and I miss having her outside my office at my beck and call. She and her husband have relocated to San Francisco. Similarly, Holly has moved to Boston where her husband is an astronomer at the Center for Astrophysics. Holly was a JCMT support astronomer and during her time with us she had responsibility for the telescope pointing and tracking, for monitoring the progress of the JLS, for some public outreach, and for some recent editions of this Newsletter.

The end of October was a momentous day for the JAC: we not only said goodbye to Linda and Holly, but also to a telescope. UKIRT was successfully transferred to UH ownership, and it is now operated by a new partnership between UH, the University of Arizona (UA) and the Lockheed Martin Advanced Technology Center. The five UKIRT-dedicated staff at the JAC are now employed by UA: Sam Benigni, Tim Carroll, Tom Kerr, Erik Moore and Watson Varricatt. These five individuals still have offices in the JAC building

JAC Staff Photo (October 2014)

but UKIRT, after 35 years as a UK telescope, now belongs to someone else. It is taking a little bit of getting used to.

This is my last Newsletter column after more than 12 years as Director of the JCMT. Following the transfer of the telescope at the end of January 2015, I will be returning to the UK to take up a new position as Director of Operations Planning for the SKA project. It is a challenge to which I look forward with enormous enthusiasm, not only because it will take me back to England, where I spent several happy years as a student and postdoc, but also because it will be a huge change of outlook to be involved at the early stages of an ambitious project rather than continually fighting (to use a cricket metaphor) a rearguard action. I look back on my time at the JCMT with pride at what has been accomplished: three new instruments working extremely well (ACSIS, HARP and SCUBA-2), two more ready to be commissioned (POL-2 and FTS-2), a vibrant legacy survey programme producing frontier science across a wide range of astrophysics, a full-featured science archive, and most recently of course a secure future for the observatory and its staff. I am enormously grateful to everyone who has made these achievements possible: the funding agencies for their support of the observatory, the various members of the Board over the past 12 years for their thoughtful deliberations and governance, and the user community for their support and understanding, even when things didn't happen as quickly or as efficiently as we all might have wished. Most of all, however, I want to thank all the staff who have worked at the JAC during my time as Director: without their excellence and dedication, none of this would have been possible, and they have been an absolute joy to work with. One of them, who resigned from the JAC a few years ago to move to a different project, wrote the following message to all staff on the day of her departure:

"Thank you everybody for being such great colleagues and friends. JAC is a real working family and I have never stopped being awed by the dedicated professionals who have made this place what it is: the best run observatory in the world bar none."

I couldn't have said it better myself.

The JCMT tripartite agreement was signed in Hilo on 26th April 1987. Seated, left to right: Dr Don Hall (University of Hawaii), Dr Bernard Gingras (NRC, Canada), Professor Bill Mitchell (SERC, United Kingdom), Dr Albert Mulder (ZWO, Netherlands). Standing, left to right: Dr Don Morton (NRC), Dr Harry Atkinson (SERC), Professor van der Molen (ZWO).

From the Chair of the JCMT Board

Walter Gear, Cardiff

As Chair of the JCMT Board, I am of course very sad that the long operation of the observatory by STFC in the UK (and by its predecessors, PPARC and SERC), by NWO in the Netherlands, and by NRC in Canada, is coming to an end. However, we can all look back with immense pride at the outstanding contributions that the observatory has made to a huge range of science over the past three decades. These have been reported in this Newsletter as well as in world-class journals and in many cover-page articles in *Nature* and *Science*.

This success has resulted from the vision and skill of the users of the observatory, of course, but fundamentally most of all from the dedication of the staff who have worked at the JAC over the years. I would like to dedicate this final article to them, and to thank them all, very sincerely.

A Personal Retrospective

Richard Hills, Cambridge

After a number of false starts, work on what was then called the UK Millimetre-wave Telescope got underway in 1975. Tom Phillips (then at Queen Mary College) and I (a new post-doc at MRAO) wrote a proposal for a 15m dish with a surface accuracy of < 50μm rms (good enough for operations down to ~800μm wavelength). Items 1 and 2 in the science case were observations of molecular lines and of emission from dust. The focus was on galactic clouds but the prospect of extragalactic research did get a mention. Our first estimate of the cost was £700k, but we thought that we should allow ample margin and so asked for £1.5M. Wise people at the research council "pencilled-in" £2.8M(!), which is roughly £30M at today's prices. This proved to be (just) sufficient for the telescope and its enclosure, although in those days budgets were adjusted for inflation and exchange rate, and manpower in the Establishments and Universities was not counted.

The management of the project was given to the Appleton Laboratory (AL), which was then at Slough, and they had feasibility studies carried out by Hawker Siddeley and Marconi. The technical results were promising, but it was clear that having a commercial prime contractor was going to be too expensive. The then Project Manager, Barry Shenton, realised that we had to move the design responsibility and risk in-house and proposed that Rutherford Lab (RL) should do it. This was tricky to arrange because AL was fighting a rear-guard action to avoid being merged with RL. The merger was however pushed through and Ron Newport took over the management of the project within the new RAL.

Detailed design work proceeded quite rapidly, but the issue of the site proved more difficult. Although Hawaii was the obvious choice and the "IR Flux Collector" (soon to become UKIRT) was going ahead there, building telescopes on Mauna Kea had already become controversial and we were advised that there was no prospect of getting permission for a second UK telescope. It was therefore decided to site it at what was to be the new UK Northern Hemisphere Observatory on La Palma. Negotiations for the use of that site dragged on, however, and it was not until the end of 1979 that these came to a conclusion. By that time the money that had been in the budget for the UKMT had gone elsewhere and SRC's budget was being cut, so much of 1980 was spent finding ways to save money. It was the Dutch who came to the rescue by taking a share in the NHO and proposing to join the millimetre-wave project as well.

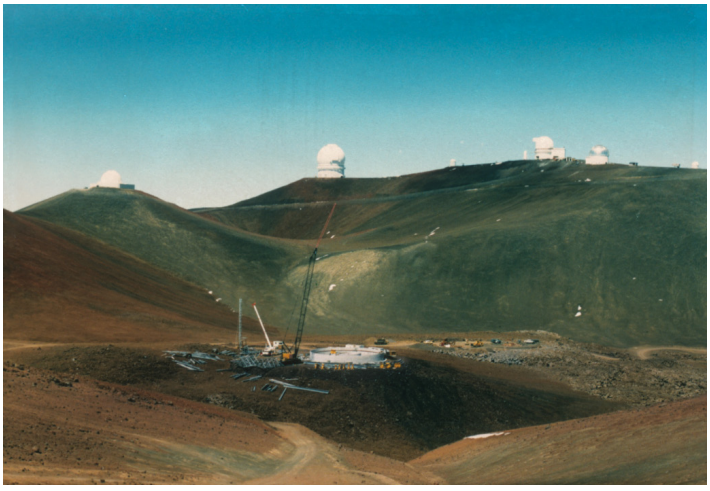
It was agreed that we should make it a joint project and the name James Clerk Maxwell Telescope was chosen. It was however pointed out by Thijs de Graauw that, if we were serious about the short wavelengths, then La Palma was not really high enough – we should be building it on Mauna Kea. The circumstances in Hawaii had changed by this time and it was thought that approval could be obtained so long as thorough environmental studies were done. The costs on Hawaii were higher and we also needed a better surface accuracy so we could reach the 450μm window, so we proposed to the SRC that the site should be changed and the budget increased. The answer was the inevitable one – we should indeed change the site but there was no extra money. A further round of cost savings ensued in which we reduced the size of the enclosure (but not the dish!) and removed things like a proper control room and an elevator. Gaining the necessary permits in Hawaii took a good deal of time and effort but by spring 1983 we were ready to start work on the foundations. Fortunately we were able to get 1600 tons of concrete in the ground before the next funding crisis hit and less secure projects were axed.

The next item was the steel-work for the enclosure. The fabrication at a works near Bolton only took a few weeks (which surprised me) and they did a trial erection to make sure all the bits fitted and that the rotation and door mechanisms worked. (We did not know then that they had used cheap Russian-made bearings to save money.) Shipping it to Hawaii was more problematic: the large boat that it was scheduled to go on broke down, so the shipping company sub-contracted it to a small freighter which was supposed to take it direct to Hilo. We were already somewhat alarmed when the pictures of it setting off showed that the boat was barely visible under the large pile of steel lashed to its deck. After several weeks had passed with no word, investigations revealed that the boat had actually gone to Holland and loaded up with an additional cargo of high explosives. This meant that there was a delay before it could get through the Panama Canal – presumably they have special days for dangerous cargos. It then disappeared again – no doubt to off-load the explosives somewhere on the Pacific coast. By the time it reached Hawaii the penalty clauses for late delivery were nearly equal to the total fee for the charter, and the captain stopped outside the territorial waters and demanded full payment of the original price or he would off-load the steel into the sea! It seems that he did not understand the law of the sea because we were able to obtain a writ for "piracy on the high seas" and the US Coastguard went out and nailed it to the mast. They took possession of the boat and towed it into Hilo.

The fabrication of the steel for the telescope took place in Ijmuiden, near Amsterdam. It again went well and we were able to do a test assembly and first trials of the drives in the factory. This time the shipping went smoothly and by late 1985 the main parts were on the mountain with an enthusiastic team to do the assembly. There were many more exciting moments, such as lifting in the reflector structure: the crane was not large enough to lower it in from the top, so it had to come in through the front, with the building and the crane turning at the same time. There was also a fright when the purpose-built measuring machine proved unable to cope with the amount of vibration on the structure and we had to improvise a holography measurement scheme. Receivers, back-ends, a chopping secondary mirror, a control system and a whole lot of software and other components all arrived from the many collaborating groups in the UK and Holland, and by the end of 1986 we had a just-about-working telescope.

Arrangements for the Canadians to join the project, bringing additional strength to the partnership and saving the SERC from yet another financial crisis, were concluded just in time for the opening ceremony. The opening was mostly memorable for the fact that when the traditional "lever to start the first observation" was pressed, nothing happened: one of the VIP guests was leaning on an emergency stop button! Fortunately this inauspicious start does not seem to have damaged the productivity of the telescope too much.

Overall it was a wonderful project to work on. We had a tremendous amount of fun despite the various delays and setbacks. It is a shame that space does not allow me to name the very many people who worked so hard and unselfishly to make it a success, but I would like to send them all my best wishes and thank them for their contributions.



ROE archive images from the construction of the JCMT on the summit of Mauna Kea. Top: The foundations are laid. Bottom left: the steel structure of the JCMT is erected. Bottom right: Dignitaries at the dedication of the JCMT, 27th April 1987. Left to right: Roy Tolcher (Head of Council Works Unit,SERC); Dr Don Hall (University of Hawaii); Sir John Clerk (direct descendant of James Clerk Maxwell); HRH Prince Philip, Duke of Edinburgh; Mrs Lynne Waihee (deputising for her husband, the Governor of Hawaii); Dante Carpenter (Mayor of Hawaii County); Professor Bill Mitchell (Chairman, SERC); Dr Bernard Gingras (NRC, Canada); Dr Paul Williams (Director of the Rutherford Appleton Laboratory, SERC); Dr Albert Mulder (ZWO, Netherlands); Professor Richard Hills (Project Scientist); Brian Edwards (Project Engineer)

A Personal Retrospective

Ian Robson, ROE Fellow, Director 1992-2002.

I was no stranger to the JCMT when I took over as Director in November 1992. I was first involved as a member of the site-testing team; we had explored the Izaña site on Tenerife in February 1978, but for us submillimetre continuum astronomers, the Canary Island sites were never going to be high enough. I was then co-opted to the Millimetre Telescope Users Committee, but was eventually thrown off when I cast severe aspersions on the engineers' claims that it wouldn't be a problem pulling the windblind back every single night to observe. However, before then I had succeeded in ensuring that the chopping secondary (nutating subreflector to the radio guys) would chop at a rate that was suitable for continuum work rather than for the (desired at the time) line astronomy. I was subsequently Chair of the JCMT PATT TAG, Chair of the JCMT Users Committee and member of the JCMT Board.

In 1992 the continuum side was very healthy, with a well-proven, tried-and-tested, multi-band photometer in UKT14 and, excitingly, SCUBA was in the pipeline (although I spent considerable time berating the ROE to get it completed and delivered). However, the heterodyne side left much to be desired, with detector sensitivity well below the state-of-the-art. Adrian Russell, Head of Instrumentation, had already instigated a 'triple-sourcing' method of trying to ensure that the required SIS devices were available to the JCMT instrument builders from the partner countries (in spite of resistance from some quarters). In fact, this triple sourcing was sorely needed; getting the required devices into the next generation of heterodyne instruments was one of the bigger challenges of my early days.

In terms of the big picture, one of my key roles was to formulate a strategy for the operations and development of the JCMT to ensure that not only was it the premier facility in the world, but that the future developments would ensure that it would remain unchallenged for the foreseeable future. The strategy I proposed to the JCMT Board was as follows: improve the efficiency of the instrument suite (a new breed of instruments that would future-proof the facility); improve the observing efficiency (better user software, leading to weather-based, queue scheduling); improve the telescope efficiency (understand and tweak the surface to provide maximum sensitivity and resolution). Along with this I had to manage the operations budget reductions that seemed to come from one or other of the partner countries over a number of years of my tenure.

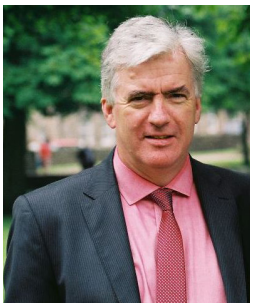
Looking back, the development strategy was mostly very successful, with a new generation of instruments focussing on high frequency performance (RxW) and 2-D arrays (SCUBA-2, HARP and its associated correlator, ACSIS). The arrival of SCUBA and its ability to break into new territory by undertaking large surveys eventually gave me enough ammunition to persuade the user community to accept the concept of flexible scheduling. This would deliver the highest-priority science, as ranked by the PATT proposal review system, rather than continuing with the age-old gamble of fixed blocks of nights and taking the weather that luck dealt you, irrespective of your actual requirements. In spite of budget reductions, the overall efficiency of the facility remained steady. Instrument (un)reliability turned out to be one of the larger contributors to downtime, and towards the end of my tenure, SCUBA was starting to become difficult to maintain at the level we required.

Optimizing the telescope surface was something we never really managed to get to grips with; however, with a lot of effort and off-site support from Richard Hills, we did understand much better how the surface was actually behaving, and, to some extent, we could then modify observing patterns to compensate. The quality of observations was vastly improved by using the CSO water vapour data to monitor the extinction, and when SCUBA skydips and then the line-of-sight water vapour radiometer were introduced the quality of the astronomy, especially at high frequencies, improved by leaps and bounds.

Of course, the key to the success of the JCMT came down to people, especially the operations staff in Hawaii. In spite of problems of funding reductions leading to layoffs, changes of terms and conditions, the possibility of a takeover by a new entity in the UK 'Prior Options' process (which took a huge amount of time and angst), the staff remained resilient and totally dedicated. Without their professionalism and dedication, the JCMT would not have reached the pinnacles of esteem that it did and the astronomy output would have been severely diminished. Finally, acknowledgement must go to the JCMT Board; they were always supportive, even when I was asking them to sign up to an act of faith, and in effect they committed all of the Development Fund to the future developments, taking a considerable gamble with the very high-risk project, SCUBA-2. They showed leadership and courage and always had the JCMT at heart.

I had a great ten years, I enjoyed it immensely. I managed to do some exciting science with the telescope and I was always rewarded in seeing how much great science was undertaken by the user community, pushing the boundaries of astronomy and maintaining the JCMT at the forefront of ground-based astronomy.

A Personal Retrospective



Walter Gear, Cardiff

JCMT has been a major part of my professional life for almost 30 years (!), at times even the dominant part. I first observed on it in 1986 when it was recently commissioned, and when one had to point the telescope manually using a trackerball at the control desk. I was a lowly postdoc back then, but then got my first permanent job at the Royal Observatory, Edinburgh in the JCMT support group under Jocelyn Bell-Burnell. That was an interesting time as Canada was negotiating to join the UK and the Netherlands. As a result of Canada joining, the JCMT Development Fund was set up, which allowed me to propose and lead the team that built the SCUBA camera and to spend a very hard-working but happy time in Hawaii in 1996/7, commissioning and operating it. I have remained closely associated with the telescope as a user and by being on various committees and the Board at different times, and so I was extremely sad and disappointed, not to mention angry, when, in 2012, STFC announced they were going to cease operating JCMT. Shortly after that I was asked if I would Chair the Board, and only agreed on the basis that the Board and agencies would do everything possible to ensure that JCMT did not simply close down but would continue to operate in a new way.

Of course, like everyone else involved, I am now extremely happy that the efforts to ensure a continued life for JCMT have been successful, and that, although STFC have now agreed to hand over ownership to University of Hawaii, they in turn have agreed with the East Asian Observatory to operate JCMT as a front line facility, hopefully for many years to come. I am also extremely pleased and proud that both the UK and Canadian communities have demonstrated their belief in the future of the facility by putting their hands into their pockets to come up with funds to join EAO and to define a world-leading science programme for the telescope over the next few years.

At a recent meeting in London to discuss possible plans for the future science direction of the telescope, I was struck by a few things, apart from the sheer number of people who were there. Firstly, that there were quite a few people who, like me, had grown up scientifically with JCMT and were still firmly committed to a future for it. That community of people was created by the existence of JCMT and has expanded now to initiate, operate and exploit other major facilities such as ALMA. Secondly, that there was also a large number of much younger scientists who were enthused about the possibilities for doing their future science with JCMT. Finally, it was clear that - after the usual slightly stiff introductions, and once it got down to serious science discussion - the East Asian scientists present were just as passionate about JCMT as those from the UK and Canada, and just as enthusiastic to collaborate to make sure that the best possible scientific legacy is created.

So it is goodbye to the old regime and hello to the new. Many people have contributed to the huge scientific success of JCMT over the past 3 decades - too many to mention individually - but I do certainly want to thank all the dedicated staff at JAC and elsewhere, who, over the years, have gone beyond the extra mile to ensure the best possible experience for the users and the best possible scientific output. Many of the current staff are, of course, staying on under the new management, and it is a huge relief to maintain that pool of knowledge and culture. New staff, including those from East Asia, will bring a new injection of energy and enthusiasm which I am sure will meld well with the experience of the existing staff to maintain JCMT as what we all know it is, namely the very best millimetre/submillimetre single-dish observatory in the world! I look forward to spending a large amount of time with the telescope and staff over the coming months and years.

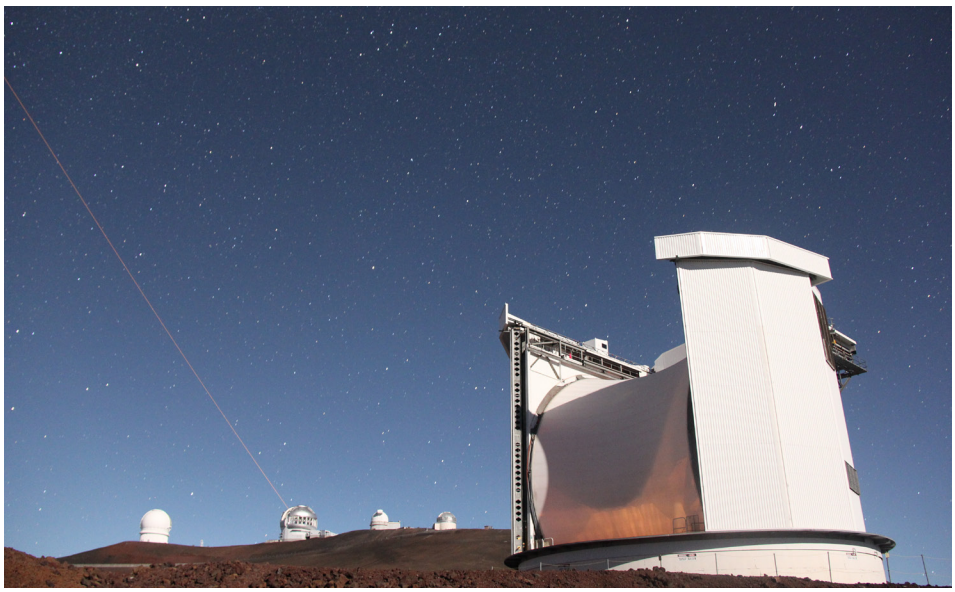


Image: The JCMT open for a night of observing. Behind from left to right are the observatories: CFHT, Gemini with its laser guide star, UH 2.2 meter telescope and UKIRT. Image credit - William Montgomerie.

A Personal Retrospective

Antonio Chrysostomou, Hertfordshire, Associate Director 2007-2012

I first travelled to the Joint Astronomy Centre as a first year PhD student, back in 1990. Wide-eyed, excited and open to almost anything. That was when I first experienced the JAC '*ohana*. I would hear Marge, Donna, Anna, Thor and Jay use that word, and I would wonder what it meant. I soon found out that the literal translation was 'family', but it was more encompassing than that, reaching further than the standard family unit. I must admit that I had my initial doubts. The JAC was supposed to be a scientific establishment, an outpost of the British, Canadian and Dutch governments undertaking to solve some of the most important astrophysical problems of the day. There's no time for touchy-touchy, feely-feely sentimentality! I have a Mediterranean heritage, I know what family means. Don't get me wrong, I was sure that as soon as I walked out of the door and stepped onto the streets, markets and beaches of that beautifully sleepy Hilo town, I would find '*ohana* and lots of it. I was born on a small and hot island – I knew and understood the pace of such things. My unconscious bias was telling me not to expect anything like this in a scientific establishment. Here in this place, we are serious, we are committed, we encounter problems and we solve them, we discuss, we engineer, we innovate, we discover, we strive for the heights.

Indeed we do. We do these things, and more.

It didn't take me very long to realise that the JAC was a different place. It's true that, at the time, I was young and naïve, and I probably thought that every scientific research establishment welcomed its visitors with smiles, enthusiasm, and a hug of aloha. But as my career progressed I realised that the JAC was no ordinary place. I returned to the JAC many times over the next few years, a stalwart UKIRT observer making the most of a series of numerically-incremented instruments: IRPOL2, IRCAM3, CGS4. Little did I know then that I was sowing seeds that would begin to take root. In the winter of 1996 I had the chance to join the JAC as a UKIRT support scientist – it was a no-brainer. The two years and eight months that we would spend there were all too short – punctuated by the friends we would make and keep, and the birth of our daughter. The roots grow.

It was during this period that my relationship with the JCMT began to develop. Our UKIRT team may have trounced the JCMT on the football/soccer field – while those who were there may recall some controversy over the late, equalising UKIRT goal in the first game, there was nothing to hide behind in the 5-0 result of the replay! - but there was a fond, friendly and infectious rivalry between the two telescopes, with the joint computing, engineering, software and admin staff left with the difficult choice of dividing their loyalties, somehow, for this one fixture. But we all knew that there was something special happening at the JCMT; something was in the air. It was called SCUBA.

With SCUBA on the telescope, my research programmes started to steer me more towards the JCMT. I sat on and then chaired the time allocation committee, represented the UK community on the JCMT Board, and helped to shape and form the JCMT Legacy Surveys. The roots grow stronger. Then, and rather unexpectedly, another opportunity arose; this time to be the Associate Director, JCMT.

The next five-and-a-half years would reveal to me what the JAC '*ohana* was truly about. This period of my life was altogether the best, most challenging, stressful, enjoyable, testing, pleasing, angriest, rewarding, frustrating, happiest time. Like a sword of Damocles, SCUBA-2 was hanging by a horse's hair over our heads. There are those who read this who won't fully comprehend the stress and strain that the JAC staff, bottom to top, were under to get the instrument delivered and commissioned. And there are those who read this that will understand and remember it all too well. The roots grow deeper. It was abundantly clear that the fate of the JAC as a whole, and any chance of a future into this or the next decade, lay with the success or failure of SCUBA-2. Under such pressure, the '*ohana* does what it always does. We gather together, we support, we nourish, we sacrifice, we strive for each other. And the results are magnificent!

Now and all too soon the JAC finds itself at yet another crossroads. The decision for my family to return to the UK in 2012 was the single hardest decision we have had to make. I have no doubt that it was the correct decision for my family, but it is now two years later as I write this and I am still wracked with feelings of sadness, a sense of longing and, yes, disappointment. But there is something new now, a feeling of hope. The Hawaiians teach us that without rain there are no rainbows. I understand this, but why did it have to rain so hard! "We are where we are", someone once told me, and so the JAC '*ohana* moves forward; people come and they go, and they will continue to do so. I want to look at the rainbow now for there is hope, excitement and a new beginning. These roots are hard to pull up. Our '*ohana* continues, for this is what we do. We persevere, we adapt, we evolve, we overcome, we endure; and it strengthens us. Kulia I Ka Nu'u.

I want to thank the many friends and colleagues at the JAC with whom I have had the fortune and privilege to work over the past 24 years. Mahalo Nui Loa.

Striving for completion of the JCMT Legacy Survey

Harriet Parsons, JAC

The JCMT Legacy Survey is an ambitious set of programmes that were approved by the Board in July 2005. The aim of the Survey was to take full advantage of the potential for large area mapping offered by HARP/ACSIS and SCUBA–2, and by doing so answer fundamental questions about the formation and evolution of planets, stars, galaxies and ultimately the Universe itself.

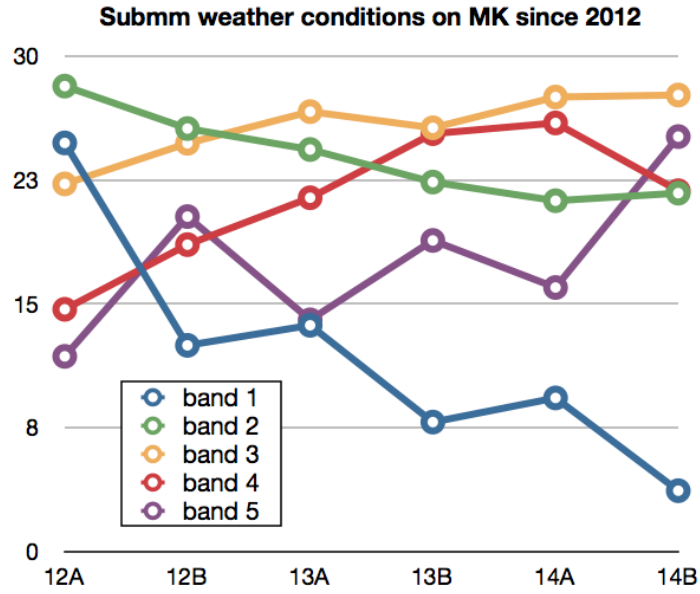
The new Legacy Survey was highly anticipated. SCUBA was retired in 2005, and 2006 saw both a six month shut down for an engineering re-fit for SCUBA-2 and the commissioning of ACSIS. Observing commenced in November 2007 for GBS, NGLS and SLS – using HARP/ACSIS – with much excitement. These HARP components of the Legacy Surveys were completed in 2011 around the same time that the JAC confirmed acceptance of SCUBA-2 from the UK ATC. In October 2011 the SCUBA-2 portion of the Legacy Survey began in earnest.

The Legacy Survey programme was significantly re-scoped through a peer-review process in early 2012 to take full account of the on-sky performance of SCUBA-2 and of the reduced time frame available under STFC management of the Observatory. As time went on it became clear that in order to see the Legacy Survey through to completion by 31st January 2015 an increase in the productivity of the telescope would be required. This is a laudable goal for any observatory under any circumstances and was attempted at the JCMT by the following: improving the efficiency of SCUBA-2, improving the efficiency of observing, and simply by observing more!

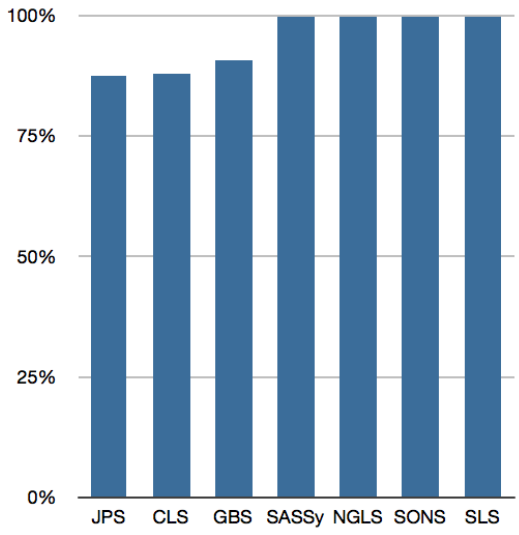
Addressing the first two goals above, Dan Bintley describes the engineering improvements to SCUBA-2 that have kept it working longer and cooler and faster and therefore to greater effectiveness (see p23 of this Newsletter). To address the last point, an extension of the 12-hour observing night was implemented in October 2013 (Jessica Dempsey, Newsletter #35, p22) that has resulted in an extra eight hours of survey observing per week.

Completion Rates to Date

Four of the original surveys are now complete - defined with respect to the



Percentage of nighttime in each of the 5 JCMT weather bands encountered during semesters 12A through 14B (Semester A: February - July, Semester B: August - January). During the 3 years shown, the fraction of good weather - bands 1 & 2 - has diminished substantially. Hardest hit have been the CLS and GBS surveys, which require SCUBA-2 at 450um, and therefore the best weather.



JCMT Legacy Survey as a function of current completeness. The four surveys that have reached completion are: the Spectral Legacy Survey (a HARP only project), the Debris Disk survey SONS (SCUBA-2 Observations of Nearby Stars), the Nearby Galaxy Survey (NGLS) and the SCUBA-2 Ambitious Sky Survey (SASSy).

programme approved by the Board on 31st January 2012 following the re-scoping exercise. Of the three remaining surveys the Gould Belt Survey, GBS, has less than 50 hours of band 2 time remaining and should be completed prior to the transfer of the JCMT to EAO. The JCMT Plane Survey (JPS) is a little under 90% complete. With the winter months prohibiting further observations of the Galactic Plane, the JPS team are focussed on producing their first full public data release.

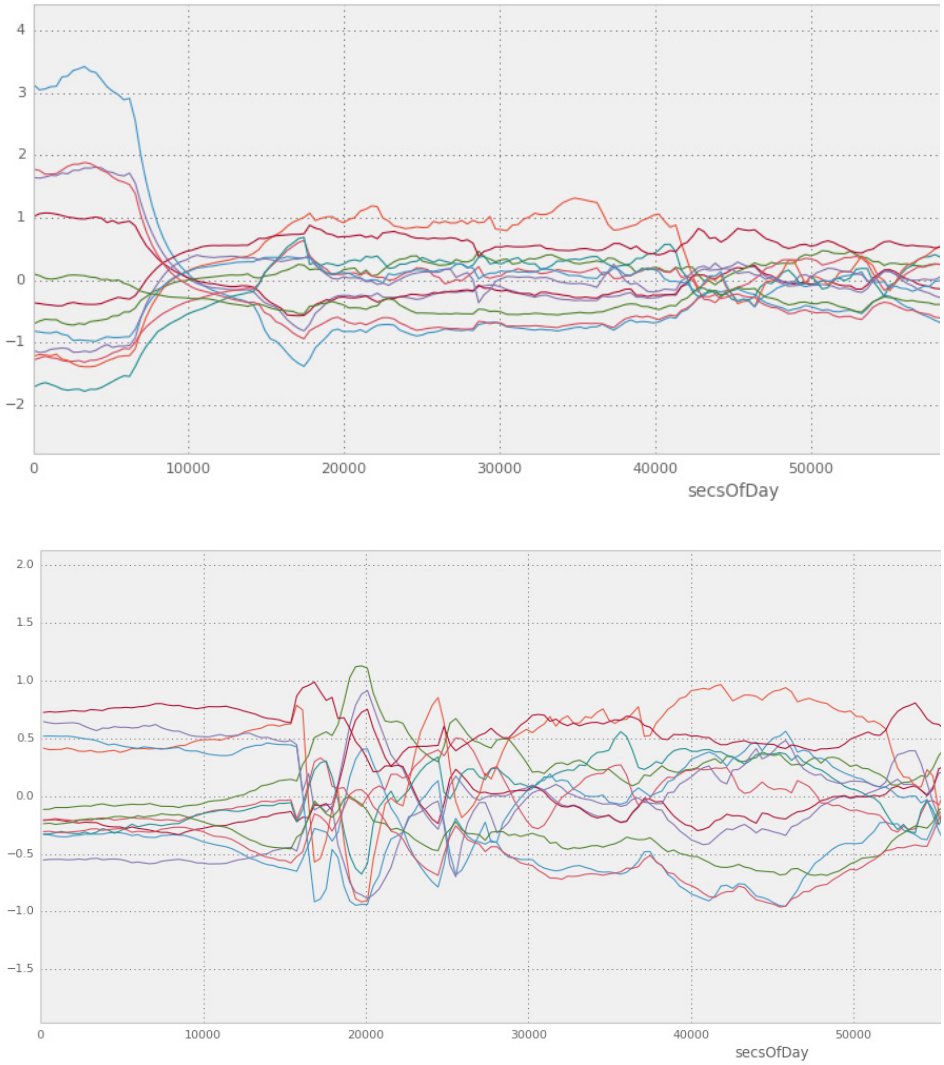
Despite our best efforts it might be the weather that ultimately dictates the final completion levels. A recent review shows that we have been combatting unusually declining weather conditions on Maunakea (see figure on Page 11). The Cosmology Legacy Survey (CLS) has been hardest hit by the deficit of 'good' weather. It is estimated, however, that with the improvements mentioned in this article, CLS will reach an overall completion rate of almost 90% at the end of JAC operations on 31 January 2015.

Keeping Cool

Craig Walther & Jessica Dempsey, JAC

It has been understood since SCUBA-2 was first commissioned that early evening observations show instability, with higher FCFs and poorer focus results than if science observations are delayed until and hour or more after opening the telescope. Holography done in these hours also shows a dish shape that is distorted, likely from the diurnal variations in temperature and the sudden changes initiated from opening the facility. In June 2014, the temperature sensor logging of the JCMT surface and support structure was re-initiated. These measurements showed confirmation of these issues. In order to try and improve the thermal stability of the dish, two operational changes have been made. Firstly, in early December 2014, four large fans were installed around the telescope structure, in order to make a first attempt at improving thermal mixing behind the dish and near sources of heat such as the HARP electronics rack and SCUBA-2 mezzanine. Secondly, a new policy of early opening of the roof and doors by the TSS from Hale Pohaku, has been initiated when summit conditions are suitable. This allows up to an additional hour for the telescope temperatures to stabilize prior to initiating observing.

The first image shows the difference from the mean dish temperature for



Temperature difference vs. time: these two figures show the difference (in degrees Celsius) from the mean dish temperature for twelve sectors of the surface as a function of time (seconds). Top: data from 28th November 2014. Bottom: data from 10th December 2014.

each sector of the surface, for the date 28th of November, 2014 (prior to fan installation). The first point of interest is the strong stratification of temperature across the dish during the daytime, when the facility is closed. Immediately upon opening (approximately 7000 on the plot), these temperature differences begin to rapidly converge, although some stratification persists.

The second image shows the same sector differences, but for December 10th, 2014 (after the fan installation). The daytime stratification is still present, but over a much smaller temperature range. It is still too early to be certain whether the fans are having a significant effect, however we do believe that the early opening method, in combination with better thermal mixing from the fans, will greatly improve the quality of the early evening science.

Pushing Expectations - SCUBA-2

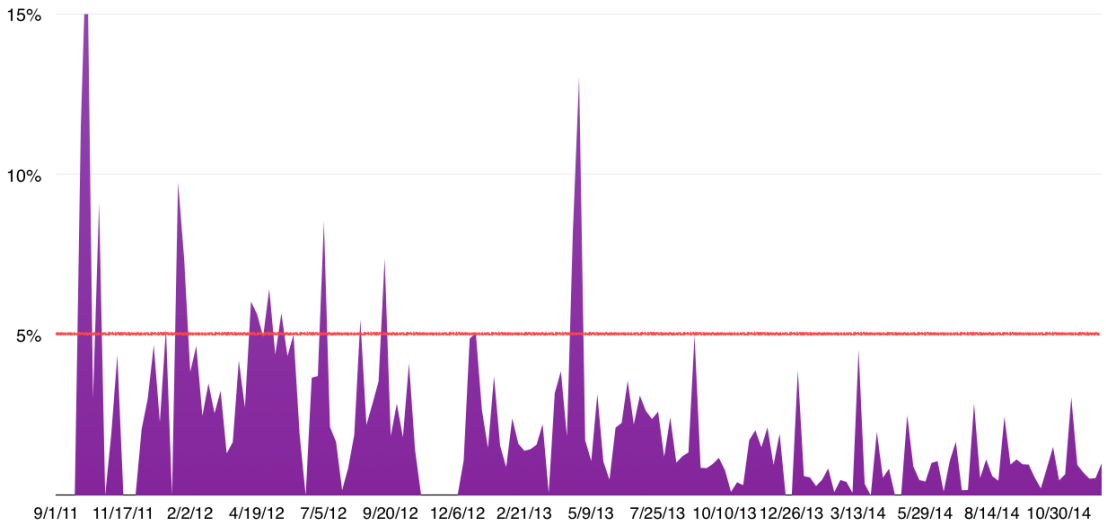
Dan Bintley, JAC

The performance of SCUBA-2, and of the TES (Transition Edge Sensor) arrays in particular, have been remarkably consistent over the past three years of science operations.

The fundamental achievement of the JAC staff at JCMT has been to keep SCUBA-2 operational, despite the inevitable equipment failures (mostly pumps), power glitches at the summit and necessary maintenance of the cryogenic systems and with the absolute minimum of downtime. It takes 3 weeks to warm up SCUBA-2 and then cool it back down to operating temperature. Originally it was envisaged that a full warm up/cooldown cycle would be done every 6-8 months. We have been able to extend this period to 18 months, creating many additional weeks of potential observing time for SCUBA-2 users per year.

We have continued to make changes, both large and small, to how we observe with SCUBA-2 and in the setup of the detector arrays and SQUID readout. The aim has been to increase the efficiency and performance of the instrument on the sky.

For example, in July 2013, we switched to "Open Shutter observing", which keeps the shutter open between observations (we still compensate for the changing sky background power), but which reduces by a factor of three the number of movements of the cold shutter during the night. This saves time, reduces faults and helps with the stability of the detector arrays. The arrays are "set up" in the dark, (with the cold shutter closed) and we have also been able to reduce by 2 minutes per setup the time required to find the optimal settings and then adjust the 11,000 SQUIDs. Additionally, we have reduced the number of SQUID setups required in a night by implementing effective real-time monitoring of the health of the arrays. In these, and many other small ways, we have saved precious minutes that add up to additional science observations for the user each night.



Plot of weekly SCUBA-2 fault rate since commissioning. A low fault rate over recent months is evident and has contributed to the completion rate of the of the JCMT Legacy Survey.

The detectors themselves have required few adjustments to the bias and heater settings during three years of science operations. However, by continuing to study the noise properties of the detector arrays, we have found new bias regimes, which improve the dark NEP performance by between 10% and 30% on 5 out of 8 sub-arrays. This gives modest but significant gains to the on-sky performance and mapping speed of SCUBA-2.

Outreach Activities

Hands-On Telescope Building

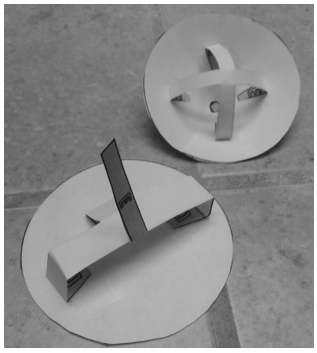
Harriet Parsons, JAC

Visiting the summit of Maunakea is a somewhat challenging undertaking, with the high altitude and road conditions often prohibiting many from visiting the cold mountaintop to view the telescopes and beyond. Those under the age of 16 years are also discouraged from visiting the summit due to altitude-related health risks. As a result many residents on the island of Hawaii have never seen the JCMT before.

In order to give the general public a greater understanding as to how the JCMT operates, the staff at the JAC decided to design and make an easy-to-assemble working paper model. This model could be used by staff and teachers to explain how this alt-azimuth mounting works. The model includes: the observatory building (with the doors open), roof (also in the open position), the protective Gore-Tex membrane, carousel floor, instrument platform, secondary mirror with support structure, and finally the primary mirror.

To download and make your own model JCMT visit the following web page:

http://outreach.jach.hawaii.edu/JCMT_model.pdf



Looking Forward

Paul Ho, East Asian Observatory

The bulk of the Universe is cold. With a characteristic temperature below 10K, the peak of the radiation curve is in the far infrared. From the ground, the submillimetre-wavelength window is as close as we can get to this peak. This helps us to see the fainter sources, and perhaps the most distant sources. The JCMT was a pioneer in this exploration. Its construction on the top of Maunakea opened the window for submillimetre astronomy. Her mission is not complete. To the lay person, a telescope may be dated by its time of construction. To the professionals, we know that the telescope is only the first step in gathering the light. It is the instruments and receivers that define the sensitivity and utility and performance. The JCMT continues to be at the vanguard because of its recent wide-field imaging performance.

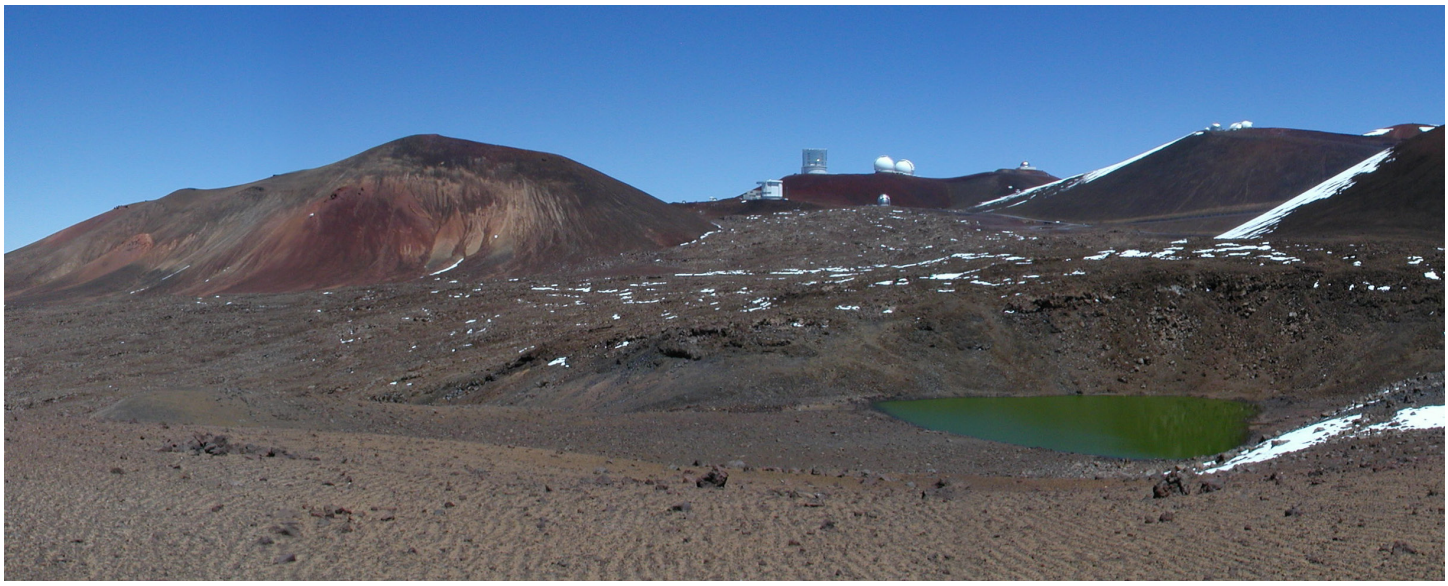
Science policy must be taken with the long view of discovery. Astronomy has a history in the expansion of knowledge and understanding of fundamental importance. Practical applications and impact on daily lives will follow, as we have demonstrated. It is natural that progress will come with cost, and larger and more sensitive instruments can only be built with the commitment of society and government. Moreover, scientific progress can be made only with an attack across a broad front utilising a variety of techniques and approaches. Larger facilities cannot function without the support of ancillary instruments. Large forefront telescopes like ALMA rely somewhat upon smaller facilities which can explore and define the research agenda and targets. An exploration of all size scales of any phenomenon is necessary in order to provide context and understanding. JCMT can continue to play a strong role in submillimetre astronomy. Stepping back from the JCMT at this moment would be a poor utilisation of the large investments which have been made. We in the East Asian region see the JCMT as an opportunity to invest, and an opportunity to do our part to support an important enterprise. I suggest that there is in fact a lot more for us to do together.

We, the JCMT community, are at a new beginning. Instead of looking at just continuing, I argue that we should look to the future. To imagine a much longer time line, we should be investing

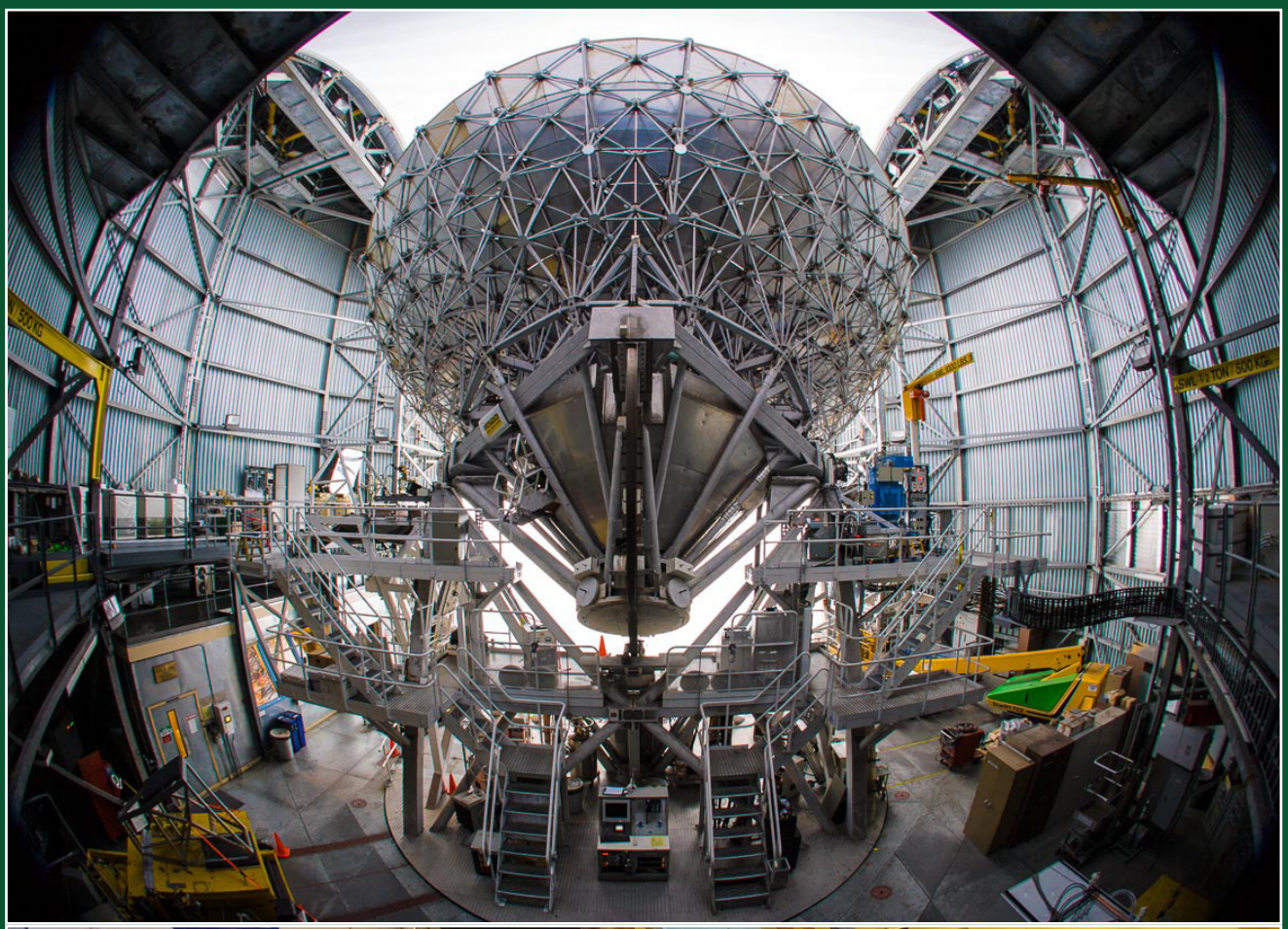
in upgrading our suite of instruments, and in upgrading the telescope performance. In American baseball, we often say that the best new recruitment or hire is the player we did not lose to another team. I say in submillimetre-wavelength astronomy, the best investment is in fact to improve the performance of our existing instruments. This is an honest assessment only if we can envision real improvements. For the JCMT, we can imagine improving the wide-field capability, to improve the detector sensitivity, to provide larger-format heterodyne capabilities, to provide larger-format polarisation capabilities. These improvements are equivalent to increasing greatly our light-gathering capabilities, which is equivalent to increasing the aperture of the telescope. Hence, the central theme here is to aim to increase the throughput of the JCMT.

Going forward, it should be expected that surveys will continue to dominate the research agenda on JCMT. The wide-field imaging capability is our unique advantage, and will be complementary to many on-going surveys at other facilities. To integrate the new user communities, and to continue on-going surveys, the science programmes must be based on active collaborations across all of our regional communities. Workshops are proceeding in these past months, and we expect survey teams to get together to work on the future initiatives. At the same time, we must encourage PI-driven science programmes in order to cultivate and promote the growth of new generations of JCMT research teams and young scientists. While SCUBA-2 has been the main JCMT instrument, the POL-2 and FTS-2 instruments need to be properly commissioned and placed into operations. These instruments have tremendous new capabilities which should be deployed as soon as possible. Upgrading SCUBA-2 must be planned immediately if we are to envision even better sensitivity and better wide-field capabilities as soon as possible. Other new instrument teams have also approached us for deployment on JCMT, and we will consider them all and deploy them if we can reach agreement. As the JCMT is a facility which can accommodate real-time and hands-on training, we want to make this a central feature of our operations. Students will be invited to take up residence at the JCMT in order to learn, to participate, and to train. The past practice of sending observers in order to support operations will not be continued. Instead, we should have longer visits by regional staff, who will actually involve themselves in solving operational problems or improving data quality and analysis. All of these are just my thinking, which still need to be vetted by our communities before we put them into play. Whatever improvements that can be made, we shall do so in a seamless fashion from the present operations.

Of course, as in any enterprise, the central equity of the highest value is the personnel who are engaged. The JCMT community is a vibrant and productive bunch, whose vision and performance is well demonstrated. In East Asia, we have new blood who are ready to join in this adventure. Working together, planning together, competing and collaborating, we can continue our adventure. The discoveries, the necessary resources, the innovations will come. All that is necessary is for all of our brain power to coordinate and cooperate. It will be my mission to provide the long time line within which we can begin our quest again. In these past decades, the JCMT has been setting the research agenda which drove the frontiers in our discipline. We will continue to do so.



A view to the JCMT across Lake Waiau, on Maunakea. Image: Robin Phillips




KEEP THIS
DOOR CLOSED
DELL