

**Memo to NSF Astronomy Division Chair James Ulvestad from ACCORD
July 26, 2010**

INTRODUCTION TO ACCORD

ACCORD is an informal association of observatory directors representing all US O/IR observatories that include a telescope with aperture greater than 3m. A current list of ACCORD members is provided in the signature box of this statement. The represented observatories include LBT, Keck, HET, Gemini, Magellan, MMT, Hale, WIYN, ARC, Blanco, Mayall and Shane telescopes. The US portion of the Gemini Observatory is represented through NOAO. The majority of the observatories represented were built and are operated using predominantly non-federal funds. These will be referred to as the “independent” observatories. For US observatories, more than 80% of the collecting area is owned or managed by the independent observatories. ACCORD is the primary forum for discussions between the independent observatories and the NSF.

The aim of ACCORD is to optimize research capabilities for US ground-based O/IR astronomy. The strong competitive position of US ground-based O/IR astronomy during the past century can arguably be attributed to this mixed private-public investment in facilities. However, in 2010, world-wide astronomy has become much more competitive, the total cost of facilities has increased and the ratio of the cost of instrumentation (including adaptive optics systems) to the initial telescope cost has increased significantly. The ACCORD position is that maintaining the US position in astronomical research will require a greater level of coordination between the federal funding agencies, federal-funded observatories and the independent observatories than has been the case in the past. The rest of this position paper describes the programs in place and ideas for addition programs designed to achieve this level of coordination.

As we approach the publication of the report from the 2010 Decadal Survey, ACCORD requests a meeting with the Astronomy Division of the NSF to discuss these programs.

THE US SYSTEM OF LARGE TELESCOPES

The 2000 “Millenium” Decadal Survey described a model in which the U.S. ground-based O/IR facilities should be viewed as a single integrated system. The 2006 Senior Review commissioned by the NSF to evaluate the U.S. federally-funded astronomy facilities concluded that NOAO should deliver “...community access to an optimized suite of high performance telescopes of all apertures through Gemini time allocation, management of the Telescope System Instrumentation Program [TSIP] and operations of existing or possibly new telescopes at CTIO in the south and KPNO or elsewhere in the north. *The balance of investment within the Base Program should be determined by the comparative quality and promise of the proposed science.* [emphasis ours] In addition, there should be ongoing support of technology development at the independent observatories through the Adaptive Optics Development and the Advanced Technologies and Instrumentation Programs.” This description of a U.S. O/IR System is largely endorsed by ACCORD.

TSIP through 2010: The aspect of the O/IR System most relevant to ACCORD is TSIP. A program was initiated in which NSF funding is provided to enhance instrumentation at the major independent observatories. In exchange, time is made available to the astronomical community on a peer-reviewed basis administered under the auspices of NOAO. The current incarnation of this program is TSIP. In place since 2002, TSIP is widely viewed as a successful initiative in that important new instruments have been funded and the community has gained valued access to the independent observatories. Approximately \$27.4M has been spent or committed on the program since the program started and 386 nights of time at large telescopes have been made available to the US astronomy community (<http://www.noao.edu/system/tsip/summary.php>) at the independent observatories. The NSF funding of TSIP is highly leveraged given the large investment in place by the independent observatories. The nature of the TSIP decision process is such that there is now some coordination of instrument development across the U.S. O/IR community. One of the considerations in the evaluation of new instrumentation proposals to TSIP is complementarity with the existing capabilities available to the U.S. community.

In 2004, a TSIP review suggested modifying the program to include simple acquisition (the “buy time” mode) by NSF/NOAO of community observing time at the independent observatories without tying it to instrumentation construction. The rationale here was that the number of instruments that can be effectively deployed on any one telescope is limited so that funding required for instruments was likely to peak, whereas scientifically-driven need for community access to these facilities would continue to grow. This mismatch could, in principal, be resolved by NSF/NOAO purchasing time for the community.

TSIP moving forward: In 2008, the NSF convened a group to evaluate community access to large-aperture O/IR research facilities: ALTAIR, Future of NOAO. This committee reaffirmed the great value placed on TSIP access to the independent observatories by the U.S. community and recommended that the TSIP program be expanded to ~\$10M/year from its current (intermittent) \$4M/year. At its February 26th 2009 meeting, the members of ACCORD confirmed that they would be willing and able to provide the corresponding amount of community observing time¹ in a combination of “instrumentation” and “buy time” modes. ACCORD stresses that it is essential for all parties involved (independents, NOAO, community observers) that there be annual continuity in the TSIP funding stream.

There will be an important watershed in the Gemini partnership when the UK withdrawal from the partnership is completed. ACCORD advocates a process for considering how the U.S. and NSF will respond to this opportunity that includes careful cost-benefit analysis in the context of the full US O/IR System.

National Treasure Programs: A new possible component of The System that ACCORD supports would be an NSF program that funds mid-scale projects costing more than the \$4M upper limit of the Major Research Instrumentation program and less than the ~\$100M lower limit for the Major Research Equipment and Facilities Construction program. This new program would support the most ambitious and forward-looking projects at major observatories independent of whether they were federally funded or independent.

¹ This commitment assumed continuation of the current process for “instrumentation” projects (Incentive factor 2) and a “buy-time” program (with incentive factor 1.5).

Adaptive Optics: The power of adaptive optics (AO) in astronomy has long been recognized by ACCORD. While the gains are most dramatic for the larger apertures, AO can also be applied productively on those of intermediate aperture. AO is also critical to the scientific case for the Extremely Large Telescopes (ELTs) of the future. The power of AO has been confirmed by a growing stream of astronomical results; these include the proper motions of stars near the Galactic Center, images of planets around nearby stars and improvements in effective seeing over fields of many arc-minutes - to name but three. Following the recommendations of the previous decadal survey, ACCORD has been a constant advocate of expanded NSF support for AO work and recently (2007) commissioned an update to the AO roadmap. The revised AO roadmap, which is strongly endorsed by ACCORD, emphasizes that implementation and operation of AO systems, whether in diffraction limited or ground-layer² mode, requires substantial and consistent investment. ACCORD believes that the US O/IR community has been substantially underfunded for AO work if it is to remain competitive, especially with Europe, in the crucial AO arena. ACCORD thus recommends that NSF provide funding of approximately \$4M/year, **stable** over a 10 year period, to support AO development work (the earlier label of AODP would be appropriate) in addition to AO implementation proposals being considered under TSIP, MRI etc. ACCORD also reiterates that AO is of critical importance to the case for the ELT generation.

Developing New Components of the US O/IR System in the Next Decade: The 2000 decadal survey recommended two major projects, in addition to establishment of the System, for O/IR astronomy – namely the Giant Segmented Mirror Telescope (GSMT) and the Large Synoptic Survey Telescope (LSST). These two capabilities will be rediscussed and prioritized in the ASTRO2010 report. Two approaches have emerged for each and as a result the latter is now referred to generically as the LST. These projects have made significant progress in the last decade with some NSF or other federal technology development funding and, in the cases of TMT, GMT and LSST, with substantial amounts of non-federal (private and international) support. It thus appears that the major future developments in US ground-based O/IR astronomy will continue the tradition of public-private partnerships that has evolved into the current Telescope System.

There has been debate within the community about the priorities to be assigned to LST (survey mode) and GSMT (detailed/spectroscopic mode) especially given the current and likely future economic climate. ACCORD views both as essential components of US astronomy if it is to remain scientifically competitive in the future in the international arena. The history of astronomy, especially in the second half of the 20th century in which the entire electromagnetic spectrum was opened up for investigation, clearly demonstrates the remarkably productive synergy between survey and detailed study/follow up modes. This statement applies not only to synergies within the O/IR waveband (e.g. SDSS/Keck) but perhaps especially between surveys at other wavelengths and the O/IR. For example, radio, x-ray and gamma ray surveys have gained enormously from follow up with large telescopes at O/IR wavelengths. This synergy can confidently be anticipated in the LST/GSMT era, as can the need for follow-up telescopes of significantly greater aperture than the survey instrument. Furthermore, the follow up instruments

² While the ground-layer correction mode is perhaps less well known, it has recently been demonstrated (Hart et al 2009) to improve seeing by a factor of almost 3 over a field substantially greater than 2 arcmins.

will require a range of capabilities including, for example, wide-field multi-object O/IR spectroscopy and diffraction-limited imaging over the widest wavelength range possible - depending on the science involved.

It is for these reasons that ACCORD strongly endorses a combined plan for survey and more detailed study that is a combination of LST and GSMT. Certainly, the US should avoid leaving Europe, with its planned EELT, unchallenged in detailed study mode. ACCORD believes that such a plan is not only necessary but also feasible given the long US tradition of private funding for O/IR astronomy, the more recently established Telescope System of public-private partnerships and international institutional collaborations. Such combinations are indeed present in all of the LST and GSMT consortia, with private funding likely to grow rapidly in the future. ACCORD encourages the NSF to continue providing technology development support and to prepare for construction and operations contributions to LST and, in the case of GSMT, accompanied by commitments of public observing time.

ACCORD has traditionally held a meeting in Washington D.C. approximately every other year to facilitate discussions with NSF Astronomy. The current ACCORD Chair, Mike Bolte, will be in contact with you to schedule such a meeting in the Fall of 2010.

Signed

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*Dr. Hawley is prevented from signing this document as she is a member of one of the ASTRO2010 panels