Committee on the Future of the SMA

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Committee Objectives

- To recommend to the CfA Director and the ASIAA Director the role of the SMA in the era of ALMA
  - Whatever role is selected
    - Demonstrate unique contributions of SMA
    - Rank priorities for development

Future of the SMA Committee Members

- Edwin Bergin (Michigan)
- Chris Carilli (NRAO)
- Giovanni Fazio (Chair; CfA)
- Paul Ho (ASIAA; CfA)
- Daniel Marrone (Chicago)
- Karl Menten (MPIfR-Bonn)
- Scott Paine (CfA)
- Frank Shu (UC/San Diego)
- Gordon Stacey (Cornell)

Background

- Following an earlier Committee telecon and numerous individual discussions, a Workshop on the Future of the SMA was held at CfA on 8 and 9 September 2009.
- All committee members were present as well as several invitees:
  - Pierre Cox (IRAM; PdBI)
  - Linda Tacconi (MPE-Garching)
  - Lee Mundy (Maryland; CARMA)
  - Al Wooten (NRAO; ALMA)
- Members of the scientific staff of SMA were also present.

Future Options Considered

- Keep the SMA operational on Mauna Kea
- Relocate at High Altitude (5.5 km) Site (Chile, or Antarctica at Dome C or Dome A)
- Locate the SMA next to ALMA
- Terminate the operation of the SMA

Future Options Considered by the Committee

- As a result of earlier discussions the Committee decided to pursue only the following two options in more detail at the meeting:
  - Remain at the Mauna Kea site.
  - Move the SMA to a high altitude site in Chile.

- Two teams were formed to write up the science case for each option.

Workshop Agenda

- Welcome (Charles Alcock)
- Introduction (G. Fazio)
- Status of the Current Submm/mm Arrays (R. Blundell, L. Mundy, and P. Cox)
- Status of ALMA and Future Schedule (A. Wooten)
- Future Plans for CARMA and PdBI (L. Mundy, P. Cox).
- Future of the SMA
  - Two options to be pursued in detail (R. Blundell, S. Paine, R. Wilson, G. Fazio, E. Tong, and G. Nystrom)
- Science Objectives for Each Option (F. Shu, E. Bergin, P. Ho)
- Recommendation of Option (Executive Session)
- Final Report Schedule and Assignments

Recommendations

- The Committee unanimously recommended that the SMA remain at the Mauna Kea site and that its capabilities be progressively upgraded as soon as possible.

Conclusions

- Keep the SMA at the Mauna Kea site, and progressively upgrade its capabilities as soon as possible.
  - SMA would remain the most sensitive submm array in northern hemisphere at 345 GHz.
  - Addition of focal-plane arrays to SMA would permit unique science: large-area, very high resolution, multi-year continuum and spectral line mapping (e.g., nearby galaxies and GMC).
  - The site is a very important location for submm VLBI.
  - The SMA would remain at the forefront of submm astronomy into the foreseeable future.

Conclusions

- The very high-altitude site in Chile permits:
  - Operation at THz frequencies, for which ALMA has no current capability (e.g. fine structure lines of N^+, C^+, and H_2D^+).
  - The detection of fainter continuum sources as well as rarer emission lines.
- Problems:
  - No site with the required infrastructure was identified.
  - Single dish THz telescopes have demonstrated no compelling and unique science that requires very high angular resolution.
  - Even at 5.5 km altitude THz operations would be limited to 25% of the time.
  - SMA antenna performance, such as pointing and calibration, would have to be improved.
  - The high cost to move the SMA to Chile ((\$30 – 40 million)

Recommended Upgrades at Mauna Kea Site

- Develop the most sensitive dual polarization receivers in all frequency bands, but concentrate initially on 345 GHz.
  - Increase IF bandwidth to 18 GHz and upgrade the receivers to dual polarization now (increases wideband sensitivity by a factor of 3).
  - Later increase IF bandwidth to 30 GHz (increases wideband sensitivity by a factor of 3.9).

- Increase the diameter of the current antennas from 6 meters to 7 – 8 meters by adding an outer skirt (increases wideband sensitivity by factors of 1.36 and 1.78, respectively).

Recommended Upgrades at Mauna Kea Site

- Initiate a program to design and install a 3 x 3 focal-plane array at each antenna.
- Add two additional antennas.
- Establish a closer collaboration with CARMA, ALMA, and PdBI, particularly in the development of 30 GHz correlators and of 230 GHz wide-band receivers.