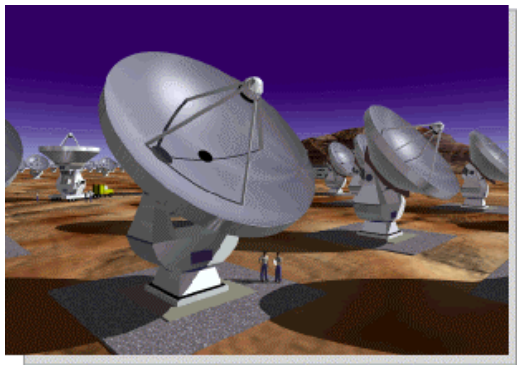

Atacama Large Millimeter Array

ESAC/ASAC/Science IPT update for the EAB

John Richer (Cavendish Lab, Cambridge)

Chair, ALMA Science Advisory Committee (ASAC)

UK Project Scientist for ALMA

(Standing in for Ewine van Dishoeck)

European Science Advisory Committee (ESAC)

- Now enlarged to one member per country
- First meeting: June 12th, Garching
- Rather late, but many diary conflicts
  - European Project Scientist may be in place by then
- Key jobs: elect ASAC members, establish work programme
- STC link established (Richard Hills)
- Greater focus on community interaction than ASAC
  - E.g. ALMA Science Day, November 2003
- ANASAC formed also as mirror image

EU Framework 6 proposals

- Working group of ESAC members (van Dishoeck, Cox, Booth, Richer) plus ALMA and ESO personnel
- Achievements:
  - Radionet: ALMA Forum (290kEuro) - focus for collaboration
  - Opticon: minor role but money for 1 meeting/year
  - Marie-Curie RTN based on pre-ALMA science (Menten)
    - Would train 14 scientists
    - Training a key issue for ALMA
- Construction proposal envisaged for Autumn 2003
  - ESO-led, approx. 10 MEuro bid
  - *May* contain additonal Software, Frontends, Calibration hardware
  - Difficult proposal to develop – deliverables are the key
  - Needs ESO lead to be established quickly

ASAC Activities

- First ‘new’ ASAC Face-to-Face meeting: Grenoble, April 2nd 3rd
- Europe represented by old ASAC members:
  - Ewine van Dishoeck, Pierre Cox, Rafael Bachiller, Peter Schilke, John Richer
- NA represented by new members:
  - **Chris Wilson**, Lee Mundy, Phil Myers, Chris Carilli, Jean Turner
- Short telecon with JAO formed bulk of Project input
- Main work: discussing 6 charges from the Board.
- Regular monthly telecons also held

ASAC Issues

- Role of ASAC now much clearer
- Small group should work well
- Definition of future charges: the more time the better!
- Clarification of status of members
  - EU/NA Project Scientists
  - Japan
- *Inputs* to ASAC
- Election of EU members
  - 12 June ESAC meeting
- Face to Face meeting: early September 2003
  - First `proper' meeting

ASAC general charge

- The ALMA Science Advisory Committee (ASAC) **advises the ALMA Board** on those major issues presented to the ASAC by the Project Scientist or the Board **that affect the science capabilities of ALMA** and require decisions to be made or priorities to be set **regarding project tasks and resources**. The ASAC shall be kept informed of progress and developments in ALMA through periodic reports and briefings provided by the Joint ALMA Office and shall **meet at least twice a year**. Reports of the ASAC's deliberations shall be made **in writing** to the Board by the Chairperson of the ASAC following each Committee meeting, on a schedule **specified in advance by the Project Scientist**. The Project Scientist shall serve on the Committee *ex officio.*

ALMA

Charges this meeting

1. Calibration: The ASAC is asked to review the current status of the ALMA Calibration Plan. The ASAC should consider whether the goals of the plan are reasonable, whether the correct strategies are being followed, whether the resources devoted to this task are adequate to fulfill the goals, and suggest how the goals should be prioritized.
2. Configuration Design: ALMA configurations up to 4.5 km baselines have recently been defined. The ASAC is asked to comment on the options which remain available for longer baseline configurations, and, in particular, to consider the possible performance tradeoffs between the maximum-resolution and intermediate baseline configurations.
3. Baseline Correlator: The ASAC is asked to comment on the scope of the proposed Baseline Correlator upgrade, considering the most recent available information on cost and schedule. The ASAC is asked to comment on the consequences of this upgrade on the averaged ALMA data rates.

Charges this meeting

4. Front End: The ASAC should comment on the completeness and adequacy of the high level specifications of the receivers, and on their relative importance in terms of science return.
5. Software: The ASAC is asked to evaluate the results of the IRAM-AIPS++ tests (Phases I, II and III), and to comment on their consequences for the ALMA software. The results of AIPS++ testing at NRAO should be considered as part of this evaluation. Preliminary results from the Software PDR may be available at meeting time (though probably not in advance) and should also be considered if relevant.
6. Inhomogeneous Array: The ASAC is asked to discuss the impact on development, commissioning, and scientific performance of using two different 12m antenna designs in the ALMA array. Issues the ASAC is requested to consider include the impact of an inhomogeneous array on (i) the phase stability of the array, and its dynamic range and other imaging characteristics; (ii) operations and maintenance costs; (iii) software development schedule and costs; and any other issues the ASAC feels the Board should be aware of.

ASAC Report

- ASAC very impressed by progress by JAO and the Project
- Very encouraging progress towards achieving ambitious scientific goals, for *example*
  - Chile negotiations
  - Proposed enhancement to baseline correlator
  - Receiver noise temperatures
  - Near-final configuration design
- Japanese observers provided helpful input to open sessions
- Major areas of concern: software, receivers, operations

1. Calibration Plan

- Slow progress to Calibration Plan. Formalisation of Science IPT, Calibration Group and milestones helped progress significantly
- Phase calibration: basically in good shape
  - *Combination* of fast-switching and 183 GHz radiometry
  - Effort in place to do this; reasonable progress and planning
- Amplitude calibration less well advanced – **highest priority**
  - Abandon existing schemes, adopt (pseudo) conventional dual load
  - Extra resources for Science IPT recommended
- Polarisation calibration still lacking (effort problem)
- Test Interferometry at ATF critically important validation tool
  - Resource implications again

2. Long Baseline Configurations (4.5-14 km)

- Very exciting scientifically:
  - 1mm on 10km baseline yields 20 milli-arcsec beam
  - same resolution as 6m at 600nm (NGST/JWST)
- Excellent designs by Mark Holdaway for long configurations
  - Practical, with good imaging properties.
  - ASAC suggestions detailed:
    - Move antennas away from saddle near Pampa La Bola
    - Properties of multi-array image simulations to be investigated
  - Soil/access seems to be good

3. Baseline Correlator Enhancement

- NRAO proposed modification which increases number of spectral channels by factors 1x,2x,…32x over baseline design
- No detailed design, cost or schedule information, but this is a *very exciting proposal scientifically*
  - Remedies key weakness of baseline design
- ASAC strongly supports proposal
- modeling needed to investigate effect of filter edges
- Schedule not impacted if 1st quadrant delivered unenhanced
- Data rates: probably not a serious problem (?)
- 2GC: brief presentation but not in our charge

4. Frontend Specifications

- Not formalised, not complete
- But very encouraging lab results
  - Receiver temperatures and bandwidths approaching the ambitious specifications
  - Critical for ALMA science goals
    - 10% better system temperature is like 6 antennas!
- Main scientific concern:
  - Gain stability specifications may be hard to meet
  - Needed for imaging `large' sources (> 9 arcsec at 350GHz)

5. Software and AIPS++

- Disappointing AIPS++ tests
  - Did not met expectations
- Most positive aspect is statement of NRAO commitment
  - End of consortium should be positive for ALMA
- AIPS++ must match performance of other packages
- Re-engineering of AIPS++ requires committed ESO/NRAO collaboration
- Important for Europe to develop skilled teams
- Software PDR: need for Operations Model for ALMA

6. Antenna designs: 1 or 2?

- Single design strongly recommended
  - Wins in all areas: cost, operations, software and science
  - Especially important for wide field imaging and polarisation
- If 2 designs needed, consider adding specifications
  - Common quadrupod design
  - Axis intersection specification…
  - But cost implications…
- Possible programmatic problems of single procurement understood by ASAC