Appendix B

ALMA science operations staffing compared with other major facilities

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Not for general distribution

I. Introduction

In this document, the planned staffing for ALMA operations is compared with that at other major facilities of similar size or nature. In particular, a comparison is made for the 'core functions' of the ALMA RSC, i.e. Phase I and II proposal support and data reduction support. Also, the amount of manpower for the pipeline data reduction and quality control, where appropriate, is summarized.

All estimates are in FTE without the science time of the astronomers involved. For many facilities, the number of 'bodies' is usually significantly larger than the number of FTE since scientists and astronomers have of order 20–50% of their time for science. For that reason, a rough estimate of the number ('bodies') of astronomers (in all possible areas) is also given, since this plays an important role in the quality of the support and scientific flavor of an institute or facility.

These kind of comparisons are prone to errors and inherent uncertainties in the numbers. Various facilities have been contacted directly in the last months and have kindly provided input, often with lengthy explanations. Nevertheless, manpower at the boundary of software/user support is counted differently for different facilities, and there may be hidden contributions that are not accounted for in these numbers. Therefore, all numbers should be viewed with a healthy dose of scepticism, but they do provide a reference point and sanity check for the ALMA manpower estimates.

II. Some notes and conclusions

Table 1 compares the manpower estimates for ALMA with those at various major space- and ground-based facilities. In addition, §III gives details on data reduction support at various facilities, in particular those involving radio- or millimeter interferometry. Some notes and preliminary conclusions are as follows:

- Assuming that the number of ALMA proposals is not much larger than 1000 per year, FTE support for phase I + II proposal preparation appears similar compared with other facilities. ALMA has fewer observing modes than, for example, HST instruments.
- Although the number of FTE for ALMA data reduction support to users seems small (only $\sim$2 per RSC; up to 4 in the draft ESO Long Range Plan), it is quite consistent with other facilities. However, the current ALMA numbers do not take the TBD fraction of science time of the astronomers into account. If this is taken to be $\sim$50%, each ALMA RSC would have less data reduction support than current radio- and millimeter facilities such as MERLIN, JIVE and Plateau de Bure, which have smaller numbers of users than ALMA is expected to have at its peak. In terms of number of 'bodies', the difference may be up to a factor of 2. Part of the difference may be caused by the fact that the ALMA core functions do not include face-to-face user support.
- The amount of manpower for pipeline data reduction and quality control shows the largest fluctuations between facilities. Some of this difference may be due to how software development

Table 1. Manpower estimates at various facilities

All numbers in FTEs per year without science time

Item/task	ALMA[a] RSC-Eu[b]	ALMA[a] RSC-Tot	ALMA[a] Chile	HST[c]	SIRTF[d]	VLT[e]	ISO/ ESA[f]	VLA[g]	IRAM PdB[h]
No. prop./year	500[i]	1000[i]	–	1000	1000[i]	1000	600-1000	700	120-150
No. success prop.	150[i]	300[i]	300	200	200[i]	400-700	400-600	300	60
FTE Phase I+II prop support	6	12	3	22	11	11	7	< 1	1
FTE Data reduction support	2	4	–	2	2	0	4	3	2
FTE Pipeline data reduction/quality	–	–	15	47[j]	6	6	5	n.a.[k]	1
FTE Archive/ Database	2	4	2	11	2.5	12	15/3[l]	n.a.[k]	1
Total no. astronomers[m]	8+	16+	20	82+	43	70	13+	50+	15+

[a] ALMA numbers cf. Table 2; RSC-Tot= RSC-Europe + RSC-North America; RSC-Tot + Chile need to be added to compare with other facilities. The Chile numbers have been corrected for the science time of the astronomers; the RSC numbers are NOT corrected for the TBD fraction of science time of the astronomers (i.e., 0% science time is assumed)

[b] Numbers provided in the draft ESO Long-Range Plan have a slightly different distribution over the functions, with less FTE for proposal support and more FTE for data reduction support

[c] HST numbers provided by M. Hauser, August 15, 2003

[d] SIRTF numbers provided by M. Bicay, August 15, 2003

[e] VLT numbers provided by D. Silva, August 22, 2003

[f] ISO numbers provided by M. Kessler, August 28, 2003; includes only the ESA-ESTEC/Vilspa part, not that of national data centers (which is small)

[g] VLA numbers provided by A. Wootten, August 1 2003; see §III

[h] IRAM PdB numbers provided by F. Gueth, August 22, 2003; see §III

[i] Estimates

[j] Includes software maintenance

[k] N.a. = numbers not available

[l] Production of first archive required 15 manyr; subsequent versions required a few FTE

[m] Entries with + indicate a lower limit to the number of astronomers at the facility. For ALMA, there could be significantly more astronomers in the same building depending on the RSC location

and maintenance is counted, some of it may be inherent. The ALMA project should review this number carefully.

- The *total* number of millimetre astronomers involved in ALMA (RSC-Tot + Chile) is comparable to the number of astronomers at, e.g., the SIRTF Science Center. At any ALMA location, however, it is potentially much less than that at other major observatories, even compared with 'small' facilities.

III. Some details on other facilities

- VLA: The official NRAO VLA scientist contingent for data reduction support is currently 2.95 FTE spread over 10 astronomers (fractions of time ranging from 10% to 50%). Estimates based on Phil Diamond's experience in the earlier VLA days suggest ∼15 scientists for a fraction (∼ 25%) of their time. There are at least 50 astronomers at the AOC.
- IRAM: IRAM PdB is an array of 6×15m telescopes and has about 120–150 proposals per year with 50–60 projects scheduled. About 50 visitors per year visit the Grenoble support center for 3–6 days each. It has 10–12 astronomers who each have to serve for ∼10% (1 month/year) of their time as 'astronomers on duty' (calibration and pre-reduction of the data) and ∼10% as 'local contacts' (helping astronomers to reduce their data at IRAM). The needed support varies from user to user (and often from project to project). Thus, this corresponds to ∼2 FTE full time. In addition, there is ∼2 FTE for coordination and 0.3 FTE for computer support (information from F. Gueth).
- SMA: The SMA is a private facility of 8 ×6m dishes at Mauna Kea, serving primarily the CfA and Taiwanese specialized communities. From CfA side, at least 6 postdocs and 10 graduate students are involved in operations and observing. There are at least 10 senior astronomers connected to the SMA at the CfA, giving a total of ∼25 scientists. Assuming that Taiwan contributes at least 25%, this leads to a total of at least 30 astronomers involved in the SMA.
- MERLIN: MERLIN has about 100 projects annually and a total number of users of ∼600 (over the lifetime of the array). 4 astronomers are directly involved in user support for 75% of their time, plus 1 software engineer (information from P. Diamond).
- JIVE: JIVE has about 80 projects annually and several hundred users per year (PI's and co-I's). 6 support scientists are directly involved in user support, which have 50% science time. There are 2–3 technical support persons (information from M. Garrett).
- Gemini: Gemini has two 8-m telescopes with 50%/50% service/normal observing (similar to VLT). The number of proposals is ∼600. There is pre-observing support by the National offices. A total of about 16–20 staff do this work, 4 in the UK, 3 in Canada, rest in US and small partners (Chile, Brasil, Australia). Phase 1 and 2 proposals are handled by National offices, which includes technical assessment of Phase 1. Gemini office then checks Phase 2 proposals. The Observatory carries out observations, although National staff visit telescopes regularly to do observations and help with communications. Gemini does not reduce data, but Gemini staff write CDs and send them with observing scripts to national offices. National offices then support data reduction as best as they can even though they did not write the scripts (information from J. Richer through I. Hook).

Table 2. Planned ALMA operations staffing for full array[a]

	Each RSC	Santiago	OSF
Astronomers			
Obs Prep Support	6	3	
Obs Support[b]		15	5
User Support			
Array Operators[c]			8
Data Analysts		5	
Database Specialists	2	2	
User Support Assistants	2		
Totals	10	25	13

[a] Provided by R. Kurz, August 15, 2003

[b] 20 astronomers with 25% functional work at OSF, 25% functional work at Santiago, and 50% research at Santiago. With the turno system, the 5 persons on staff results in 2 on duty at the OSF at all times

[c] With the turno system, 8 operators on staff results in 3 on duty at the OSF at all times