

## **Memorandum**

### **To: ALMA Executive Council**

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From: Jaap Baars - ESO

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**Subject: The Diversified ALMA Antenna Procurement Model - 2**

### **1. Introduction**

This is an updated version of the earlier discussion Memo regarding the best “Model” for the organisation and management of the ALMA Antenna series production. Recently, following the discussion of the tripartite project in Paris, we have presented some ideas about the so-called vertical and horizontal models of antenna procurement (see Report of Antenna IPT - Paris Meeting, May 2001 by Jeff Kingsley). In further discussions, particularly at the meeting of the AMAC in Garching (8-9 June 2001), it has emerged that some combination of both models would be most attractive to meet financial, technical, schedule and political boundary conditions and goals.

On the basis of discussions and written reactions to the first version, I present Version 2 of this Memo. Input has come from Richard Kurz, Robert Fischer (ESO Contracts Officer), the AEC, Nobuharu Ukita, Peter Napier and Jeff Kingsley. I have tried to accommodate alternative ideas, new boundary conditions and detailed criticism into a modified procurement model which, at least to me, appears to be reasonably understandable and to possess some realistic chances of success.

### **2. Assumptions and Boundary Conditions**

1. I assume that the tripartite agreement between North America, Europe and Japan will be realised. Each of the three partners will furnish a prototype ALMA 12-m antenna to undergo comparative evaluation by a joint ALMA team at the VLA site in New Mexico. The ALMA partners Europe (EU) and North America (NA) own the design of their prototype antennas. The situation with respect to the Japanese (JA) partner is not so straightforward.

2. In principle, the **design** of one of the three prototype antennas will be selected for the series production of 64 in total. Schedule and financial constraints will allow at most some small modifications to the production antenna, which do not jeopardise the performance guarantee of the designer. This is my understanding of an ACC boundary condition..

3. I assume that the antennas will be produced entirely by industry. The total cost of the antennas absorbs 35-40 percent of the total ALMA construction budget. In my understanding,

some (if not all) of the funding agencies will require a certain “just return” to industries in their region (boundary condition). In the current management model of ALMA each executive “spends his own money”. Thus significant orders and/or payments for (parts of) the antennas will have to be made by each of the three ALMA executives (NRAO, ESO, NAOJ). (Current ACC position.)

4. I believe it to be generally accepted that ALMA requires the delivery of identical antennas to Chile. There are both scientific and operational (maintenance) reasons for this requirement.

5. I assume, and would strongly suggest, that ALMA wants to deal with a contractor who accepts responsibility for the full functionality of the delivered antennas.

6. On the basis of the current ALMA construction schedule, a delivery of about 12-16 antennas per year over a 4-5 year time span must be guaranteed.

### **3. Aspects of the procurement**

1. With the delivery of the Complete Design Documentation (CDD) the contractors present an updated cost estimate for the fabrication of a series of 64 and of 32 antennas. Thus they are aware that the final procurement might be split over more than one company. With the delivery of the prototype antennas, the three contractors must provide a binding offer for the series fabrication of their antenna. Presumably, this offer would have a breakdown of costs over the main sections of the antenna, similar to that given at CDD. It can be assumed that ALMA will have established the ground rules for the antenna procurement by the time of the prototype delivery. Thus, in principle ALMA could inform the companies that their bids should be based on the procurement rules. It is likely that this would lead the companies to include high levels of contingency and increase the price significantly. It appears better for ALMA’s negotiating position to start with bids, based on the contractor’s preferred fabrication scheme.

2. It is highly preferable to have one main contractor for the delivery of the 64 antennas. The contractor should in principle take responsibility for the functionality of the antennas. I am wary of ALMA delivering, and hence taking responsibility for the correctness, of a set of prints, to which a contractor fabricates. I consider it likely that the designer/deliverer of the successful prototype will be the main contractor of the series. This certainly has the advantage of a credible level of confidence in his capability to deliver to specifications and performance. It is for this reason that I would prefer to place the contract with the “winning” company. Ideally the “company” would be a “joint venture” of the winning company and one partner each in the other two regions.

3. At the Paris meeting in May 2001 we presented two models for an antenna fabrication, distributed over all three geographical regions. In the *horizontal model*, certain sections of all antennas are made by one company and the companies are distributed over the three regions. A System Integrator assembles all parts to a complete antenna in Chile and delivers to ALMA with responsibility for performance. In the *vertical model* a set of complete antennas is produced in each of the three regions, based on **one** design, presumably by three different contractors. The complete antennas are delivered to ALMA, again with responsibility for performance, from each of the three contractors.

The discussions since then have indicated that each of these models has good and bad aspects in the context of the ALMA organisational and political situation. Below I describe a model, which I hope will combine the attractive aspects of each of the models, while avoiding most of the drawbacks. I call this model “diversified procurement”.

#### **4. The diversified procurement model**

As noted earlier, political conditions will force us to place significant parts of the ALMA antenna fabrication in each of the three participating regions, NA, EU and JA. However, we want the antennas build to one and the same design; they should be as identical as possible. In particular, all parts for which spares are required should be identical (encoders, motors, etc). At the end of the evaluation period one of the three prototypes will be selected for series fabrication on technical and budgetary grounds (best performance/cost ratio).

Considering that the ALMA “political ground rules for tendering” will be unusual, it appears worthwhile to inform potential bidders early about these rules. This could be done through a “preliminary inquiry” (draft Call for Tender, CfT), to be issued during the period of prototype evaluation, probably directly after delivery of the last antenna. This CfT would include design documentation for all three prototype antennas, but not results of our evaluation. Bidders would select the design of their choice. I believe that this will lead to three bids, each bidder choosing his own design, perhaps “improved” in some areas by superior features of the other designs. The bidder should assume responsibility for meeting performance specifications.

The CfT will contain instructions as to the form of the contract, according to the ALMA rules. The bidders will be required to establish a “joint venture” (JV) with companies in the other two regions and be responsive to the requirement of the separate expenditures by the three executives. A joint venture can be organised as a legal entity with which ALMA can enter into a contract. The preferred solution is that ALMA, or the three executives jointly, conclude one contract with the JV and that the invoicing system regulates the separate payments by the individual executives. It should be left to the JV how it wants to organise itself and regulate the fabrication within the contracting and payment rules imposed by ALMA. Depending on the combination of firms, this could run from a strictly “vertical” to a largely “horizontal” manufacturing process.

It is possible that the three “prototype” companies would form the JV and we could end up with more than one bid for different antennas, issued by the same JV.

[It is my personal view that the ideal situation would be a JV of the three prototype companies and that they would offer a “hybrid” antenna with the best and cost effective features of all three prototype antennas. The necessary design changes could then be done rather easily within the context of the JV and be ready shortly after we finish the antenna evaluation. Apart from a risk of “price fixing” by the Joint Venture, this could deliver the production antenna with the highest performance to cost ratio. I am uncertain about the realism of this viewpoint.]

At the end of the evaluation period ALMA will select one of the antennas as the winner. A contract for the production would then be negotiated with the JV based on their tender (including the managerial organisation of the JV) for that antenna. Under this scheme we are more or less abandoning the idea of a completely open bidding after the selection of the winning design. We are thus running the risk of price fixing by the JV. Strictly speaking, we can still go for open bidding but it is unlikely that other groups of companies would have much of a chance. The extra effort involved in familiarising with the design and the requirement to be responsible for performance would very likely result in a cost which is higher than that from the current contractors or the JV. Actually, in my view this situation would not be very different, if we did not have the need to spread the expenses and could go for just one contractor.

Peter Napier has suggested an original alternative procedure which, he believes, would maintain competition up to the award of contract (I quote):

*(a) On the basis of the test results and the initial binding bids (which do not require international offsets), identify the antenna that has the poorest performance/cost ratio. Call the other two antennas A and B.*

*(b) Invite only companies A and B to provide you with new binding bids which include the full international offset requirements and any other requirements as defined in Item 1 [of the summary]. To keep the bids competitive, A cannot be part of B's partnership and B cannot be part of A's partnership. If A and B have subcontractors in common then these common subcontractors must have strict non-disclosure requirements during this bid phase.*

*(c) Select A or B for production contract award according to which has the highest performance/cost ratio based on these final bids.*

It is clear that this proposal is at odds with the idea of having companies form a Joint Venture early on.

In any case, the main aspect of the final contract should be the contractor's responsibility for the performance of the delivered antennas from all three regions, regardless how the actual fabrication and assembly will be organised. Furthermore the JV is bound to arrange for roughly equal expenditures in the three regions.

It has been assumed in all discussions that the antennas will be assembled at the OSF in Chile. Depending on the amount of "pre-assembly" at the contractor's plants, more than one assembly line will have to be established at the OSF in order to meet the scheduled production of 12-16 antennas per year. In the procurement model sketched here, the JV could set up his preferred method of assembly. It is feasible that one of the JV-partners would assume responsibility for the assembly of all 64 antennas, taking delivery of the antenna sections from the other partners. Such a flexibility could be helpful for the final distribution of funds over the three ALMA regions.

This diversified procurement model is sketched in the diagram (Fig. 1). I believe that it provides the possibility for the three executives to satisfy their special requirements regarding contracting and expenditure within their region. It is not the simplest way, both managerially and

contractually. It appears however manageable and it would assure the delivery of identical antennas with acceptably low risk. It also has the advantage of providing a contractual situation in which a failing in his task of one of the Joint Venture participants enables the other JV members to complete the project.

The proposed scheme indeed has the danger to put the companies in a perceived state of monopoly where they could agree to jointly increase the price. Our weapon against that would be the three independent binding offers from each of the prototype firms for the construction of the antenna series. Our goal should be to stay as close to those bids as possible and avoid exaggerated “handling fees” from the companies because of their need to have a joint venture and spread fabrication geographically. We should bear in mind that fabrication would be spread significantly anyway because of the specialised nature of many of the antenna components.

## **5. Summary**

In summary, this diversified procurement proposal would go roughly as follows:

1. ALMA, in conjunction with the three partner executives, establishes the political conditions under which the antenna production will have to take place. It is essential that agreement be reached on the mode of contracting and invoicing. Ideally, the three executives would have the ALMA Project Office place a single contract with a Joint Venture, whereby the executives are invoiced separately for the activities performed under their financial jurisdiction. A single contract, signed by all three executives and containing the invoicing procedures, could be an alternative solution, which would more clearly identify the executives as the contract issuing entities.

2. After the three prototypes have been delivered and the companies have presented ALMA with their binding bid for the series production, ALMA issues an open “draft Call for Tender” (“preliminary inquiry”) for any of the three prototype antennas. Administrative boundary conditions are explained in the draft CFT, in particular the need to spread the production activities over the three regions and the desire of ALMA to conclude a contract with a Joint Venture of companies representing all three regions. This will provide us with an updated cost for the production under the procurement rules.

3. The selection of the winning prototype antenna considers performance and cost and the best one is selected for series production. If any of the tenders contains design improvements on the selected antenna, ALMA considers the feasibility of incorporating these in the production design. The performance/cost ratio of the winning bid brings us at the negotiating table with that particular Joint Venture. The final contract is now negotiated with this JV. This includes the division of subcontracts over the three regions and the modalities of the assembly in Chile. The payments schedules with the three individual executives are also agreed.

If the total price is acceptably close to the available binding bids, ALMA convinces the three executives that no further open tendering is required, nor advisable. If the Joint Venture

appears to be unreasonable in their financial requirements, ALMA takes recourse to open bidding.

This procedure hinges strongly on the notion that it will be difficult, if at all possible, to obtain independent open bids from “arbitrary companies” for these highly sophisticated antennas which will be competitive and technically reliable. In all cases, ALMA will require that each bidder assumes performance responsibility for the “common” design, selected by ALMA.