

## Visits to Spanish Electronics and Antenna Companies

Peter Napier, Juan Uson, National Radio Astronomy Observatory.  
José María Torrelles Arnedo, Instituto de Astrofísica de Andalucía, CSIC.

27 February, 1997.

### Summary

Visits were made to four Spanish companies in order to determine if MMA development and fabrication work could be carried out in Spain. From these visits it is quite clear that the capabilities exist within Spanish industry to work on significant parts of the MMA electronics and antenna systems.

### Introduction

During the period 27 January to 31 January, 1997, visits were made to four Spanish companies. The goal of the visits was to evaluate the possibility of Spanish companies being involved in the development and construction of the Millimeter Array (MMA) in the event that Spain joins the MMA Project as a Partner. Three of these companies (RYMSA, Mier and Schwartz-Hautmont) were suggested by the CDTI (Centro de Desarrollo Tecnológico e Industrial) from the "Ministerio de Industria" of the Spanish Government. A fourth company (TTI) was suggested by a member of the Spanish committee established to consider Spain's possible partnership in the MMA. It is expected that other Spanish companies, beyond these four, will have the appropriate background and suitable experience for MMA work.

### RYMSA

On 27 January we visited the company "Radiacion Y Microondas S.A." (RYMSA) at their facility in Arganda about 30 minutes drive from Madrid. We met with Francisco Vila, Director of the Space Division, and Santos Martín Fernández, Commercial Director for the Space Division. RYMSA is a company specializing in the design and fabrication of radio and microwave equipment, primarily passive components such as antennas, feeds, polarizers, multiplexers, filters and switches. They have 102 employees, of which 35 are university graduates, and in 1997 are forecasting sales of \$14.1M. They currently have the experience and ability to work at frequencies up to 75 GHz but soon hope to get a contract to work at 135 GHz on components for the radiometers for the COBRAS/SAMBA Project. Because much of their work is for space applications they are skilled in making low mass equipment and many of the components they showed us were impressively light weight. Although they have not previously fabricated equipment for cryogenically cooled receivers, it appeared that their low mass components would be suitable for cooling. They have all of the commonly used software packages for the design of microwave components and have complete fabrication and test facilities. Several pieces of specialized equipment include numerically controlled spark erosion milling machines (both mold and wire) capable of tolerances of 2 microns on pieces up to 25 cm in size, and a thermal/vacuum

chamber (capable of simulating an elevation of 5000m) with a volume of 80x80x150cm.

RYMSA would certainly be capable of providing passive components for the MMA receiver bands at and below 110 GHz and for the IF part of the electronics system. For the purposes of cost estimation they will provide us with their standard manpower charging rates as soon as NRAO signs a non-disclosure agreement. There is also a division of RYMSA in Mexico.

### Mier Comunicaciones, S.A.

On 30 January we met with José Manuel Báez, Director of Business Development for the Space Division of Mier, in the offices of the Institut D'Estudis Espacials De Catalunya (IEEC) in Barcelona. Josep M. Paredes (Universitat de Barcelona) and Antonio Rius (IEEC), two members of the Spanish committee, also attended the meeting.

Mier is a company in Barcelona specializing in the design and fabrication of electronics systems such as low noise amplifiers and downconverters, primarily for telecommunication applications. They primarily work at frequencies up to 20 GHz but expect to increase this to 30 GHz soon. They have built radiometers for ESA in the 12-18 GHz range. They are experienced in the design and use of MMICs using the Philips and Thomson foundries. Their low noise amplifiers (LNA) use room temperature HEMT devices supplied by Siemens. Typical performance of their 12-14 GHz LNA is 1 dB NF. Their HEMT LNAs take approximately one man week to assemble including the use of a manual bonding machine. They would be interested in and capable of assembling the MMA 30 GHz LNAs and in supplying IF equipment in the frequency range 2-18 GHz, but they currently have no cryogenics experience or equipment.

To give an idea of likely costs they gave us their current, ESA audited, manpower charging scales as follows:

Manager: 7000-7500 pesetas/hr (52-56 \$/hr)

Engineer: 6800 ptas/hr (50 \$/hr)

Technician 6000 ptas/hr (44 \$/hr)

To these costs ESA allows an increase of 15% for a firm-fixed-price contract and 8% for profit. The 15% is a risk insurance that is not charged on incidentals and supplies.

### TTI

On 30 January we met with José Alonso Fernández, Space Division Coordinator for the company Tecnologías de Telecomunicaciones y de la Información (TTI), in the IEEC offices in Barcelona. Josep Paredes and Antonio Rius also attended the meeting. TTI is a young (1.5 years old) company located in Torrelavega (Cantabria, northern Spain). It consists primarily of 15 PhD-level engineers with close ties to the Engineering School of the University of Cantabria where they rent or lease most of their technical resources. 6 of the engineers previously worked for ESA. Within the experience background of their engineers there is a wide range of engineering

expertise, including RF and millimeter equipment, digital signal processing equipment and software, telecommunication satellite systems and earth observation satellite systems.

Of particular interest to the MMA would be their experience in the modeling (linear and non-linear) of MESFET, HEMT and HBT devices, MMIC design for RF specific applications (using the Philips and Thomson foundries) and RF front-end equipment development (design, assembly and testing up to 100 GHz). Additionally, they work in co-operation with an Italian company, Officine Galileo, who do sub-millimeter and quasi-optical work for ESA. We have requested additional information concerning the capabilities of TTI in all these areas. In particular we have requested copies of published papers and reports which demonstrate the specific experience of the TTI engineers so that we can better judge which parts of the MMA system could be worked on.

As a start-up company TTI is able to offer particularly attractive cost rates for its work. As an example of this they quoted the following manpower rates:

PhD level engineer: 4200 ptas/hr (31 \$/hr),

Laboratory cost (includes technician or draftsman cost): 1500 ptas/hr (11 \$/hr).

#### Schwartz-Hautmont

On 31 January we met with Antonio Aldecoa Llauradó from the Commercial Department of Schwartz Hautmont at their shop facilities in Vilaseca (Tarragona). Josep Paredes and Antonio Rius also attended the meeting. Schwartz-Hautmont is a large, heavy engineering factory that builds steel structures of all types. They have considerable experience in the fabrication of telescopes and antennas including the Keck 1 telescope and enclosure, the Carnegie Telescope enclosure in Chile, and the new JPL 34 m antennas in Australia and Spain. These projects were won on the basis of international competitive bid. In addition they have done more than 10 other large antenna projects. They have worked as subcontractors for several US antenna companies such as TIW, Ford Aerospace and Loral. They would clearly be qualified to fabricate the steel az/el mounts for the MMA antennas. They are investigating the possibility of one of their subcontractors machining the high precision aluminum reflector panels.

To give an idea of costs they quoted 500 ptas/kgm (1.7 \$/lb) for fabricated steel. Since returning from the visit to Spain we have contacted the Project Manager for the JPL 34m Project and he is very happy with the quality of their steel fabrication, rating it as slightly superior to the fabrication of the Goldstone 34 m which was done in a US shop. They were lowest bidder for the 34m job by about 1%, the other low bidders being an Australian company and a US company (who planned to use a Korean steel fabricator). As well as fabricating the Australian 34m antenna, Schwartz- Hautmont were also the contractors for the assembly of the antenna. This assembly work has gone less well, presumably in part because this is the first time that they have been the contractor for assembly as well as fabrication. There have been significant problems with Australian labor unions.

### Other Contacts

As well the meetings with the four companies, the following useful contacts were made. These contacts should be pursued further in the event that Spain decides to become a partner in the MMA.

RYMSA uses a Spanish company specializing in CFRP fabrication for their CFRP antenna work. This company is Fibertecnic in Vitoria, part of the same holding group that partially owns RYMSA. Their phone number is (011) (34) 45 279100, Fax (011) (45) 275792.

We met Adriano Camps Carmona, Lluís Pradell Cara and Adolfo Comerón Tejero, all from the Department of Signal Theory and Communications at the Universitat Politècnica de Catalunya (UPC) in Barcelona. This department has groups active in microwave systems, photonics (optical communications and lidar atmospheric sensing) and high frequency superconductivity.

TTI told us about a company, INASMET Centro Tecnològic de Materiales, in San Sebastián, which specializes in advanced materials including CFRP and other composites.

One of us (JMU) gave a seminar on the MMA at the IEEC. This was attended by about 35 people, most of whom were on the staff of the IEEC; others were from the Department d'Astronomia i Meteorologia of the Universitat de Barcelona.

JMU also met with two prominent Spanish physicists, Prof. Pedro Pascual de Sans (Universitat de Barcelona) and Prof. Alberto Galindo Tixaire (Universidad Complutense, Madrid) and discussed briefly the MMA as well as the possible participation and benefits to Spanish astronomers and Spanish industry. These two professors were founders of the Spanish theoretical physics group (GIFT) and are well known physicists. Their endorsement was crucial to the Spanish decision to rejoin CERN some years ago.