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The M1 Cell-M3 Tower Undergoes Tests in Europe

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The M1 cell-M3 tower of the Very Large Telescope is undergoing final integration and testing at the GIAT factory in St. Chamond. There, at the same factory (previously Creusot Loire) where the 3.6-m telescope of ESO was built twenty years ago, the French consortium of GIAT Industries and SFIM Industries, selected by ESO for the design and construction of the M1 cell-M3 tower, is working to complete the European testing of the first unit of the M1 cell-M3 tower.

The most noticeable part of the system, the laser welded, white painted primary mirror cell, whose construction was finished in summer last year, is now fully equipped with the 150 axial supports and the 72 lateral supports of the primary mirror. Steel pipes of various diameters, all filled under vacuum with oil, interconnect the hydraulic pads to form the whiffle-tree networks supporting in the most accurate way the weight of the primary mirror. The force actuators, used for active optics correction are mounted and linked to the Local Control Unit through their dedicated bus. Hundreds of metres of cable connect the many electrical boxes, the sensors and the other equipment spread inside the cell. Although not much space has been left free, still remarkable is the accessibility provided by the cell design. On the top surface of the cell, the axial interfaces to the mirror with their tiny flexures are now in position, optically adjusted to within a few tenths of a millimetre. The M3 tower rotation mechanics, embedded in the centre of the cell, is fully operational. Only missing at the time of writing is the cold plate used to cool down the mirror to eliminate or reduce mirror seeing. The plate, located just below the primary mirror, will be mounted only at the end of the testing phase to allow at any

Figure 1: First integration of the M1 dummy mirror in the cell.

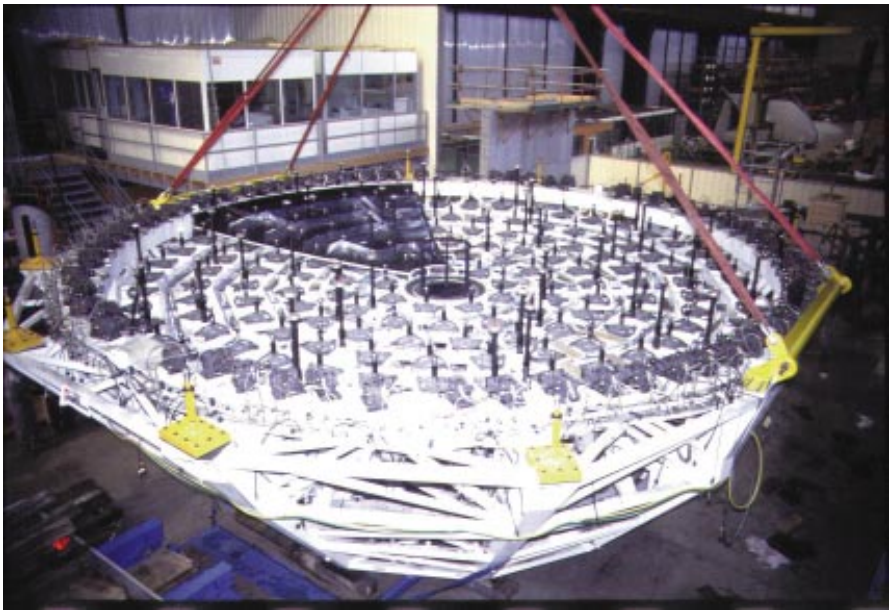

Figure 2: Top view of the fully equipped M1 cell. Also visible is one sector of the cold plate.

Figure 3: The M1 cell is brought below the M1 dummy hanging in the handling tool to test the integration procedure.

time visual control of the mirror axial interfaces.

The testing activities in Europe started in February with the hardware and software tests of the LCU. Afterwards, the active supports were tested. The M3 tower upper part was then installed on the rotation stage, aligned and tested.

One remarkable phase was the introduction of the primary mirror dummy. This operation was accomplished with the help of special jigs which allowed the mirror to be kept centred while it was slowly lowered on the tiny axial interface devices by means of the handling supports located in the cell. Once the mirror was integrated, it has been possible to test and tune the mirror position control system, allowing the adjustment of the mirror in five degrees of freedom.

At the time of writing, one important milestone in the project has been achieved with the joint testing of the M1 cell with the huge handling tool, which will later be installed in the Mirror Maintenance Building in Chile. This machine, whose specification and preliminary design were prepared by Max Kraus of ESO, allows the removal of the four primary mirrors from the transport container and their rapid and safe transfer between the M1 cells and the coating plant. The MMB Handling Tool, in its final version designed and built by GIAT, was erected in the St. Chamond assembly hall, near the M1 cell, to prove its complete functionality and to check the interfaces. The testing included, among other things, a complete transfer cycle of the primary mirror dummy from the transport container into the M1 cell and back into the container. The European testing of the handling tool is now finished – the tool is being dismantled and packed in containers to be shipped to Paranal.

The final and most exciting step of the testing phase is the tests in the inclined test set-up. To reproduce operating conditions similar to those of the telescope, a large and stiff steel frame simulating the telescope centrepiece has been manufactured. The frame is mounted by means of bearings on top of two concrete columns, built in the assembly hall. The M1 cell with the primary mirror and the M3 tower will then be attached to this structure at its twelve interface flanges and gradually rotated up to 90 degrees. This will provide the possibility of the complete verification of the system against the technical specification.

The successful completion of this test, scheduled for the end of July 1997, will allow GIAT and SFIM to ship the M1 cell to Chile. In the mean time the handling tool will have been erected, in time for the final joint acceptance testing of both the handling tool and the M1 cell-M3 tower.

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Figure 4: The M1 cell and M1 dummy is lifted by the handling tool.