Historical events that led to the Magdalena Ridge Observatory

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The observatory’s two facilities, a fast-tracking telescope and an optical interferometer, are the result of a strong science agenda supported by three enabling opportunities.

The Magdalena Ridge Observatory (MRO) consists of a fast-tracking 2.4m telescope (shown in Figure 1) and a long-baseline optical interferometer\(^1\) (see Figure 2 for an artist’s conception). Interferometry is a technique in which the light from two or more telescopes is coherently combined to form fringes that are later made into images. Animations that demonstrate the MRO interferometer (MROI) and optical interferometry are available online.\(^2\)-\(^4\) The method yields spatial resolutions dependent on the separation of the telescopes rather than their diameters.

For the MROI, which will operate 10 movable telescopes at optical and near-infrared wavelengths separated by 7.5–347m, the angular resolution will range from 0.3 to 30 milliarcseconds. Thus, the MROI will be able to produce model-independent images of targets unresolvable even with space-based facilities. A video that demonstrates optical interferometry at the MRO is available online.\(^5\) The MROI facility, along with a few others, demonstrates how this technique is maturing rapidly from experimental to facility-class operations. Nevertheless, it is important to understand that the MRO’s start-up was realized not only because of the strong science motivation but also thanks to certain timely opportunities.\(^6\)

One of these opportunities was the existence of a developed site. The first building on the Langmuir Research Site (where the MRO is located) was constructed by the Langmuir Research Laboratory in 1963 and was followed shortly thereafter by two astronomical facilities: the Joint Observatory for Cometary Research and the Supernova Search Telescope. Consequently, site characterization (e.g., seeing) data was extensive, and a basic infrastructure had been developed. MRO designers were able to match the instrument capabilities to the site, and the existing development reduced the potentially considerable infrastructure cost.

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Figure 1. Aerial picture of the MRO 2.4m telescope. The Very Large Array of radio telescopes appears in the background.

Figure 2. Artist’s impression of the MROI. The building was constructed in 2007. The telescopes are under construction at the factory, and the first telescope will be delivered to the site early in 2009.

Continued on next page
Additionally, a 2.4m telescope\textsuperscript{7} mirror and cell designed for zero-gravity conditions were donated to the New Mexico Institute of Mining and Technology (NMIMT/NMT) to develop a fast-tracking telescope. The instrument’s purpose is to track missiles over White Sands Missile Range during the day and to carry out astronomical research at night. This initiative culminated in the fast-tracking 2.4m MRO telescope, which began operation on 1 August 2008. It will shortly be complemented by the MROI, allowing for stand-alone and synergistic work between the two facilities.

Federal funding provided the final key opportunity. Following a telephone discussion and site visit between David Westpfahl (NMT) and D. Newton (Army Space and Missile Defense Command, SMDC) on 4–5 October 1995, the MRO concept was born. The MRO’s official start date was 5 October 1995. Incipient funding was established in August 1998 via SMDC, followed by an August 2001 proposal to the Remote Sensing Division of the Naval Research Laboratory (NRL). This led to a cooperative agreement between NMT and NRL (19 September 2001) to begin a partnership in the MRO. NMT and Cambridge’s Cavendish Laboratory entered into a memorandum of understanding on 27 June 2004 for the detailed design of the MROI. Additional funding for the MRO has come through special budgetary earmarks enabled by the New Mexico Congressional delegation, identifying the project by name in the federal budget. The UK Science and Technology Facilities Council provides peer-reviewed funding in support of the Cambridge collaboration.

The MRO is made possible by several key opportunities and close work between the university and governmental sectors. The MRO 2.4m telescope has entered the operational phase, and the MROI will shortly become a unique observing tool for producing images at unprecedented angular resolution. The road to establishing the observatory has been built on a strong scientific agenda and, just as important, supported along the way by timely enabling opportunities.

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References