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Telescope Tales: The UM-Dearborn Observatory Unmasked (Part I)

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Abstract: In September 2007, the University of Michigan-Dearborn observatory began regular use in support of astronomy classes offered both at UM-D and neighboring Henry Ford Community College, as well as for public observing events staged in association with planetarium shows at HFCC. This debut marked the culmination of nearly seven years of planning and effort by faculty and staff at UM-D and HFCC to design, fund, and complete a project that, at its conclusion, exceeded all expectations in terms of cost, complexity, time and, most importantly, educational potential. In this first portion of the tale, we begin with a brief overview of the original conception of the project and our quest to secure funding for it. The modifications to the design of the facility that followed upon its merger into a larger building project that led to the erection of the Science Learning and Research Center (SLRC) on the UM-Dearborn campus are then discussed. We close with a description of some specific challenges that confronted us during the construction of the observatory and the installation of the telescope. Throughout, we will focus on the pitfalls and problems that inevitably accompany projects of this scope and level of detail, and we offer our experience as a cautionary tale emphasizing the need to remain flexible, vigilant, patient and persistent in the face of adversity to those who may embark on similar enterprises.



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I. Introduction

- **September 2007**: UM-Dearborn observatory begins regular service, the culmination of ~7 years of planning and effort.
- This is the tale of the design, funding and construction of the observatory and the installation of the telescope.
- **Focus**: Pitfalls, problems and solutions.
- **Moral**: Remain flexible, vigilant, patient and persistent to ensure high degree of success.



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II. Background and Timeline

- **Summer 1999**: Departmental "Areas of Excellence" defined.
- **Summer 2001**: Initial State Capital Outlay Project @ \$14.2M with ~25,000 nsf new science construction, including a "remote" observatory.
- **Fall 2002**: Project re-scaled with purchase of Fair Lane Center to \$9.6M and ~15,000 nsf with rooftop observatory.
- **Fall 2003**: Revised program analysis and schematic design completed.
- **September 2004**: Construction commences.
- **October 2006**: Science Learning & Research Center (**SLRC**) dedicated.



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UM-D's
SLRC



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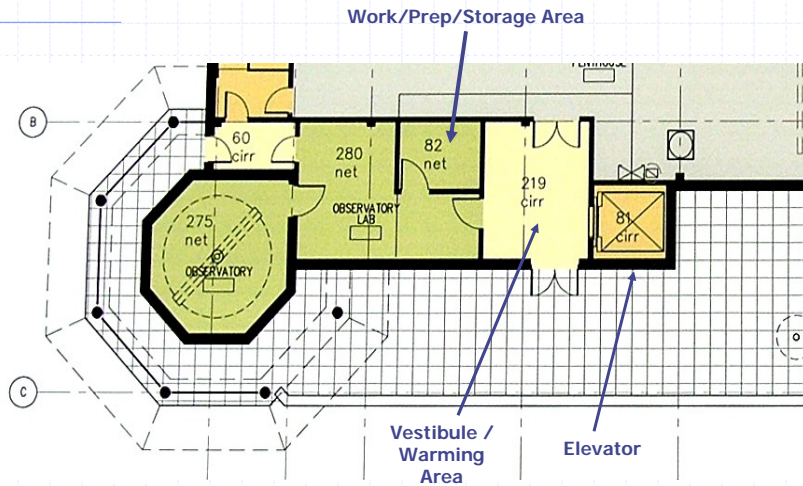
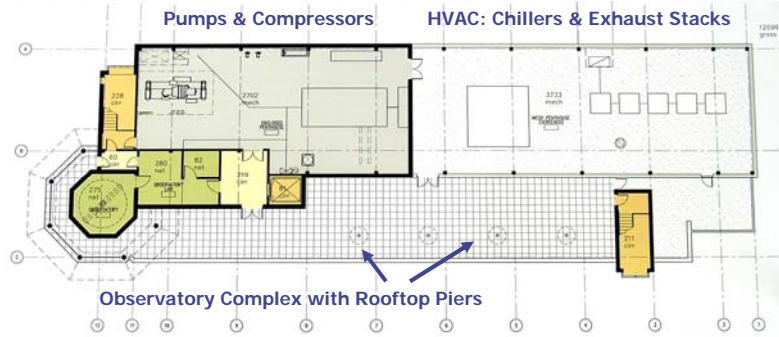
III. Telescope Funding

- **NSF CLI A&I**: "The third time's the charm."
- **DUE Grant 0310872 (September 2003)**:
"Hands-on Astronomy: Observational Activities with a Barrier Free 16-inch Telescope"
- **Total**: \$197,176, including \$52,832 in matching equipment monies.
- **Selling Points**: (1) Accessibility and (2) Institutional Collaboration: UM-D + HFCC.
- **Instrument Choices**: DFM Engineering 0.4-meter RC reflector and SBIG accessories.



IV. Observatory Design and Construction

- Floor Plan and Components: SLRC 3rd-level





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- Observing Deck and Piers:



Five piers for 8-in. reflectors, each with electrical & network connections, one designed for children and patrons with disabilities.



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- Dome:

- 12.5-ft diameter galvanized steel with motorized slit and windscreen
- Manufacturer: Ash Manufacturing Co., Inc., Plainfield, Illinois
- Cost: \$15,000
- Installation: January 2006





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Left: (a) Dome Rotation Drive Motor; (b) Position Encoder for tracking telescope movement.

Right: Shutter/Drop-out Control Box up-graded with RF receiver for remote operation.



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- 0.4-meter Telescope Pier:



- Hexagonal, interlocking truss design.
- Free-standing and unattached to dome enclosure and ascent ladder; isolated from surrounding floor by vibration-damping ring.
- Two additional building support pillars placed beneath dome area. Pillars set 32 ft. deep in clay soil; bedrock lies ~65 ft. beneath surface.
- 3/8-in. steel platform caps pier at a height of 2.0-ft above surrounding 21-in. width catwalk at top stair level.



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- Stairway to...Heaven?



Cost overruns led to initial installation of utility ladder (left) for platform access.



Six months of negotiation and ~\$15k more yielded restoration of planned 90° spiral staircase (right).



New stairway installed December 2006.

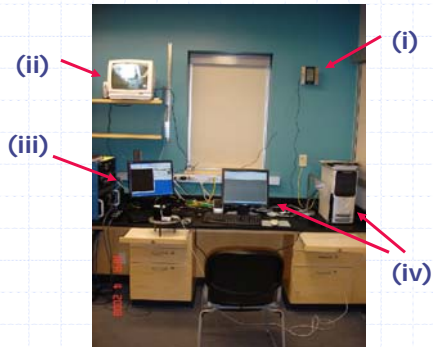


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- Interior Spaces:



(a) View into lab area from elevator/vestibule.



(b) Telescope control area:

(i) Weather station

(ii) Telescope monitor

(iii) Telescope status & function monitor

(iv) CCD control computer & monitor



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Observatory Work/Repair Area in prep room (under red-light illumination).

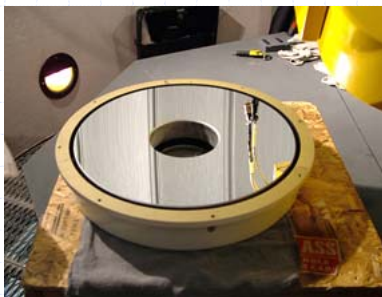


8-in. reflectors in storage in prep room.



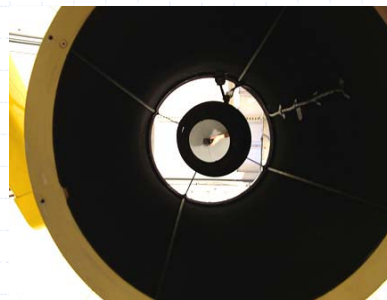
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V. Telescope Installation: 6-12 April 2007



Above: Primary mirror on platform prior to installation.

Below: View upwards through telescope tube to secondary mirror after its installation.





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Right: Ian Huss, DFM Engineering shop manager and installer.

- Basic installation completed on 12 April 2007. Final mechanical alignment and optical collimation, as well as pointing and tracking trials, could not be conducted due to inclement weather.
- “A blessing in disguise:” UM-D & HFCC staff responsible for final commissioning activities, requiring more time but yielding first-hand experience with alignment procedures and detailed knowledge of instrumental idiosyncrasies.



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UM-Dearborn Observatory

- Telescope: 0.4-m (16-in.) f/8 Ritchey-Chrétien Cassegrain
- Wave Front Quality: ●/4 peak-to-valley
- Unvignetted FOV: 1.35°
- Equatorial Fork Mount
- Dual-axis Friction Drive
- Pointing Accuracy: 20 arcsec
- Local and Remote Telescope Control
- Auxiliary Instrumentation: self-guiding spectrograph, CCD camera with filter wheel and adaptive optics; digital integrating video camera (SBIG instruments, all)
- Manufacturer: DFM Engineering, Inc., Longmont, Colorado
- Cost: \$98,000
- Funding Sources: NSF and UM-D





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VI. Recap

1. "He bends to the order of the seasons, the weather, the soils and crops, as the sails of a ship bend to the wind." – R. W. Emerson, "Farming," *Society and Solitude* (1870).
2. "With energy and sleepless vigilance, go forward and give us victories." – A. Lincoln to Gen. J. Hooker, 23 January 1863.
3. "He that has patience may compass anything." – F. Rabelais, *Works, Book 4* (1552).
4. "Perseverance is more prevailing than violence; and many things which cannot be overcome when they are together, yield themselves up when taken little by little." – Plutarch, *Life of Sertorius*, (c. 85 A.D.)