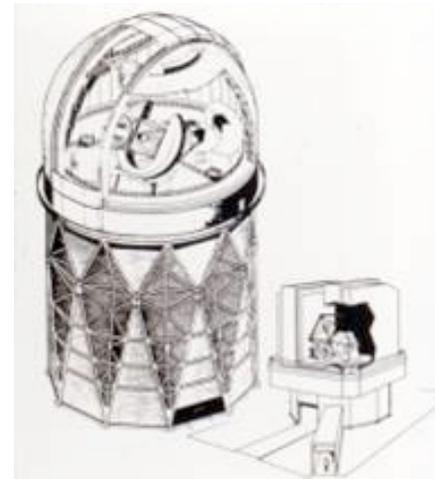
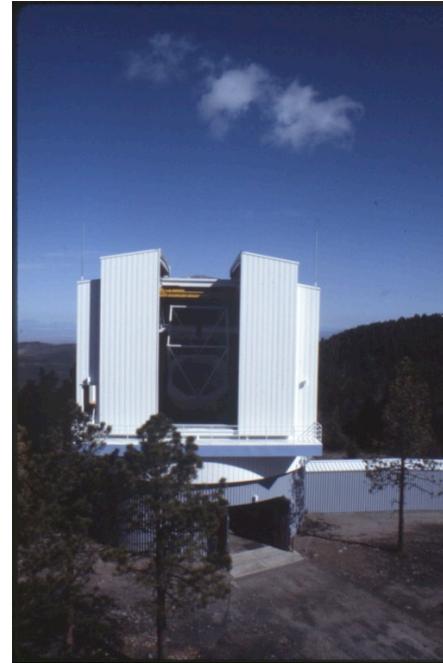


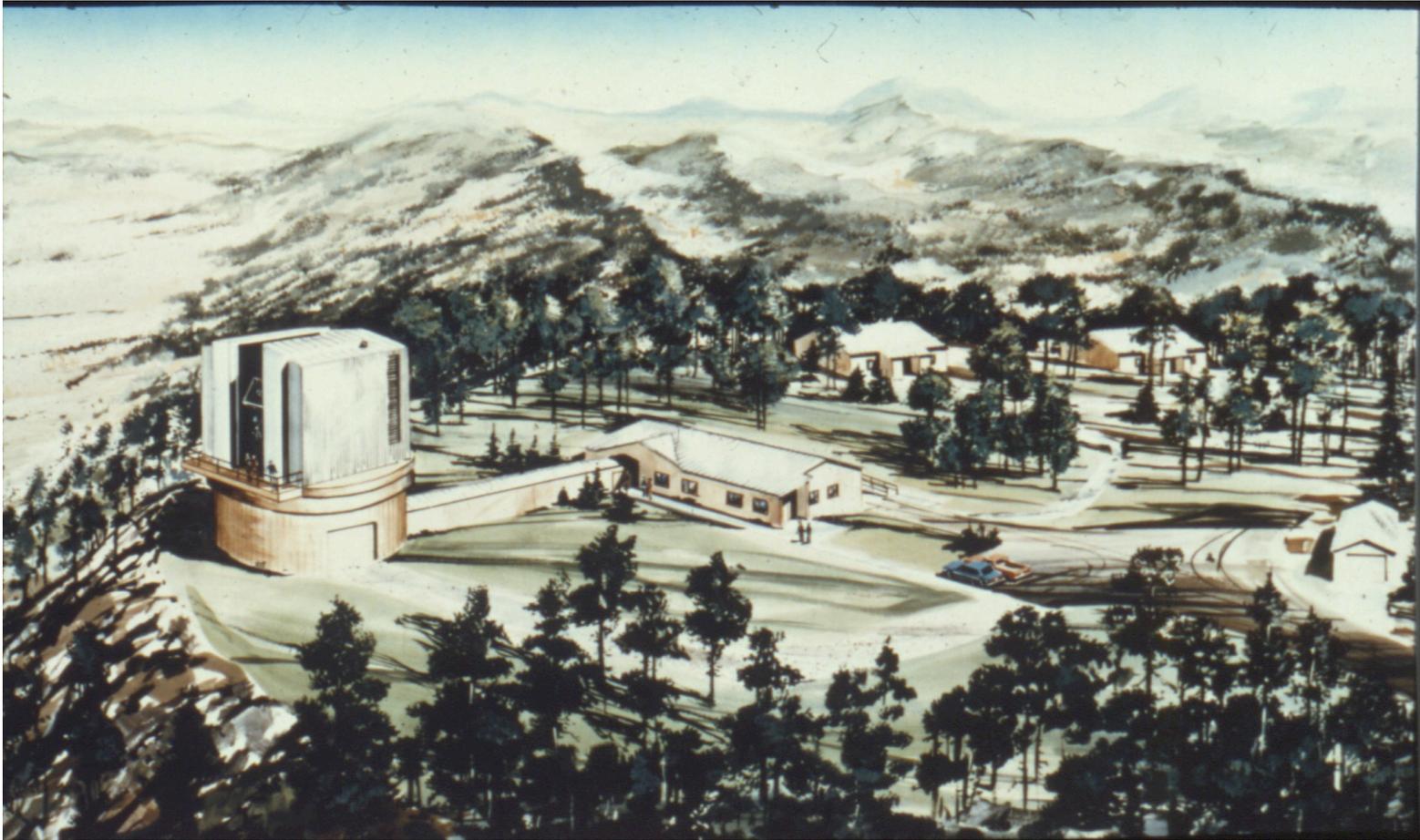
Astrophysical Research Consortium



Introduction

- By the 1950s, the biggest and best astronomy tools in the US were concentrated in a handful of universities.
- AURA national observatories didn't support the needs of a university department to implement long-term observing programs.
- In 1984, NMSU, Princeton, University of Chicago, UW, and WSU formed ARC to create an observatory that provided telescope time based on investment.
- Prior to ARC, none of the consortium members had telescopes greater than 1.0m and locations weren't ideal.
- Today, almost every telescope project is a cooperative effort – models of cooperation that rely on pioneering steps by groups like ARC.





Plan for APO

Founding Members:

University of Washington



- In 1965, UW hired Paul Hodge and George Wallerstein to join Theodor Jacobsen and expand the Astronomy Department.
- Hodge and Wallerstein hired Ed Mannery and began to plan for an observatory but realized they needed a better location outside of Washington, a larger resource base for funding, and a partnership with other astronomy departments.
- UW Regents authorized construction in 1965 and Hodge and Wallerstein spent the next ten years searching for potential partners.
- By 1981, UW ranked second in allocation of NOAO telescope time among US institutions, and first in per capita allocation.
- In 1978/79, Bruce Balick began exploring a partnership with Howard University, NMSU, and WSU and presenting ideas for an advanced technology telescope to groups around the country.
- The results:
 - a lightweight, 2m mirror only 6cm thick with a servo control system driven by computer for precision pointing
 - a cost-effective site at Sunspot, NM on the Sacramento Peak campus of the National Solar Observatory
- The overall project cost was estimated at \$3.6 million.

Founding Members:

New Mexico State University



- In 1978, with a size similar to UW and as a frequent user of Kitt Peak, the NMSU Astronomy Department recognized the need to secure access to a 2+m telescope to support faculty and graduate research programs.
- NMSU initially hoped to contribute \$500K in cash and provide a site and operations building to meet a \$900K commitment for 25% participation, but the partners decided that the Sunspot site was better and it was free.
- In July 1981, NMSU committed to \$576K for a 16% share, with hopes to raise more funds to buy a 25% share.

Founding Members:

Washington State University



- Although WSU had a small astronomy program with only two observers, Tom Lutz and Julie Lutz, UW invited them to join.
- Both groups had collaborated in the past at Kitt Peak and Manastash Ridge.
- WSU could not add personal expertise, but they could contribute a small share of money for a small share of observing time.
- For a 5% share, WSU's commitment was \$180K.
- WSU would later sell its share to the University of Colorado at Boulder in July 2001, as it could not justify the cost nor fully use its telescope time.

Founding Members:

Howard University



- In the late 1970s, Ben Peery moved to Howard University to start an astronomy program. Balick (UW) contacted him, thinking that involvement in a telescope project would help grow the new program.
- Peery proposed to buy a 30% share in the partnership, and Howard officials agreed to \$1.08 million in funding contingent upon Congress approval.
- In August 1981, the UW attorney general began drawing up an agreement for the four universities.
- However, Howard's request to Congress was excluded from President Reagan's budget and never resurfaced.
- Howard maintained an active role until the end but had to drop out in early 1982.

Founding Members:

Princeton University



- In January 1981, Princeton found out they weren't selected for a proposal to manage Hubble Space Telescope data acquisition and reduction but they still had a \$1 million endowment originally intended for that project.
- At this point, the department decided to get involved in ground-based astronomy.
- Wallerstein (UW) mentioned in an early 1982 visit with Edward Jenkins that UW was forming a consortium to build a 2.5m telescope and Princeton's \$1 million would buy a substantial share of telescope time.
- Chair Jerry Ostriker asked Don York to investigate participation in the project, but Don soon moved to the University of Chicago.
- Princeton remained interested at a \$500K level and lobbied for a larger telescope. Jim Gunn agreed to build a double imaging spectrograph.

Founding Members:

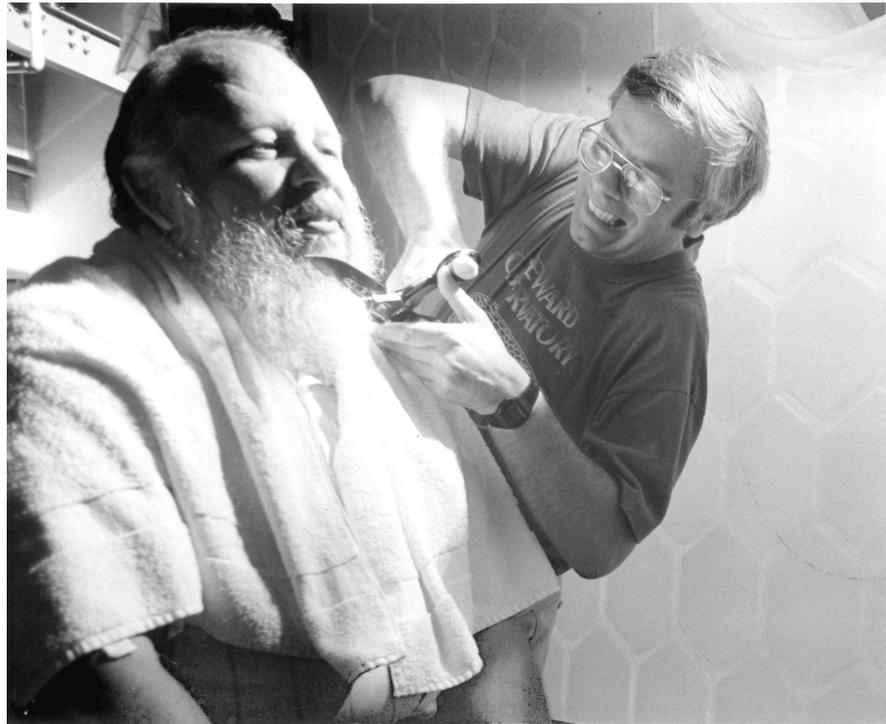
University of Chicago



- At UW, the telescope engineering group spent the rest of 1982 planning to building a larger 3m telescope, which would require another partner.
- Chicago already had access to Yerkes Observatory and MacDonal Observatory in Texas, but access to newer and larger telescopes was more difficult.
- In fall 1982, York moved to Chicago, after Dean Stuart Rice had suggested building a big telescope earlier that year.
- Rice was on the National Science Board and received a letter suggesting that space telescopes should be the national telescopes and the NSF should fund other ground-based projects.
- Having just explored this topic for Princeton, York had the solution and Chicago signed up for a share equal to UW.

Formation of ARC

- First administrative hurdle: divvying up the telescope and designing an effective form of governance, a task taken on by Bruce Margon and Don Baldwin (both UW) for most of 1983.
- The Consortium Agreement was signed by all members on January 26, 1984 and effective January 1, spelling out the obligations and allocations of each member.
- The breakdown: UW 31.25%, Chicago 31.25%, NMSU 15.625%, Princeton 15.625%, and WSU 6.25%.
- The Board of Governors has two representatives from each university (one scientist and one administrator/business person).
- At a summer 1983 meeting, Julie Lutz (WSU) proposed the name “Astrophysical Research Consortium.”
- ARC incorporated as a non-profit in Washington State on June 26, 1984 and received non-profit status on October 25, 1984.



Don Baldwin, Don York & Roger Angel

Astrophysical Research Consortium



- Project progress continued in 1983 with the final selection of the Sacramento Peak site near Sunspot, selection of a 3.5m mirror, and development of detailed concepts and budgets.
- Consortium members decided to name the site Apache Point, with final approval coming from the Forest Service on April 17, 1985.
- In 1984, the group could elect officers, make appointments, and begin spending their contributed resources.
- In the first meeting, Margon was voted the Chair of ARC, Baldwin the Secretary/Treasurer, York the Director of the Observatory, Anderson the Assoc. Director for the Site, Balick the Assoc. Director for the Telescope, and Al Harper (Chicago) the Assoc. Director for Instruments.



Sunspot, New Mexico

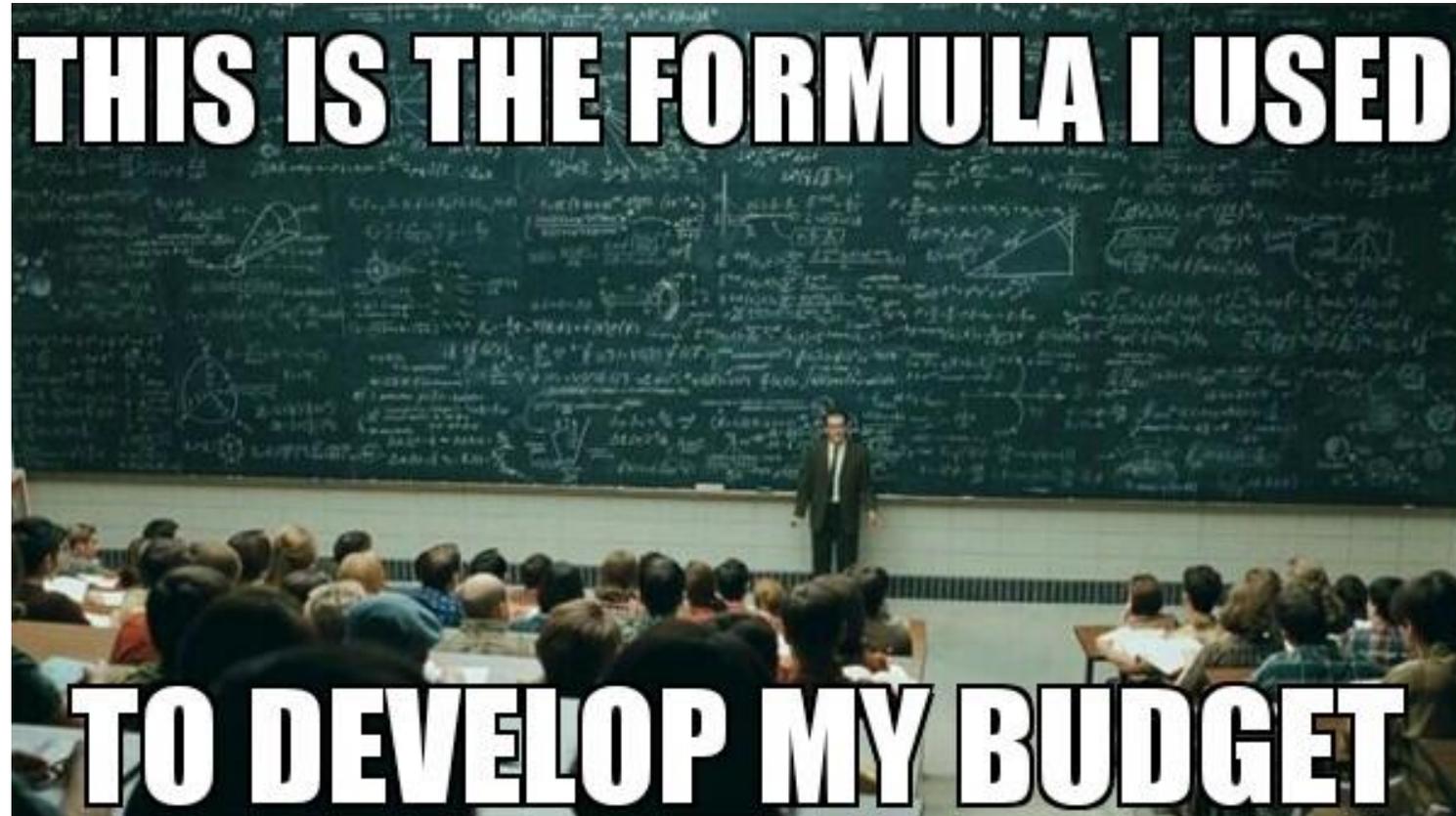
ARC Members: Then & Now

Institution	Joined	1984 %	2014 %	Comments
UW	1984	31.25% (5/16)	25.000%	
UC	1984	31.25% (5/16)	17.000%	Converts to Aldler in 2015
PU	1984	15.625% (5/32)	15.625%	Exits 7/2014
NMSU	1984	15.625% (5/32)	15.625%	
WSU	1984	6.250% (1/16)	0.000%	Exited 7/2001
IAS	1991		0.000%	Joined for SDSS only
JHU	1992		8.000%	
CU	2001		12.500%	
UVA	2007		6.250%	

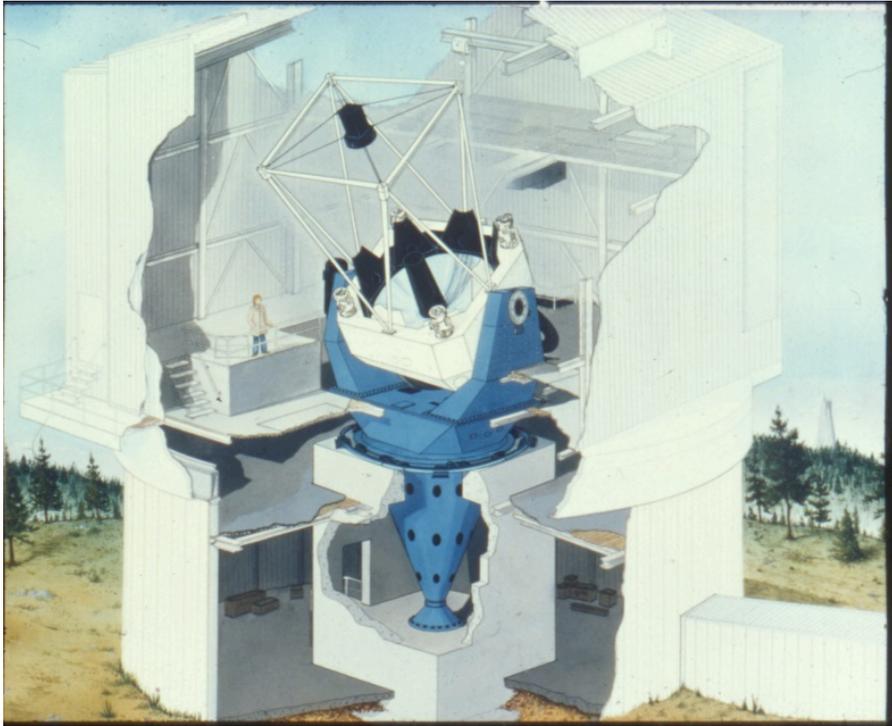
Fundraising

- Funds provided by ARC came from state sources and private donations to the member institutions.
- Members continued to look for sources to fund their individual membership dues and developed a plan for ARC to approach national organizations for funds that would reduce dues on a pro-rata basis.
- Although individual members found success, the coordinated effort from ARC did not. However, ARC found huge success with NSF funding.
- Once ARC formed, proposed budgets for 1984 (\$1m) and 1985 (\$4m) were put in place to start design and building of the telescopes and facilities and to complete site preparation.
- With rising costs, tough decisions had to be made, such as eliminating an on-site aluminizing facility at the observatory.

THIS IS THE FORMULA I USED

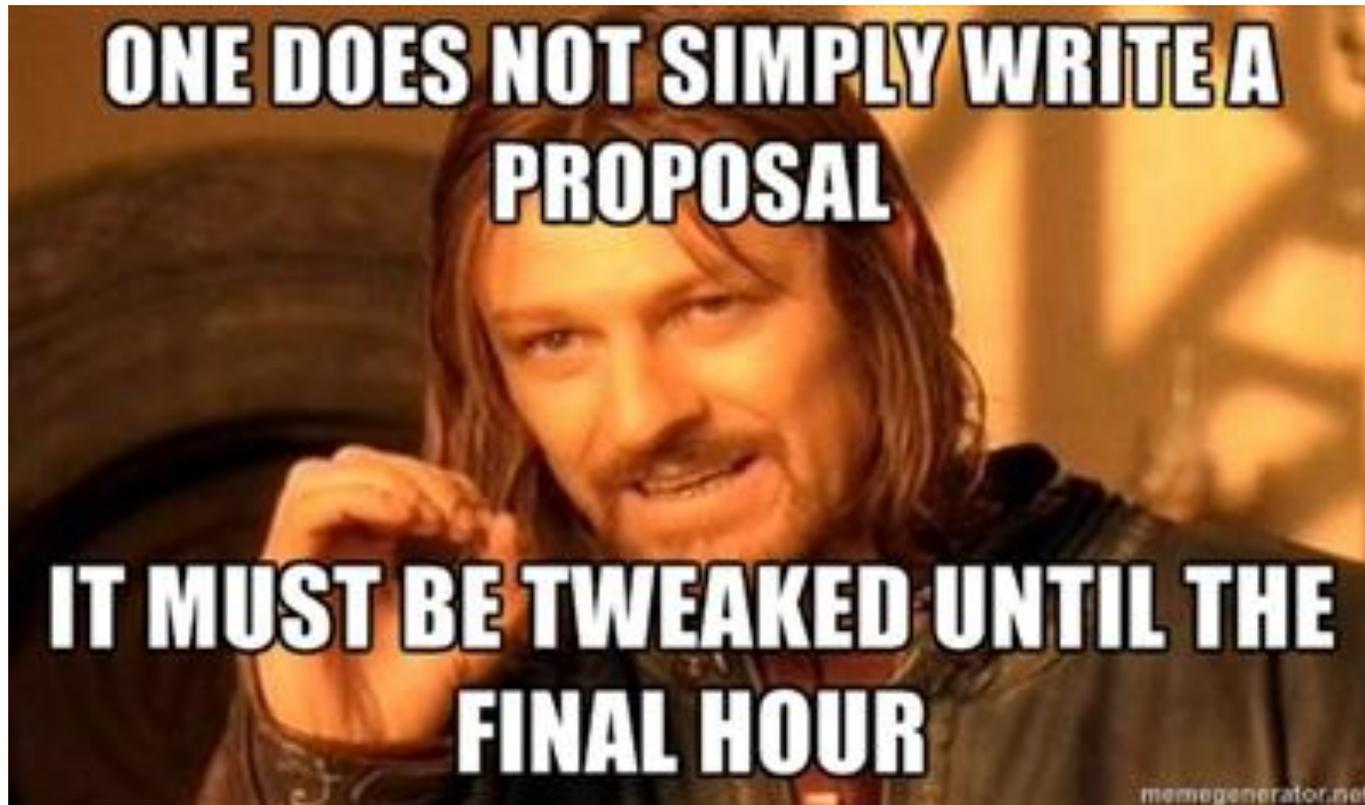


TO DEVELOP MY BUDGET



NSF Proposal

- Originally, members planned to submit a proposal by the end of 1983 for \$3.75 million, but by the time it was submitted in May 1984, the amount had grown to \$5.565 million.
- The in-person peer review took place on October 23, 1985 and in early 1986 NSF asked ARC to consider a revised budget of \$3.3 million.
- ARC agreed to accept the revised budget and move forward with telescope fabrication. NSF agreed to give \$450K more, with ARC members coming up with the remaining \$750K.
- Given budget restraints, only the echelle spectrograph, 2m camera and a makeshift CCD camera could be finished.
- On July 11, 1986, NSF granted ARC \$3.74 million but the project was behind schedule by one year.



**ONE DOES NOT SIMPLY WRITE A
PROPOSAL**

**IT MUST BE TWEAKED UNTIL THE
FINAL HOUR**

memegenerator.net



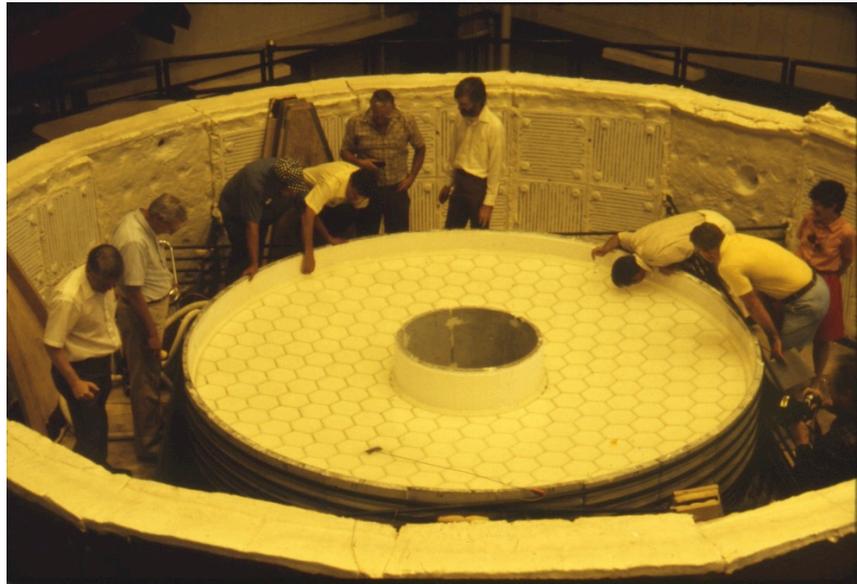
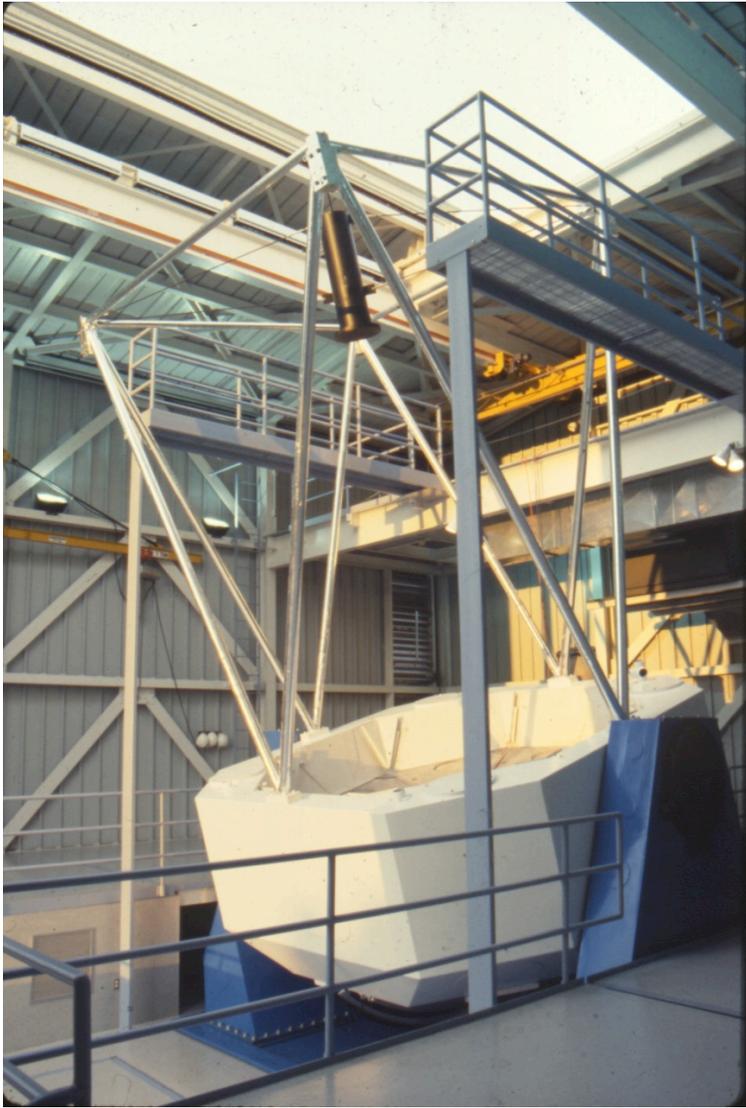
Annual 3.5m Telescope Assessments

Capital + Operations Combined

Year	Assessment *	Comments
1994	\$466K	Incl \$34K for secondary improvement.
1997 **	\$950K	Incl \$300K for Capital
1999	\$1,000K	Incl \$275K for Capital
2004	\$1,357K	Incl \$310K for Capital
2009	\$1,570K	Incl \$350K for Capital
2014	\$1,555K	Incl \$350K for Capital

* Misc revenue offsets operations assessment.

** Capital budget assessment initiated in 1997.



Completion of APO

- In early 1993, with the primary mirror on site, ARC set a date for the dedication to coincide with a rare annual solar eclipse the following year.
- The eclipse took place at 10:30am during which guests from the Goddard Space Flight Center imaged solar spectral lines with their 12m spectrometer.
- The dual imaging spectrograph (DIS) built by Gunn took its first images in April 1994 and has since become the observatory workhorse.
- On May 27, 2004, ARC celebrated the 20th year of its existence and the 10-year anniversary of the 3.5m telescope. The accomplishments: creating a thriving organization, constructing a world-class observatory, and fulfilling its goals of building strong astronomy departments and conducting great scientific work.

Board of Governors

1984 - Current



Princeton

Ostriker
Sinisgalli
Gunn
Tremaine
Turner
Spergel
Strauss



Chicago

Rice
Rosner
Schramm
Oxtoby
Konigl
Turner
Olinto
Fefferman
Kolb



UW

Baldwin
Margon
Hogan
Kwiram
Balick
Irving
Anderson



NMSU

Beebe
Darnall
Burnes
Casillas
Adams
Dwyer
Walterbos
Paap
Czerniak
Murphy
Brown
Chanover



WSU

Lutz
Radziemski
Spitzer
Brown
Miller



JHU

Heckman
Poehler
Bagger



IAS

Bahcall
Rowe
Masten
Tremaine



UC-Boulder

Peterson
Shull
Barker
Pampel
Moore
Rankin
Darling



UVA

Rood
Brunjes
Hawley
Galloway
Skrutskie

Board of Governors

as of May 1, 2014

UW	Dr. Werner Stuetzle Divisional Dean of Natural Sciences email: wxs@u.washington.edu	Dr. Scott Anderson Chair, Dept. of Astronomy email: anderson@astro.washington.edu
UC	Dr. Edward (Rocky) Kolb Dean of Physical Sciences Division email: rocky.kolb@uchicago.edu	Dr. Angela Olinto Chair, Dept. Astronomy & Astrophysics email: olinto@kicp.uchicago.edu
NMSU	Dr. Nancy Chanover Assoc. Professor, Dept. of Astronomy email: nchanove@nmsu.edu	Dr. Jeffrey Brown Assoc. Dean for Research, Arts & Sciences College email: jbrown@ad.nmsu.edu
CU	Dr. Patricia Rankin Assoc. Vice Chancellor for Research email: patricia.rankin@colorado.edu	Dr. Jeremy Darling Assoc.Prof., Dept. of Astrophysical & Planetary Sci email: jdarling@colorado.edu
IAS	Mr. John Masten Assoc. Director of Finance & Administration email: jmasten@ias.edu	Dr. Scott D. Tremaine Professor, School of Natural Sciences email: tremaine@ias.edu
JHU	Dr. Jonathan Bagger Vice Provost of Grad Programs email: bagger@jhu.edu	Dr. Timothy M. Heckman Director, Center for Astrophysical Sciences email: heckman@pha.jhu.edu
UVA	Dr. John Hawley Assoc. Dean for the Sciences email: jh8h@virginia.edu	Dr. Michael Skrutskie Chair, Dept. of Astronomy email: mfs4n@virginia.edu

Administrators & Directors *as of May 1, 2014*

Dr. Rene Walterbos (**ARC Board Chair**)
Professor, Dept. of Astronomy
email: rwalterb@nmsu.edu

Dr. Suzanne Hawley (**3.5m Telescope Director**)
Professor and Assoc. Chair, Dept. of Astronomy
email: slh@astro.washington.edu

Dr. Daniel Eisenstein (**SDSS-III Director**)
Professor, Dept. of Astronomy
email: deisenstein@cfa.harvard.edu

Dr. Michael Blanton (**SDSS-IV Director**)
Assoc. Professor, Dept. of Physics
email: blanton@physics.nyu.edu

Bruce Gillespie (**SDSS Program Manager**)
ARC Program Administrator, JHU
email: gillespie@apo.nmsu.edu

Dr. Ronald S. Irving (**ARC Secretary/Treasurer**)
Professor and Chair, Dept. of Mathematics
email: rsi@uw.edu

Michael L. Evans (**ARC Business Manager**)
Manager of System Operations, UW
email: evans@astro.washington.edu

Dr. Michael Strauss (**SDSS-III Advisory Council Chair**)
Professor, Dept. of Astrophysical Sciences
email: strauss@astro.princeton.edu

Dr. Keivan Stassun (**SDSS-IV Advisory Council Chair**)
Professor, Dept. of Physics & Astronomy
email: keivan.stassun@vanderbilt.edu

Sloan Digital Sky Survey

Phase	Years	No. of Members
SDSS Const/Comm	1992-2000	-
SDSS-I	2000-2005	14
SDSS-II	2005-2008	25+
SDSS-III	2008-2014	37+
SDSS-IV	2014-2020	50+



For more information visit:

SDSS-I/II www.sdss.org

SDSS-III www.sdss3.org

SDSS-IV www.sdss3.org/future



Let's celebrate...

- 30 years of ARC's existence
- 20-year anniversary of the dedication of the 3.5m telescope
- APO providing quality observing time to astronomers and students
- Successful completion of SDSS-III observing next month

