

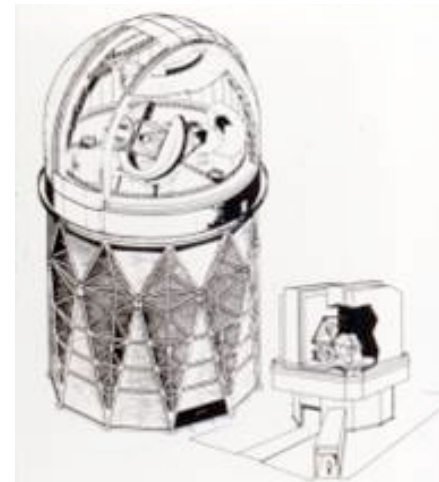
# Astrophysical Research Consortium

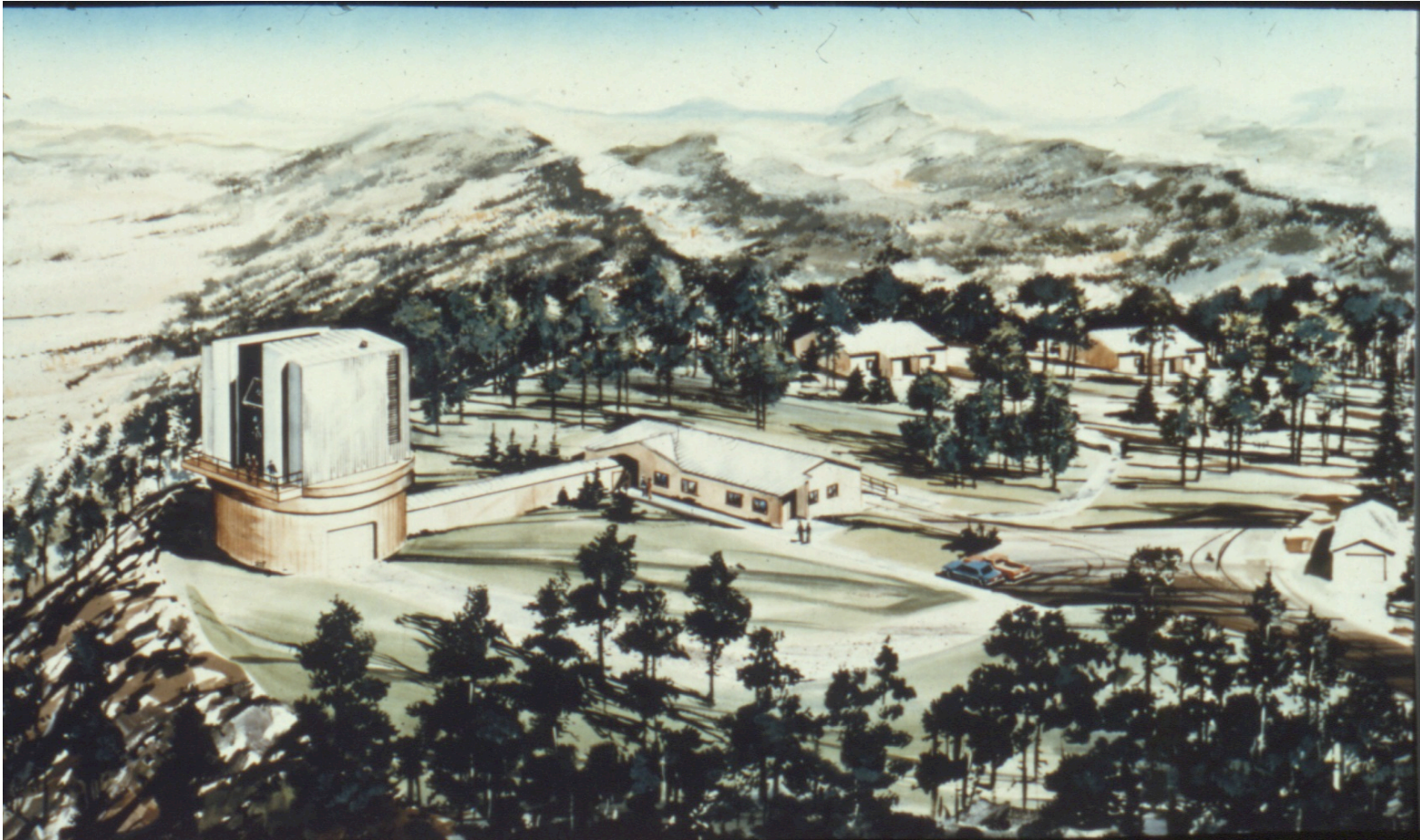




# Introduction

- 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:*

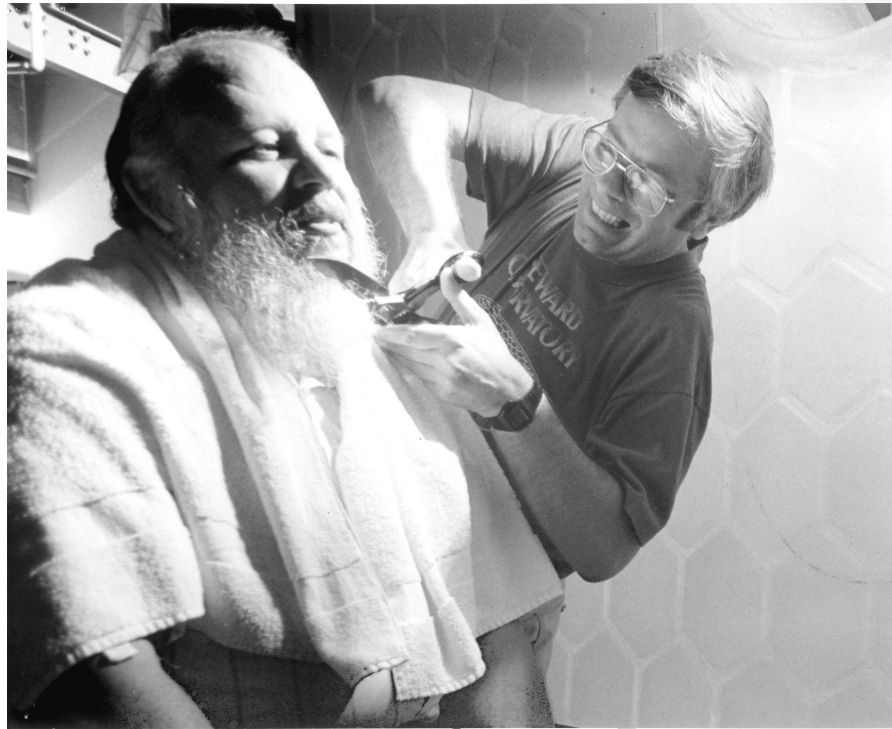
# University of Chicago



- 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

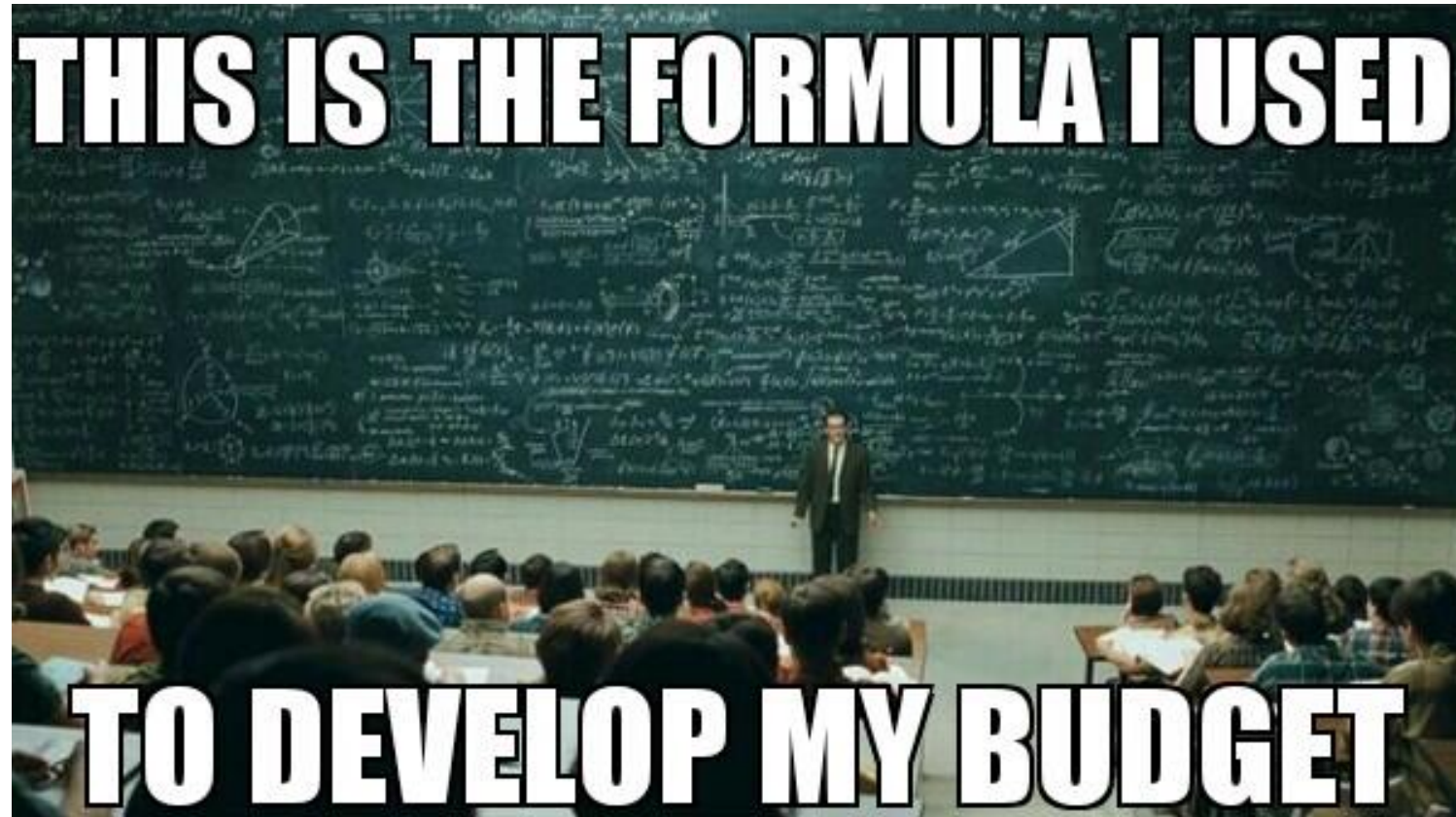
Institution	Joined	1984 %	2014 %	Comments
UW	1984	31.25% (5/16)	25.000%	
UC	1984	31.25% (5/16)	17.000%	Converts to Aldler in 2015
PU	1984	15.625% (5/32)	15.625%	Exits 7/2014
NMSU	1984	15.625% (5/32)	15.625%	
WSU	1984	6.250% (1/16)	0.000%	Exited 7/2001
IAS	1991		0.000%	Joined for SDSS only
JHU	1992		8.000%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



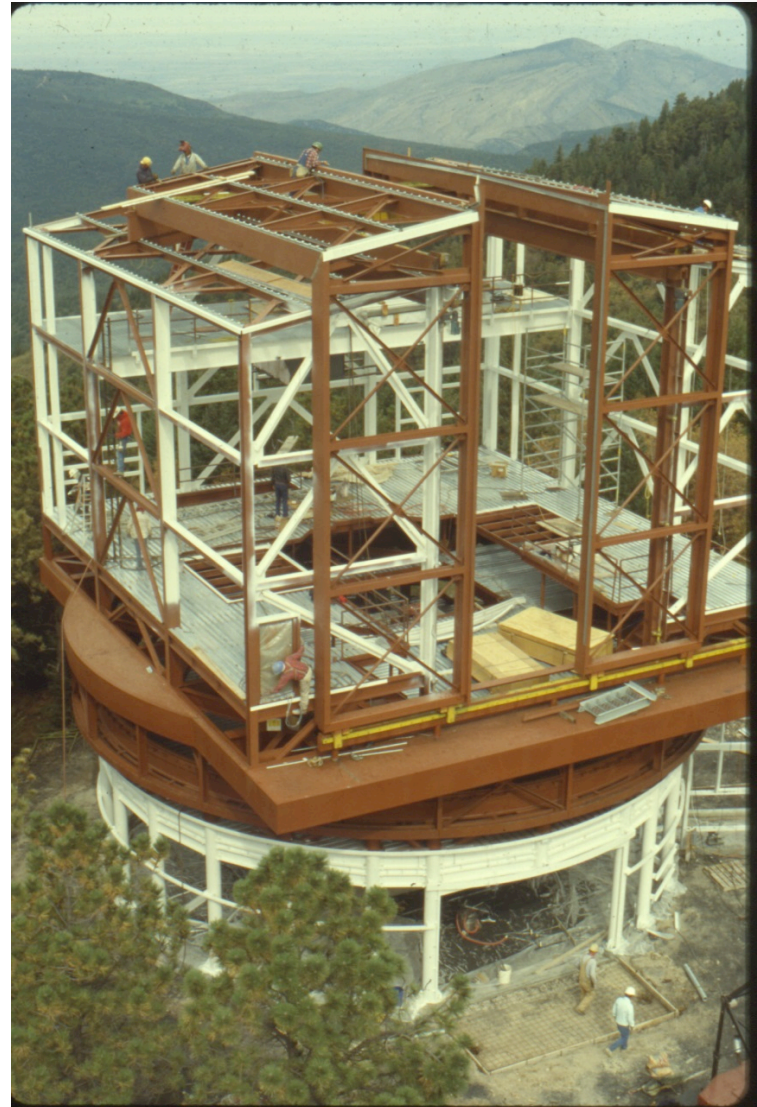
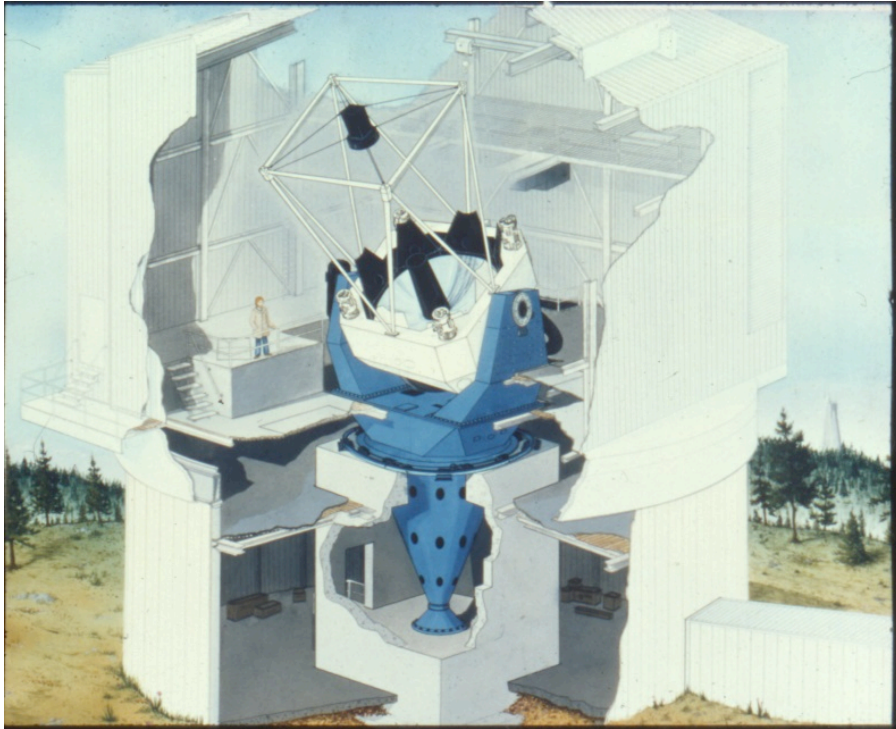
# Fundraising

- 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**



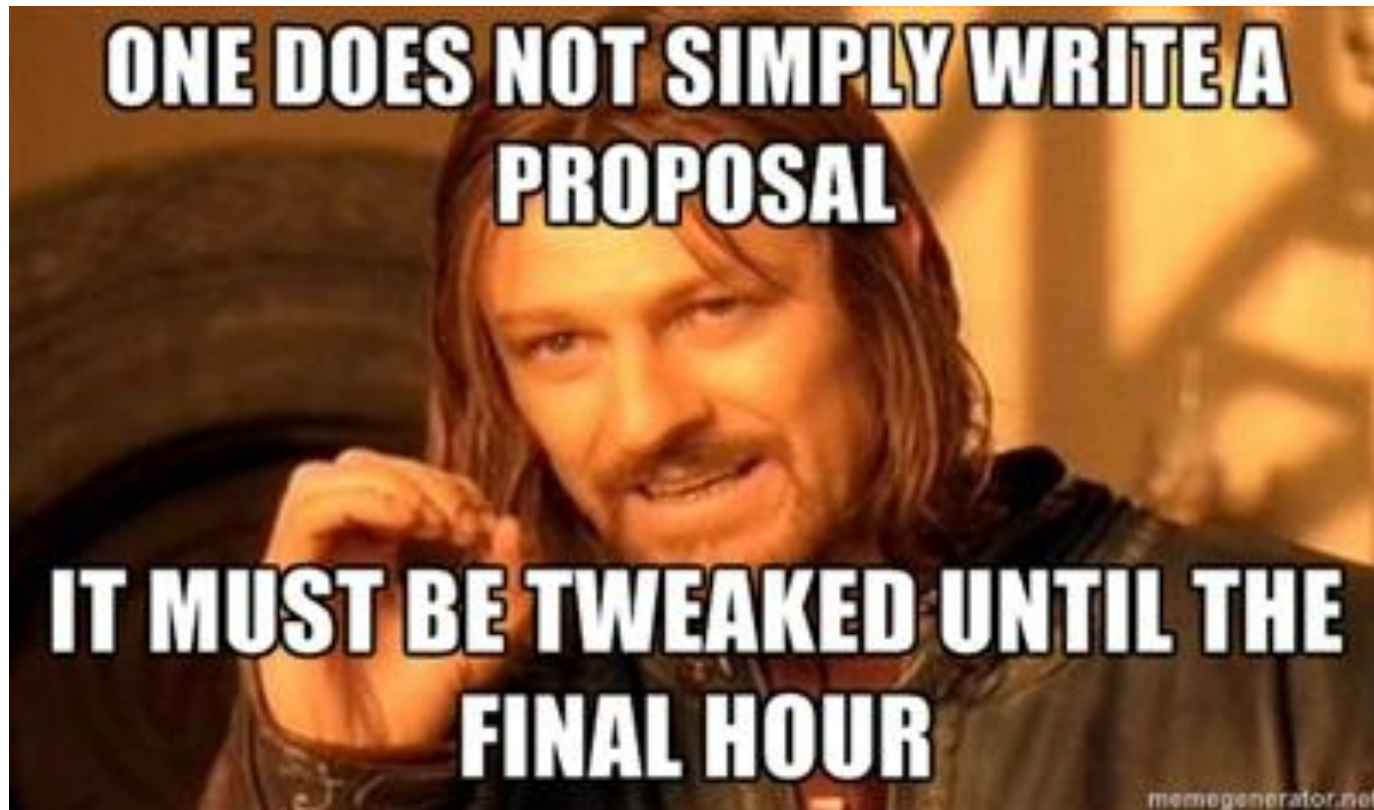
**TO DEVELOP MY BUDGET**





# 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





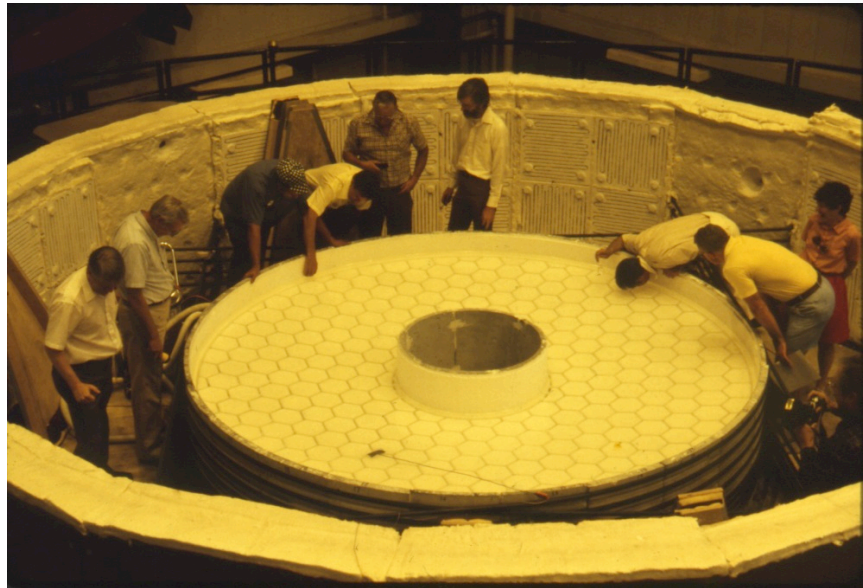
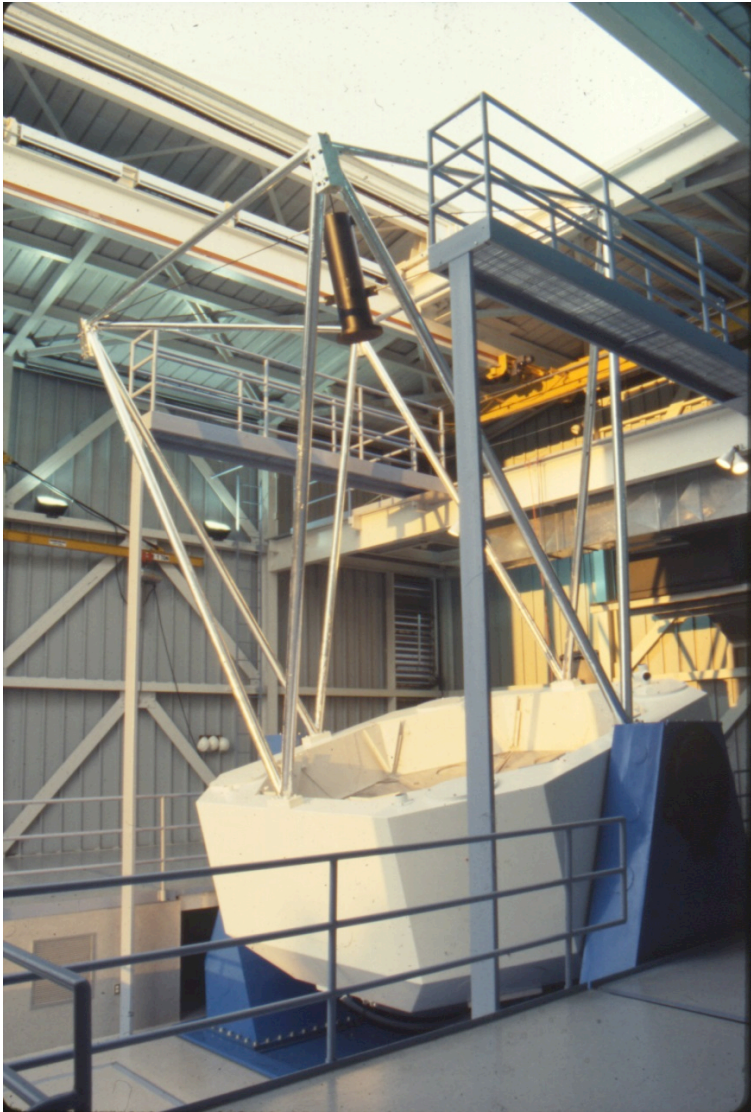
# Annual 3.5m Telescope Assessments

## 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 20<sup>th</sup> 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*

<b>UW</b>	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
<b>UC</b>	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
<b>NMSU</b>	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
<b>CU</b>	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
<b>IAS</b>	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
<b>JHU</b>	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
<b>UVA</b>	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](mailto:rwalterb@nmsu.edu)

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

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

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

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

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

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

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

Dr. Keivan Stassun (**SDSS-IV Advisory Council Chair**)  
Professor, Dept. of Physics & Astronomy  
email: [keivan.stassun@vanderbilt.edu](mailto: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](http://www.sdss.org)

SDSS-III [www.sdss3.org](http://www.sdss3.org)

SDSS-IV [www.sdss3.org/future](http://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



