APPENDIX G

Strategic Master Plan Windows on the Universe Center for Astronomy Outreach (DNA)

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NOIRLab Reference Code

Release Version: 1.0
Release Date: 2023-04-01
Internal Use

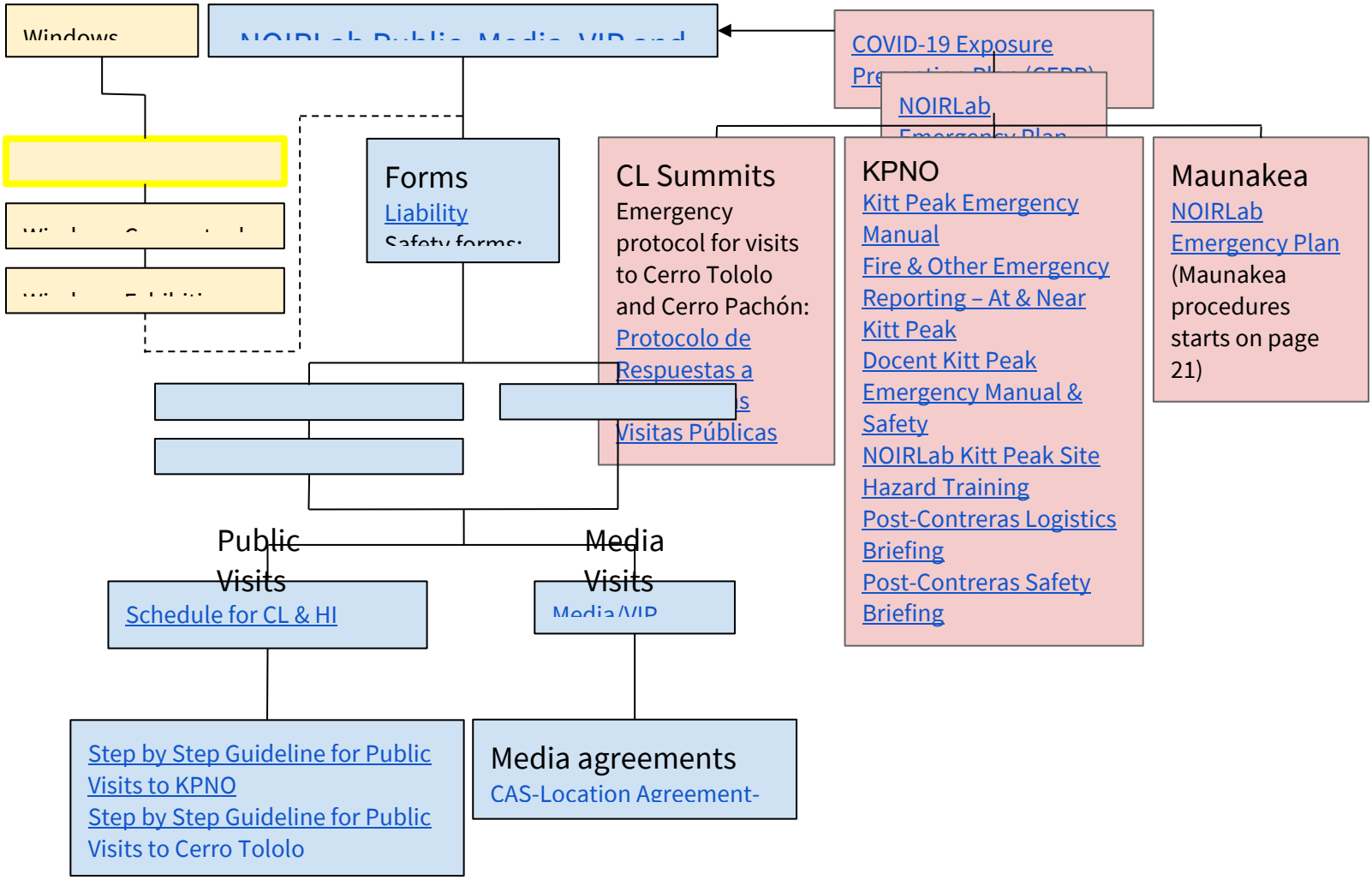
Table of Contents

About this document

This document is the first in the series of three main documents (still under development):

1. Windows Strategic Center Master Plan (this document)
2. Windows Conceptual Exhibitions Content & Audiovisuals Plan
3. Windows Exhibition Details Implementation Plan

Also of interest may be the further cascade of Public, Media, VIP and Staff Visits documentation:



Cascade of NOIRLab Public, Media, VIP and Staff Visits documentation.

In particular these may be of interest (still under development):

- NOIRLab Public, Media, VIP and Staff Visits Procedure (final)
- Public Visits Manual for KPVC Guides (2013 NOP edition) (v.0.1)

- Full Operations Plan for KPNO/KPVC Public Visits
- Windows Construction and Operations Budget

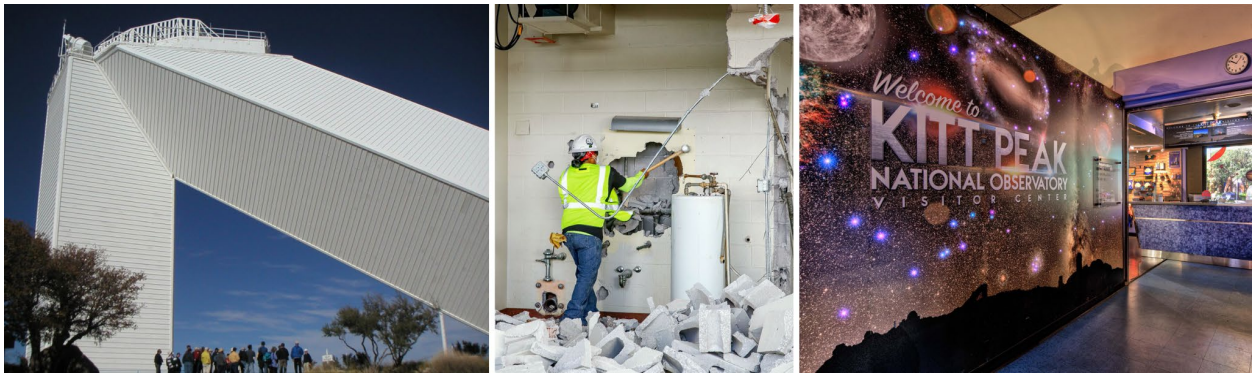
This Strategic Master Plan frames all planning around visitor and community needs and creates a strong, effective future for the new KPVC/Windows Center. The strategy:

1. Flows from, or creates a shared and enduring vision of the future of the organization
2. Informs capital budgeting and human resource development decisions
3. Guides managerial action and provides benchmarks, and
4. Directs management attention to emerging strategic issues.

This document identifies the Windows Center's vision, mission, objectives, key performance indicators, Community Needs Assessment, visitor experience, generic learning outcomes, IT planning, content production strategy (during construction as well as operations), operations plan, staffing plan, and visitor accessibility issues. In other words, this is the "DNA" of the Windows Center.

It will explain who Windows is going to serve, what the benefit will be, what direct and indirect benefits will this bring to the larger community, and which important, otherwise unmet needs are met.

The NOIRLab Kitt Peak Visitor Center (KPVC) is here defined to include the operation of the NOIRLab Windows on the Universe Center for Astronomy Outreach (Windows Center).



Left: The McMath-Pierce Solar Telescope facility becomes the home of the NOIRLab Windows on the Universe Center for Astronomy Outreach. It is an iconic structure recognized throughout Southern Arizona and visible from 75 miles away. Right: The Kitt Peak Visitor Center already welcomes around 16,000 people to the mountain in a normal year.

Executive Summary

AURA/NOIRLab is currently transforming the recently-retired McMath-Pierce Solar Telescope (MMP), located at Kitt Peak National Observatory (KPNO) near Tucson, Arizona, into a dynamic astronomy visualization and presentation center focused on NSF-funded astronomy, while preserving its iconic architecture and unique solar viewing capabilities. The name of the project, "Windows on the Universe Center for Astronomy Outreach" (hereafter "Windows Center" for brevity), was specified by the NSF.

The Windows programs and exhibits will be designed to change participants' knowledge, viewpoints and thinking about science. Particularly for young people, NOIRLab will implement programs that have the potential to positively influence life outcomes, for example by illuminating career possibilities or providing motivation to obtain advanced education.

We will design the programs, exhibits, activities and visitor facilities so that it becomes a "must see" destination for residents and visitors to the region, versus a "maybe go sometime" destination. Equally, creating this high level of appeal applies to programs that NOIRLab will run off-site, either in person or via the Internet.

One of the goals of the NOIRLab Windows Center is to showcase astronomy research from NSF-supported facilities around the globe. This alone makes it unique, but the setting — in the facility housing the former largest solar telescope in the world — makes it even more so. The scientifically historic heliostats will remain operational, featuring live images of the Sun, Moon, and planets.

After all building modifications have been completed, the spaces within the MMP will be filled in phases in order to remain within the project resource envelope. Approximately 8,000 square feet of former science and engineering support rooms will be modified to enable the eventual installation of two astronomy data visualization systems — Science On A Sphere (SOS) and a Digital Planetarium — along with interactive exhibits and an astronomy classroom. Both the SOS and Planetarium will be equipped to take astronomical imagery and modify such imagery into dataset files for spherical or hemispherical projection.

The experience will be one that combines a historical retrospective of the facility with an overview of modern astronomy. The use of the MMP facility will provide a unique environment, rich with a history of scientific discovery, to establish a context for visitors that bridges the history of astronomy research with humanity's current understanding of the cosmos. The MMP facility will be restored to original operational condition, especially the three heliostats which will allow live daytime solar disk viewing and interactive spectroscopy experiences for visitors as well as some nighttime viewing of bright

objects.

An important context for the Windows Center is its location on lands of the Tohono O'odham Nation (TON). The Center will make it a high priority to foster partnerships with members of the Nation as guides and in the development of content sensitive to, and highlighting, the TON history and the relationship with KPNO.

A broader context for the center will focus on the tools of contemporary astronomy and the roles of NSF-supported astronomical research facilities including KPNO and all of the NOIRLab Programs. It is envisioned that many of the exhibits and displays will be available virtually to make the center accessible to audiences unable to visit the physical Center. Most, if not all, content will also be made available under a Creative Commons Attribution license to share with science centers and planetariums for adaptation or as virtual experiences.

A key objective for the Windows Center is a transition to operations that are almost fully supported by revenue from visitors, fundraising and other funding sources.

Introduction

History of the MMP

The concept of a national optical observatory was born from a conference at Lowell Observatory in Arizona in 1953, during the days of the Space Race used to strengthen science in the United States. A few years later in 1957, around the time of the launch of the Soviet Sputnik satellite, civil engineer William F. Zabrinskie was commissioned to prepare three preliminary designs for a solar telescope building. Skidmore, Owings, and Merrill additionally developed ten designs, two of which were recommended for final consideration by AURA. NASA would open its doors a year later in 1958 to accelerate aerospace research and development.

Dedication on 14 November 1962.

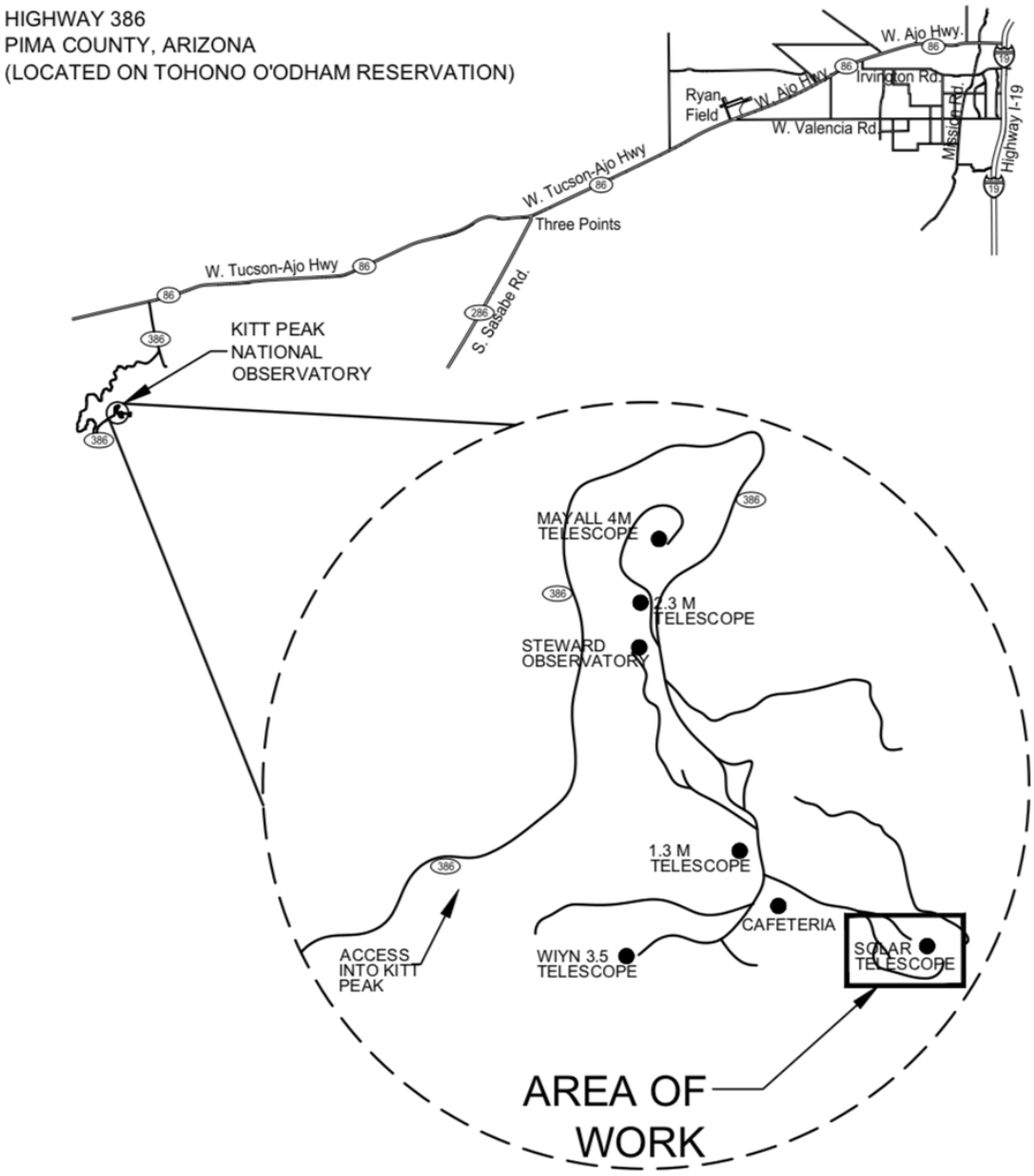
Left to right: Enos Francisco, Mary McMath, Madeline McMath, Allen Waterman, and Keith Pierce.

The Sky Islands in Arizona proved to be a favorable location for a new solar telescope, given its high altitude and relatively isolated 'ecozone' in the midst of the Sonoran Desert. Kitt Peak is located on the ancestral lands of the Tohono O'odham. A lease was signed with the Tohono O'odham that allowed construction of Kitt Peak National Observatory. This national observatory became the home to a vast collection of optical, infrared, and radio telescopes, with a rich legacy of discovery and pioneering advancement in technology. The solar telescope — now called the McMath-Pierce Solar Telescope after astronomers Robert Raynolds McMath and Keith Pierce — was opened in 1962 for scientists and technicians to perform observations and develop instruments. Astronauts from the Mercury, Gemini, Apollo, Skylab, and even Space Shuttle missions used the telescope's 2.1-meter, 1.6-meter and 1.5-meter heliostat mirrors over the 1960s and 1970s for their unique capability of projecting large-scale images of the Moon.

1964 view of the Observing Room, in what was at the time simply called the Solar Telescope.
Left to right: Astronaut Donn Eiseie, Don Wilhelms (USGS), Spencer Titley (UA), Ray Zedekar (NASA), Astronaut Theodore Freeman, Astronaut Frank Borman, Astronaut Eugene Cernan, and Harold Masursky (USGS) (1964). Credit: USGS

An important mission for NOIRLab is to share the new legacy of discoveries from all NSF-funded observatories around the globe, and to inspire, engage, and educate the general public. Delivering

some of the most exciting discoveries with the world by developing media that can be displayed in hundreds of museums is another. Although it was not originally designed to be a museum, the McMath-Pierce Solar Telescope has finished its science mission and has been transformed to an outreach center. It is now in the final stages of construction, and will be opening in 2024.



Project Location.

Our communities

NOIRLab's observatories in both hemispheres are deeply connected to their local communities, with whom strong relationships are essential. To almost 25,000 visitors every year (~16,000 at Kitt Peak in AZ and ~8000 in HI and CL), the observatories are exciting portals to the Universe. For locals, the observatories are often recognized centers of scientific excellence and the gateways to interesting and rewarding careers.

Among our relationships with local stakeholders, the most highly valued is our relationship with the Tohono O'odham Nation (TON). Successful relationship-building with tribal members depends strongly on Tohono O'odham families and individuals feeling welcome on the mountain. The KPVC serves the tribal members with nighttime star parties, observing programs and after-school educational programs. Special events for tribal members, like the Observatory Open House/Family Nights, are extremely popular, and outdoor recreational opportunities, like those enabled by the picnic area, invite tribal members to enjoy the beauty of Ioligam Du'ag, with which the Tohono O'odham have strong cultural, spiritual, and historical ties. KPVC programs, including nighttime observing programs, daytime tours, and special programs, are free to members of the Tohono O'odham Nation, whose attendance is sponsored by KPNO.

Among our main community stakeholders are (in order of priority):

1. NSF
2. TON
3. NOIRLab
4. AURA
5. Local community

Mission

The mission of the Kitt Peak Visitor Center is to inspire a sense of wonder and awe about the Universe through exhibits, daytime tours, and nighttime public programs.

Windows engages the world-wide community of life-long learners with advances in the field of astronomy, with a special focus on our closest star, the Sun. (Heidi)

With the Sun in focus, the Windows Center aims to create an inclusive and engaging experience that showcases the people, NSF-supported facilities, and history, including the Tohono O'odham Nation,

that have advanced our understanding of the cosmos[1].

Vision

Creating experiences to foster a community of lifelong learners that value the impact NSF-funded astronomical discovery has on society and our understanding of the Universe.

A world in which astronomy inspires the best of humanity (Heidi)

Big Idea

The Windows Center does not operate stand-alone but is an integrated part of the KPVC.

The Big Idea for the Windows Center is:
How we reached our current understanding of where we are in the Universe, and how the KPNO contributed to this understanding.

This big idea will be supported by, and work with, the overall tagline used by the organization:
Discovering Our Universe Together.

Alternative tagline for Windows:
The Sun is the Center

Values

The KPVC adopts and mirrors the NOIRLab values:

- Transparency

[1] Lori: The vision I see as the imagined visitor experience. It's the outer skin, the look and feel, the theme that ties all the exhibits together. I imagine that being the Sun, its place in the universe and its role in our lives -- with the solar telescope and live images of the Sun being at the heart of the center. How would that be used to achieve the mission? A start would be by tying the old NSF facility (MMP) to the new NSF facility (DKIST). Then considering the Sun as a star, the fundamental "unit" of the universe (we talk about galaxy sizes in terms of numbers of stars, for instance, not numbers of HII regions or atoms), we connect to stellar astronomy at NSF centers. Stars host planetary systems and sustain life, so we also connect to exoplanet science at NSF centers. Stars process the material of the Universe, providing the enrichment necessary for life (and stuff), etc and sometimes dispersed violently — connect to LIGO. Stars merge to form black holes —connect to EHT. The Sun, weather, and climate are all aspects of the theme that can be included in even some of the minor exhibits (e.g. water in a desert environment). My feeling is that the MMP should be at the center of the Center (!) due to its unique nature, and this lends itself best to the Sun theme.

- Respect and Empathy
- Diversity and Inclusion
- Accountability and Responsibility
- Integrity and Ethics
- Safety

Goals

The goals of the KPVC and Windows Center are:

1. To inform and educate the public daily about basic astronomy, its current research themes, and the nature of the scientific process.
2. To showcase astronomy research from NSF-supported facilities around the globe.
3. To transition to operations that are almost fully supported by revenue from visitors, fundraising and other funding sources.

Topics of Interest

- Recognizing and appreciating the wonders of the night sky
- Recognizing the location of KP on Tohono O'odham Nation Land
- Create a working partnership with the Tohono O'odham Nation
- Acknowledging the way of life, and understanding of the Universe by the Tohono O'odham Nation on site
- Asking questions about our world beyond Planet Earth, looking for ways to answer them
- Understanding our place in the Universe, and how we know
- Interpreting the Universe through the information that is embedded in light
- How instrumentation/tools are designed to help us answer questions and how they have evolved over time
- Communicating the mandate and extent of work of the National Science Foundation with regards to Astronomy
- Including current science in the exhibits, ensuring visitors understand the research being done at KPNO
- Communicate the historic achievements, functionality and significance of the MMP Solar Telescope (connect to where DKIST takes over in this research)

NOIRLab Synergies

Many of the EPO functions in KPVC already exist within NOIRLab's Communications, Education and Engagement (CEE). By integrating KPVC and CEE operations, we seek to:

- Eliminate single-point failures
- Use standard operating procedures and tools
- Eliminate duplication of work, skills and positions
- Benefit from synergies
- Ensure a common messaging for all these activities
- Implement the "NOIRLab ethos" for these activities
- Reduce the overall costs

These are functions like content development, budget tracking, staffing planning, promotion, web, graphics, education, exhibition development, social media, and visits which already exist in CEE units. These units will, in close collaboration with the KPVC Operations Manager, develop and maintain new education and engagement programs, social media posts, collateral, exhibits, audiovisuals, web pages, planetarium shows, 360-degree virtual reality images and videos, visits messaging, internal communication and help with infrastructure issues such as IT-interface, business systems and documentation framework.

Other potential synergies could be considered and realized without great difficulty: become the go-to leading national center for "general sky phenomena'. This could be implemented by becoming the "national observatory competence center" that issues press releases about eclipses, lunar phases, meteor showers, satellite constellations, planet conjunctions, and quarterly sky updates, teacher training, and does live planetarium domecasts and training across the globe.

Planning Process

Strategic Master Plan as an Integrated Model

Community Needs Assessment

Under the direction of the contracted exhibit planners, we will speak with the community, listen independently and deeply, and use that knowledge to develop a vision of the role KPVC/Windows will play in a way that resonates with the community.

This Community Needs Assessment should:

1. Review applicable visitor experience and visitor learning research literature.
2. Conduct open-ended interviews with potential users, or those in close touch with the needs and interests of potential users.
3. Conduct literature and online research about overarching community needs.
4. Conduct open-ended interviews with community leaders who are interested in economic development, education, business development, tourism, etc.
5. (Conduct surveys, focus groups and/or social media research to broaden the base of information)

Key Results

TBD

Key Outcomes

TBD

User Testing

TBD

Stakeholders

- TON
- Tenants, incl. UA
- Staff, esp. Scientists, emeriti
- NSF, DOE
- AURA Corp.

- Tourist agencies, economic development: Visit Tucson etc.
- Chamber of Commerce
- County, State agencies
- Corporations
- Governing bodies: NMOC, ABOD
- Boards of Education
- Foundations
    - Keck
    - Heising-Simons
    - Moore Foundation
    - Kavli Foundation
    - Gruber Foundation
    - Shaw Foundation
    - Wyss Foundation

      => Friends of Kitt Peak - blue ribbon board

Arizona is a state with a large, astronomy-interested market. It is a destination of choice for national and international travelers interested in astronomy.

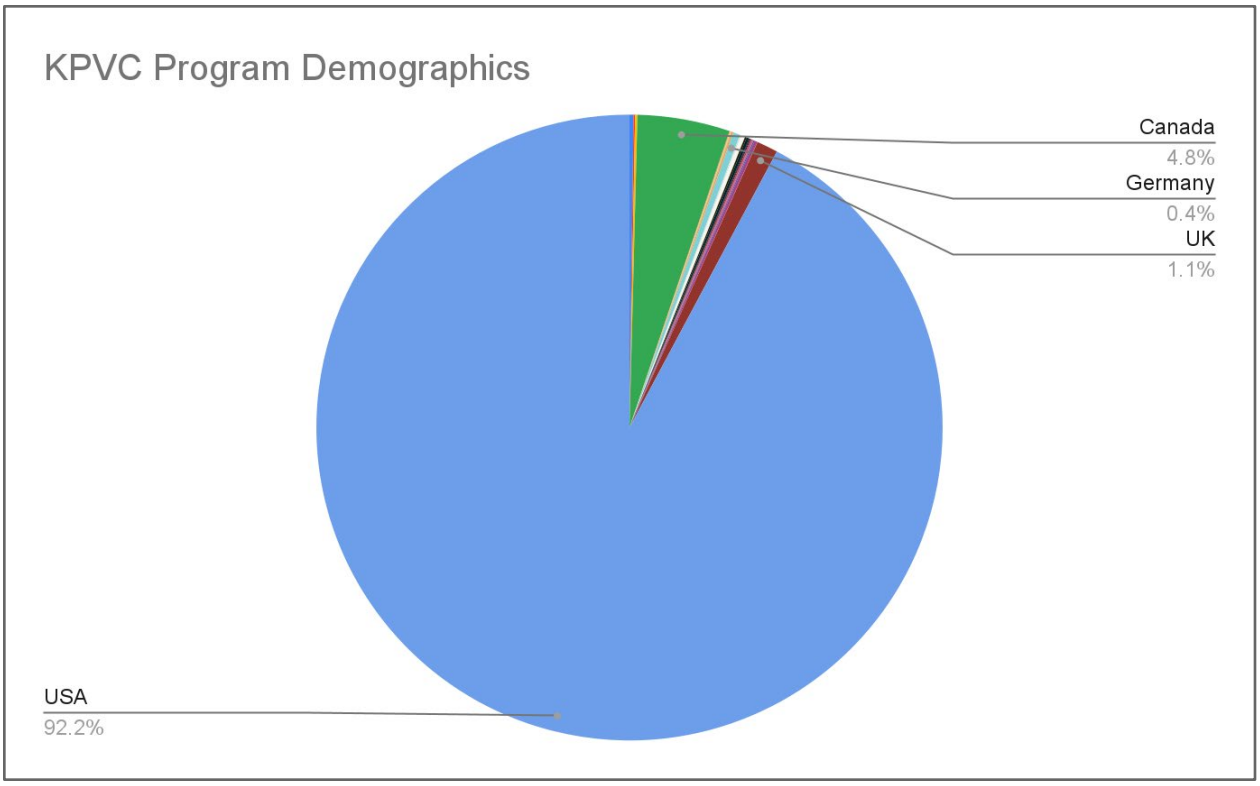
Audience types:

1. Casual tourist
2. Intermediate science-interested public
3. Advanced amateur astronomer

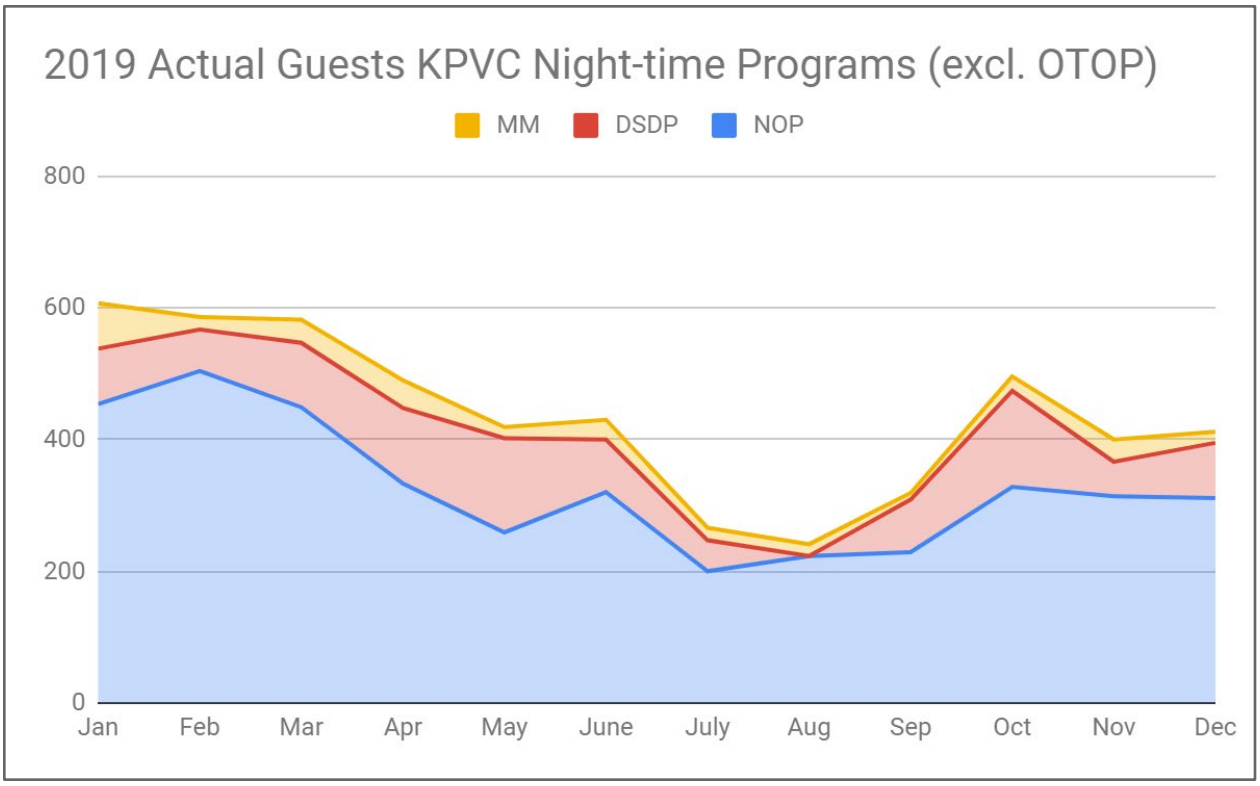
Intended beneficiaries

Needs

Needs expressed as key results



Demographics of all night-time programs excl. OTOP, showing predominantly visitors from the US.



Seasonal variations (2019 data).

Market Analysis

To be done under the direction of the contracted exhibit planners.

Market Segments & Drivers

TBD

Market Elasticity

TBD

Competition Analysis

TBD

Market Conclusions

TBD

Attendance Comparisons and Profile

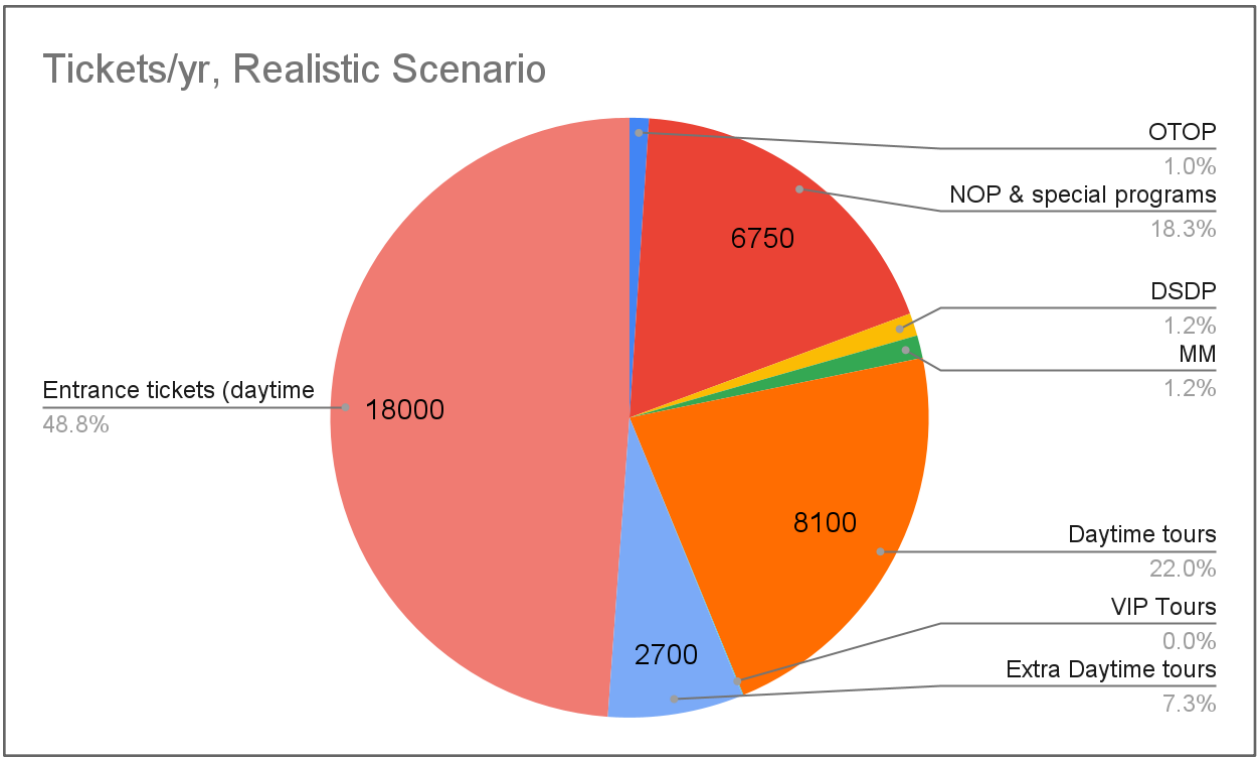
The Windows Center will be an educational attraction for a wide variety of audiences which are prioritized as follows:

- Primary: Visiting Family Groups
- Secondary: School Visitors (class field trips, especially local and Tohono O'odham Nation (TON) groups)
- Tertiary: Free and Independent Travelers/Learners

Cultural Considerations

Work with Tohono O'odham liaison and representatives from the Himdag Ki: Cultural Center to identify ways to communicate and teach about the TO Culture throughout the Windows Center, rather than create a single exhibit space. The TO Nation has been an important part of the history of KPNO, from site selection through to the present time, and we will strive to convey that message. Additionally, communication of TO culture will also be addressed, from the architecture reflecting their building styles, to the garden featuring culturally important plants, to the recognition that the Center exists on land considered sacred to the nation.

Distribution of guests on activities



Conclusion: Visitor Strategy

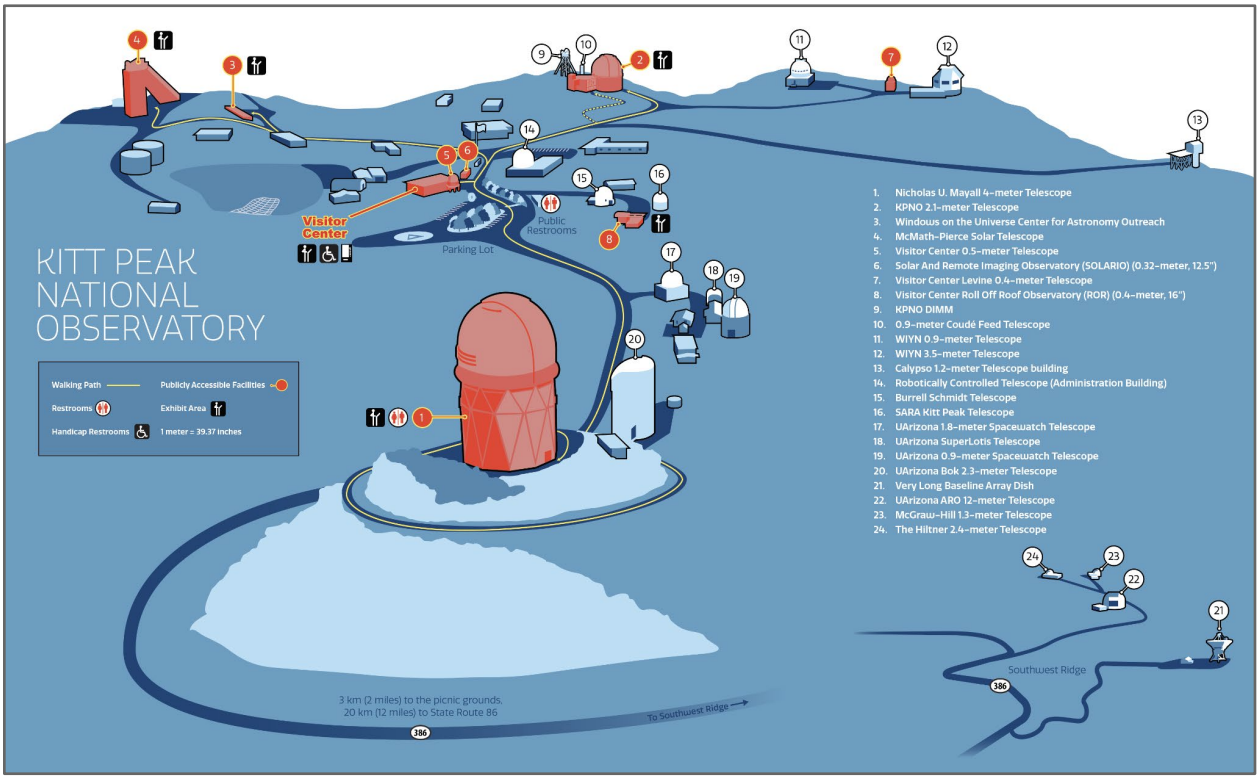
Everything KPVC does is built around the learning of its visitors and participants. Therefore, a clear view of the visitor, and the standards and care of visitors, is required.

1. NOIRLab will balance its efforts between serving regional participants (Tohono O'odham and other residents of Tucson and southern Arizona) and the considerable flow of tourists and visitors coming to southern Arizona from elsewhere.
2. Learning, in some measure, is proportional to the duration of experience and repetition. Therefore, where reasonably possible, repeat visitation and program participation will be encouraged.
3. While accommodating all visitors, a particular emphasis will be on families, with exhibits and programs that are engaging for children and for teens. This comes from an understanding that early experiences and family interactions, behavior modeling and conversations, are profoundly important to set the stage for, and foster life-long learning.
4. Understanding that guests must feel comfortable and well treated in order to have great learning experiences, NOIRLab will provide excellent guest amenities by understanding guest needs and really getting parking, washrooms, food services, signage, wayfinding and graphics, seating etc., right.

5. Respecting that Kitt Peak is a remote location with sensitive instrumentation, sometimes severe weather and wildlife, care will always be taken to keep visitors safe.
6. In order to best serve its visitors and participants, and continuously improve its quality of service, NOIRLab will engage in regular evaluation and reporting on the quality and safety of visitor experience and learning.

Programmatic Response

Program Content



The appeal of the new programs and facilities is being combined with the KPNO's brand recognition and the KPVC's existing assets — four telescopes, auditorium, exhibits, telescope galleries, gift shop — and its existing successful day and evening programs. The Sky Island is on Tohono O'odham Nation sacred land with unique mountain environment, geology, flora and fauna, etc

The interpretive exhibits at the MMP Solar Telescope will be designed to communicate the story of astronomy as practiced by astronomers. The topics for the exhibits will be selected from questions that astronomers (and non-astronomers) have asked themselves over time. These questions will be focused on our attempt to understand the Universe that we are all part of.

The following high-level sequence will be kept in mind when developing content:

- Start with personal questions of WHY? (what astronomers are trying to discover? measure? understand? see? etc.)
- Explain how we know (methods to answer the questions)
- Describe some of tools of astronomy used to help find answers
- Include work by specific people (include those related to KP and NSF first)
- With the answers to these questions, the content can provide Astronomy 101 information
- Throughout the exhibits, content should be layered, from simple concepts to include in depth information for astronomy enthusiasts. (layering to build visitor's knowledge)

Exhibit Approach

1. NOIRLab will take a balanced approach between delivering content (we tell) versus starting with the visitors' questions and interests (we listen.)
2. Its exhibits will be visually rich with lots of guests of different interests to look at and do — thus engaging visitors who come with a wide variety of interests.
3. Visitor flow will be based upon multiple entries, multiple paths and random discovery; however, it may be sequential in places if that approach best engages guests with various parts of the story.
4. Interactive or participatory experiences predominate, using cutting edge display and learning technologies.
5. Exhibits shall be designed so it is reasonably easy to refresh, add to, or change galleries.
6. Exhibits will be visually lively with strong colors, directed lighting and a mood that varies, as required, by the story.
7. Without overdoing it, the acoustic environment will be lively with exhibit sound effects, audio and background music.
8. Children and Families: Some exhibits that will work for younger children threaded through the exhibit galleries — as opposed to a major definable, marketable children's component. (Recommendation: give this one additional thought in light of the driving strategic choice.)
9. Telling the stories of Kitt Peak Astronomy, National Science Foundation Astronomy around the world, the close relationship with the Tohono O'odham Nation and the natural history of the Kitt Peak Sky Island are all vitally important.
10. Exhibit maintenance: Some high maintenance exhibits are OK if the learning they produce is great.

Program Approach

1. Specialized programs spaces, such as laboratories, observatories, planetariums and customized exhibit or classroom spaces will be developed, as needed, in support of the driving strategy.
2. Off-site programs and electronic outreach will support the driving strategy.
3. Special programs will be created to draw and support high needs individuals and communities.
4. In-depth programs will be developed, as needed, to advise the Driving Strategic Choice. These programs will address specific STEM educational needs of local schools, especially those affiliated with the Tohono O'odham Nation.

Communications Style

1. Staff will have the training in both content and presentation skills to deeply connect with, and engage visitors, creating and taking advantage of teachable moments. Staff performance will be monitored and staff will receive supportive feedback, and additional training as needed, to maximize their effectiveness with guests.
2. Rather than just delivering facts, NOIRLab will tell stories and offer views that are opinionated, challenging, honest and provocative — all the while appreciating the responsibility of communicating at, and about, a national research institution. Among its stories it will convey the who, what, why and adventures of discovery.
3. As it communicates, its "voice" will not be flat, bland and humorless, but engaging, personal, funny, ironic, anecdotal and appropriately emotional.
4. NOIRLab will speak and label its exhibits in its visitors' predominant languages, English, Spanish, and O'odham.

Stories

Specific stories to be weaved into the exhibition, SoS and the planetarium:

- Vera Rubin and her work at NSF, Kitt Peak
- David Johnson, worked at MMP monitoring activity on the Sun, operated the instrument for years.
- Jacelle, staff at NOIRLab is an expert in the TON. Can help guide us through the process of developing their story.
- The TON people story will be talked about throughout the exhibits as relevant, not only in one area.
- Ensure active participation by the Tohono O'odham Nation for the following:

- There will also be a welcome in the lobby from the Nation, and their stories will be woven throughout the interpretive content.
- The group liked the idea of dedicating the exhibit space outside of the classroom to produce a contemporary exhibit about the TON.
- Climate change is very important to TON, how climate change is affecting them, living in the desert, etc..
- Ensure there is a connection with the TON cultural center

Threads

- Personal stories from KP staff.
- Focus on the exciting idea that you are at a research family that is doing research now (current information is **key**)
- App available with current news and stories — updated daily or at least weekly
- Include NSF story as part of the tools of astronomy (e.g. DKIST Largest solar telescope in the world. In Hawaii, under the National Solar Observatory. All under AURA. Link the research done at the MMP and connect to where DKIST takes over in this research. Think about the future. Use large, dramatic images of the Sun
- Avoid going down the path of “history lesson” about astronomy

Educational Concept

The goal of NOIRLab’s education programs is to enhance the science literacy of all citizens and to demonstrate the value to society of astronomical research. At NOIRLab’s research facilities, visitors are introduced to telescopes, instruments, and other tools of astronomy as well as the latest research. NOIRLab’s programs also stress the importance of preserving the clear, dark night skies above these very special places, so everyone can continue to enjoy the spectacular Universe that inspires all of us. The Windows Center will further this goal by engaging visitors in educational experiences and exhibitions that are relevant and connect to the unique history of Ioligam Du’ag (Kitt Peak) and the cutting-edge astronomical research conducted on the mountain.

Diverse STEAM educational experiences targeting the main audiences will include docent-led guided tours; school group experiences that include an offering of tours, planetarium shows, and Science on a Sphere shows; and interactive exhibit-based observational experiences such as solar viewing and solar spectrum investigations. These audience experiences and shows will be led by trained KPNO staff and docents who are volunteer TON community staff, as well as retired scientists/staff.

Notes from workshop: What do we want the visitor experience to be like:

- Consider textures, colors, sounds

- Want to captivate visitors and entice them to continue all the way through the experience
- Develop master plan that captures the vision for the exhibits and displays
- Work through bigger framework of project to compile a visual document representing vision for project
    - Document includes site planning, exhibit renderings, themes, etc.
    - Important to show donors with visuals
    - Document is carried through all phases of project as a “road map” of the overall vision

KPVC Activities

Currently KPVC runs up to 10 activities/day in full operation:

148 theoretical monthly activities:

Activity	Day	Max. number of participants	Number of guides
8 OTOPs	Around new Moon	4 per activity	1
30 NOPs	Daily	50 per activity	2 and 3 above 30 participants
10 DSDPs	10 days around new Moon	10 per activity	1
10 MMs	10 days around Full Moon	10 per activity	1
90 daytime tours	7 days a week except Christmas Day, Thanksgiving Day, and New Year’s Day	20 per activity	1
1 VIP tour	On demand	4 per activity	2

150 monthly SOS shows (5 per day)

Free Self-Guided Tours

KPNO is open to the public 7 days a week, 362 days a year, from 9am–3:45pm. Visitors to Kitt Peak may tour the Visitor Center Exhibits, visit the Visitor Center Gift Shop, walk through the publicly accessible grounds of the facility — all free of charge.

Guided Tours

In addition to Free Self-Guided tours, guided tours of the Mayall 4-meter, 2.1-meter and McMath-Pierce Telescopes are offered three times daily. Each tour is led by a docent and visits one of the historic telescopes on the mountain.

VIP Tours

The Visitor Center also hosts 5-hour-long “behind-the-scenes” daytime VIP tours on demand. These docent-led tours feature smaller groups, include access to telescopes not normally included in either self-guided or guided tours and permit a “deeper dive” into the history and future of astronomy on Kitt Peak.

Nightly Observing Program (NOP)

The NOPs are the “bread and butter” of the KPVC. Normally accommodating up to ~50 visitors, the Nightly Observing Program is a 3-4 hour introduction to nighttime observing at the observatory. THe NOP offers guests an introduction to the dark night sky above Kitt Peak after they watch a glorious Arizona sunset from nearly 7,000 feet above sea level. The program features the use of planispheres and binoculars for identifying constellations, bright stars, and the brighter deep-sky objects. Guests will also spend an hour at the telescope, exploring the night sky for spectacular celestial objects. At the end of the program, visitors leave the mountain in their own vehicles.

Dark Sky Discovery Program (DSDP)

Generally accommodating 8-10 visitors, the DSDP also begins with a pre-sunset arrival to the mountain, a video in the Visitor Center, and a small dinner. Guests spend a full two hours at the telescope with a small group to facilitate more time at the eyepiece and more interaction with the guide as they observe a variety of objects and discover the wonders of the dark night sky above Kitt Peak. At the end of the program, concurrent with the end of the NOP program, visitors leave the mountain in their own vehicles.

Night of the Marvelous Moon (MM)

This program takes place in the bright time around the full Moon. After sunset viewing, guests receive an indoor presentation on basic lunar exploration history and geology. They then view those features in person, through the lens of the telescope.

Overnight Telescope Observing Program (OTOP)

The OTOP is the most extensive of the nighttime offerings. Available to small groups (4 people), OTOP visitors normally arrive at the observatory in the afternoon and receive a key to their private dorm room before eating dinner in the Kitt Peak Dining Hall. After the NOP and DSDP programs depart for the evening, a VC guide will remain with the OTOP guests throughout the night at either the 16” Visitor Center Roll Off Roof Observatory or the Visitor Center 0.5-meter Telescope. They will retire to their dorm room after observing, remaining on Kitt Peak for the night and departing in the morning in their

own vehicle.

School and Group Tours

Private tours of Kitt Peak may be scheduled for groups of 10 or more. These docent-led tours will begin with a brief introductory talk about Kitt Peak, and then head to one of the following telescopes; the McMath-Pierce solar telescope, the Mayall 4-meter telescope, or the 2.1-meter telescope.

Remote-Imaging Program

Participants may reserve one of the public telescopes for a night of astro-imaging. Staff will have the observatory open and the telescope homed at log in. Raw data, including calibration frames, will be made available within 24 hours. Staff-assisted option available to work with a guide who will conduct the session, including processing of the images.

Windows Activities

Planetarium shows

Visitors will be able to surround themselves with the wonders of the universe as they experience a dynamic experience in the Windows Center Planetarium. They will be able to select from a variety of shows that leave them with a better sense of how contemporary astronomy, KPNO (and especially the MMP Telescope) and NOIRLab in general impact humanity's understanding of the Universe.

Science on a Sphere shows

The Science on a Sphere (SoS) features real data projected on a large spherical surface with content ranging from solar system (and exoplanet) science, to simulations on climatology and cosmology. Visitors will experience a visually compelling representation of real data and timely science as well as issues such as climate change.

NOIRLab Educational Programs

Current NOIRLab education programs that will extend to the Window Center offer experiences to develop connections with local and indigenous communities such as Tohono O'odham Engagement, Colors StudioLab (Colors of Nature), Globe at Night, Under Dark Skies, 88+ Constellations, and Teaching with Telescopes. Programs including Teen Astronomy Café and Rubin Education will provide small groups of students with deeper experiences to explore and interact with authentic data. Project ASTRO and Star Educators bring astronomical resources and connections to educators nationwide and will take advantage of the Windows Center Astronomy Lab (formerly Classroom) as a flexible venue for professional development sessions.

Additional information on future proposed programs can be found in Appendix B.

Benefits

As public gathering places, museums and science centers, like the Windows Center, have the potential to have a positive impact on the community in which these institutions are located. When programs are implemented in a thoughtful way, with community input and needs taken into account, the benefits to the community are many and include those outlined below.

To maximize this impact, we will

1. Create a unique, innovative destination versus a typical or conventional visitors center.
2. NOIRLab's growing strength in public education and outreach among science institutions will be reflected as a growing reputation in these areas nationally and internationally. It will become the place others visit to see how this is best done.
3. Work diligently to block-bust the barriers to maximizing its efforts to become and function with the public education and outreach leadership expected of a National Laboratory.

INSPIRATION AND INQUIRY

- The planetarium and *Science on a Sphere* will immerse viewers in space, inspiring their creativity, interest, imagination, and awe.
- The Windows Center will expose visitors to a diversity of ideas, people, and places that will inspire the younger generations with a variety of STEM careers.

BETTER UNDERSTANDING OF OUR PLACE IN SPACE

- The Windows Center will help visitors to value their place in space and the future of exploring space to improve our understanding of the Universe.
- The interactive nature of the exhibits will provide an experience similar to that of scientists and engineers and improve visitors' critical thinking and decision-making skills.
- The exhibitions and programs offered at the Windows center will reinforce classroom learning and provide a more in depth hands-on exploration of the content.

DIFFERENT PERSPECTIVES AND CULTURES

- The Windows Center will engage visitors with the cultural enriching history of the TON and its unique partnership with KPNO.
- The inclusive learning environment offered by the Windows Center will be accessible to all learners, including people with a range of disabilities, different learning styles, and people of diverse backgrounds.

Impact on local schools and education communities

Tohono O'odham Tribal Impact

NSF leases the mountaintop from the Tribal Government to operate KPNO. We presently provide day and evening programs to Tohono O'odham tribal members, free of cost. Windows will create more extended education-oriented (rather than tour-oriented) programs with the Nation and will allow more productive day visits from students in the geographically isolated Baboquivari School District in Sells. The SOS facility allows a wide range of non-astronomy school programs, such as geology and meteorology, to be held on the mountain as well. The expanded space and programming will also allow more youth group overnight visits from the Nation and additional night programs for Tribal families. We will continue our practice of providing programs free to Tribal groups.

As the project proceeds, the KPVC will expand its offerings with a sequence of grade-level-appropriate Visitor Center-based programs for groups from the Nation that make best use of our new facilities in a formal education context.

Southwestern Schools Impact

The development of all the features for Windows, combined with existing KPVC assets, will create a particularly high-value asset for students and teachers. The combination creates many opportunities for interdisciplinary science programs for K-12 students. KPVC regularly hosts student groups from Tucson schools and schools across the southwest. The student groups receive a hands-on, authentic astronomy experience that extends the traditional learning of the classroom. Our educator workshops will also be targeted to teachers from Arizona and surrounding states. Educators attending the workshops would receive a unique place-based learning experience at KPNO and use the Window's Astronomy Lab as a setting to dive deeper into the Education Programs offered by NOIRLab and KPVC.

Impact on the Informal Science Education Community

In addition to providing data sets to other SOS- and Planetarium-equipped museums, we will make available the plans for exhibits developed and tested here to interested museums, planetaria, and observatories. KPVC staff will attend professional conferences to report on successes and results from newly developed programs and workshops, in order to make our work available to our peers. The annual meetings of the Association of Science & Technology Center, the International Planetarium Society, the Astronomical Society of the Pacific, and the American Astronomical Society are meetings identified for this purpose. We will also send appropriate staff to the SOS users' conference, held once every 18 months, to share our results and learn from peers.

Visitor Experience

Visitors to the new Windows Center will experience exhibits that engage them with the facilities of Kitt

Peak National Observatory and the role they play in shaping our understanding of the Universe. Visitors will learn about the tools of astronomy through exhibits including artifacts from the observatory and the historic McMath-Pierce Solar Telescope. In partnership with the Himdag Ki: (the Tohono O'odham Cultural Center), visitors gain an understanding of the history and culture of the people on whose land the Windows Center resides.

Visitors will have the opportunity to explore the wonder and excitement of scientific discovery through modern planetarium shows and Science on a Sphere presentations. The astronomy classroom will provide opportunities for small groups of students, educators, and the general public to have a deeper experience with NSF and NOIRLab Science and Astronomy. Special events, lectures, and workshops will engage diverse audiences with authentic astronomy activities that further their experience at the Windows Center. Visitors can extend their time at Kitt Peak through one of the night programs offered by the Kitt Peak Visitor Center and view the wonders of the night sky.

The Kitt Peak National Observatory general public experience encompasses a number of different elements, all of which are related to each other. These experiences should work well together, be cohesive and well-integrated into the project site. As KPNO plans the re-opening of the site to guests, we will be paying special attention to the short-, medium- and long-term interpretation goals for the site. There are various elements that should be taken into account during this planning work.

Key takeaways for visitors

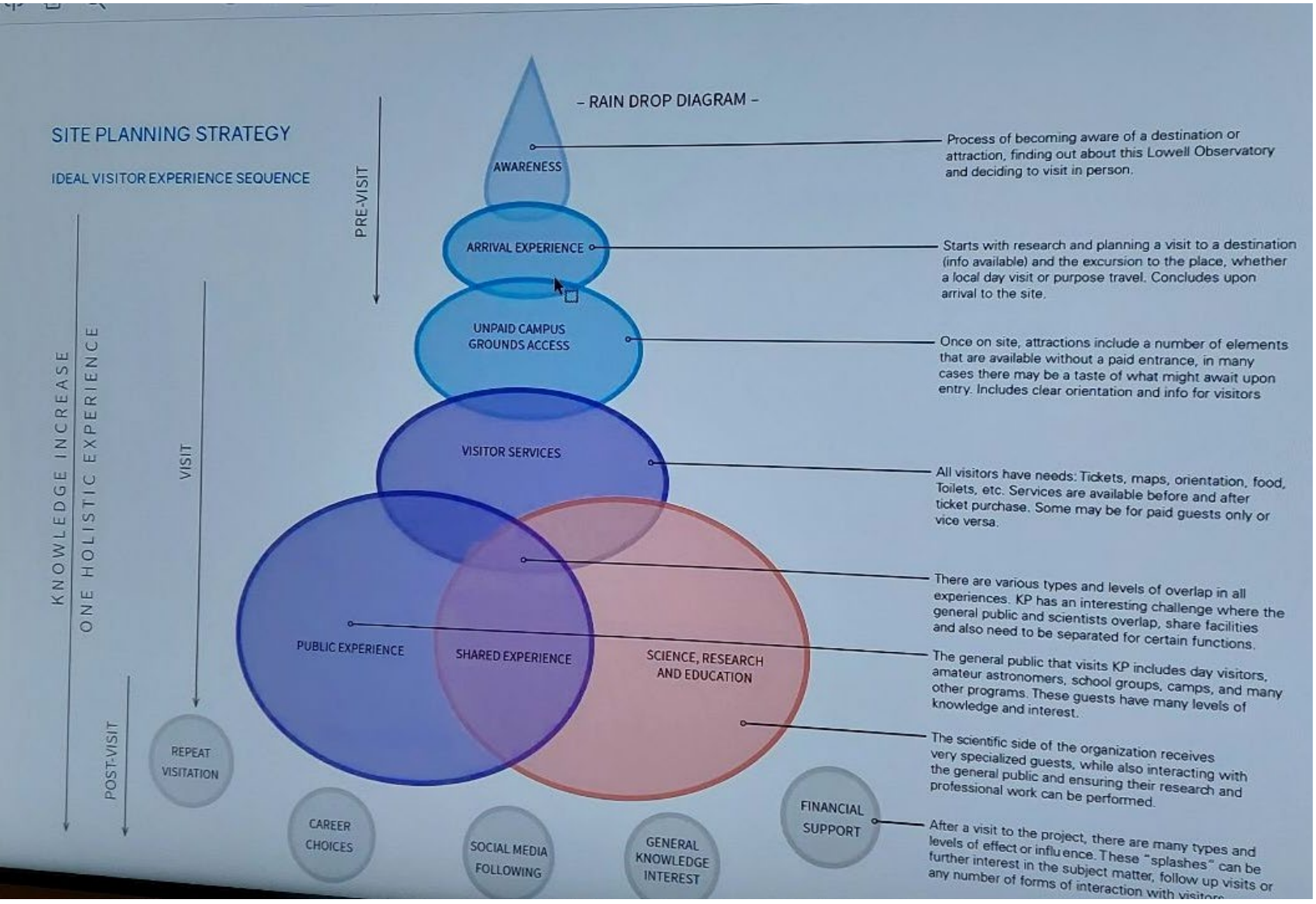
- We are all connected to the night sky
- You too can be an astronomer through citizen astronomy
- Light that we capture through our eyes and instruments tell us about our place in the Universe
- Every tool we have developed was inspired by questions that astronomers wanted to answer
- We are guests on the TON land and honor this special place

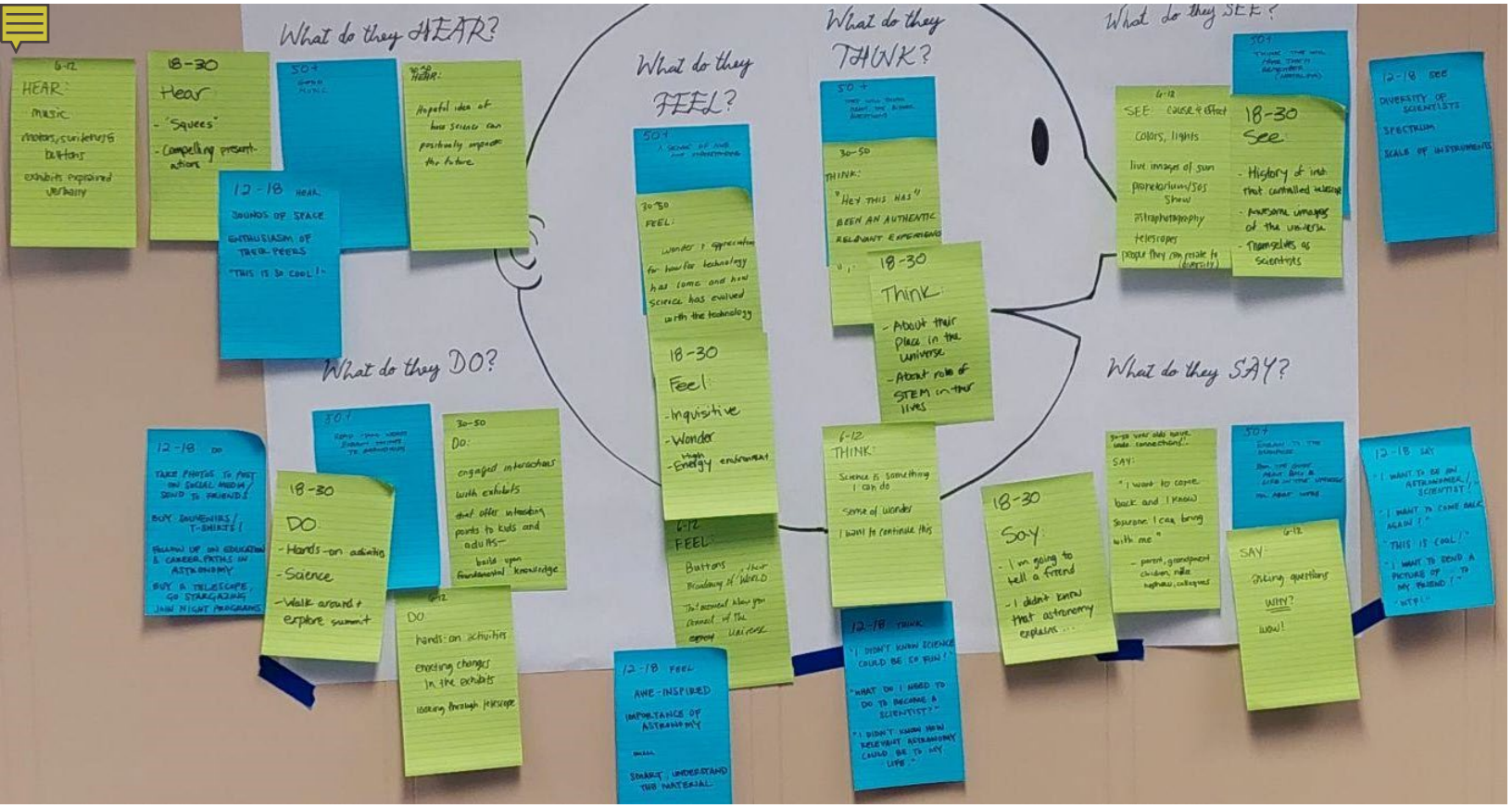
Visitor key learning objectives

- Visitors will understand the context of KPNO and the TON collaboration that allow for astronomical facilities to operate on KPNO
- Visitors will be inspired and awed by the Universe, by our current understanding of it and the role that the facilities at KPNO have played in conjunction with NSF's astronomy facilities around the world.
- Visitors will appreciate the history of the MMP and be transported back in time and experience the operation of the facility as it has functioned since the 1960s.
- Visitors will exit the Windows Center with a sense of the form and function of MMP through restored instruments and facilities that, wherever possible, will function as they did in the past

provide exceptional observations of the Sun and other objects in space

Ideal Visitor Experience Sequence:





y Performance Indicators

KPNO will measure progress of the strategic goals and key learning outcomes through metrics and key performance indicators. KPNO's leadership team will evaluate the KPIs annually to monitor the effectiveness in reaching the priorities and goals of the Windows Center. KPNO will measure progress towards goals and learning outcomes based on KPIs such as visits, sales, visitor satisfaction, webpage trends, event participation, and social media engagement. KPNO will also gather feedback from stakeholders and use their input to improve strategies to meet the established goals.

Access

1. Total number of visitors to KPNO
2. Total number of visitors to Windows Center
3. Number of visitors from TON
4. Number of Visit Kitt Peak web page visitors

Visitor Satisfaction

5. Percentage of visitors who would recommend a visit

Education & Outreach

6. Number of student or educator programs and field trips
7. Percentage of visitors with increased understanding of the Universe

Communications

8. Social Media Engagement

Evaluation

Assessing the visitor experience at Kitt Peak National Observatory will provide insight into the strengths and weaknesses of the programs including tours and exhibits, and offer a detailed look at the specific needs of our diverse audiences. Evaluation results will be used to measure the achievement of the objectives, identify problems to be addressed, and yield future program strategies. We look to evaluate the 1)overall visitor experience at Kitt Peak National Observatory, 2) visitor engagement with the Window Center's exhibits, planetarium, and *Science on a Sphere* presentations, 3) impact of the nightly observing programs, and 4) tours.

Evaluation Logic Model

Inputs →	**Outputs** →	**Outcomes**	
		Short Term	Long Term
- Trained Docents - Experienced Planetarium and SoS Presenters - Trained Tour Guides - Windows Center Exhibit Developers - Food & Beverage Services - Ticketing Service - Marketing - Financial Resources - Advisory	- Planetarium Presentations - Hands-on MMP Telescope Control Room Exhibits and Heliostat Viewing - TON Stories - Small group lectures, presentations, and educator workshops - Science on a Sphere Presentations - TON History exhibits - Understanding our Universe Exhibits - Nighttime small group observing - KPNO Tours and Visitor	Increased understanding the context of KPNO and the TON Increased awareness of our understanding of the Universe and the role that the facilities at KPNO have played in conjunction with NSF's astronomy facilities around the world.	Increased wonder or understanding of the power of astronomy

Meetings	Center Exhibits - Visitor Evaluation - Docent Feedback - Observations and Interviews	Increased appreciation for the history of the MMP Solar Telescope Increased access to STEM educational needs	

Methods

Front End Evaluation

Prior to exhibition development, a community needs assessment will be completed to determine the strengths and resources available to meet the needs of KPNO visitors. Additionally, a survey will be administered to visitors of KPNO to directly ask for feedback about what content they would like to experience with the new Windows Center and which exhibits would interest them the most.

Visitor Exit Survey

As visitors complete their experience at KPNO, they will be asked by a KPVC staff member to voluntarily participate in an anonymous survey. The survey will be available in digital form and be administered via one of five iPads (connected to the KPVC WiFi) available in the KPVC lobby. Visitors will provide feedback about their overall experience at KPNO and more specific feedback about their experience with the programs they participated in (planetarium show, SoS presentation, tour, etc.). The survey will take approximately four minutes to complete.

Observations and Interviews

Observations conducted by KPVC staff will be focused on visitor engagement in the MMP Control Room and at the exhibits. The digital observation form will be completed four times a month during various days of the week (including weekends) and times. The observations will provide insight into the number of visitors at an exhibit, visitor engagement, and popular exhibits over time. The KPVC staff member that is performing the observation will have the opportunity to informally interact with or interview visitors to record additional qualitative data.

Docent and Staff Feedback

Docents and staff providing visitor experiences such as tours or facilitating nightly observation programs will be asked to share their feedback about their training and experience managing their program with the public. Feedback from docents and staff will be used to improve communications

and support.

Analysis

Results from the visitor surveys and observations will be analyzed every September by the KPVC staff under supervision of the KPVC Operations Manager. The data collected will be examined to determine the effectiveness of programs at meeting the goals of the KPNO and Windows Center. Conclusions will be shared with stakeholders and KPNO staff to share lessons learned and determine actionable steps to improve the visitor experience.

Components

What stuff is needed - buildings, equipment, staff

Buildings

The McMath-Pierce Solar telescope, in only one of its many dimensions, represents a signature project of Skidmore, Owings and Merrill (SOM) Architects at the time when the firm was at the height of influence on American and international design and the famous structural engineer on the project, Fazlur Rahman Khan, was transforming the way that skyscrapers are built.

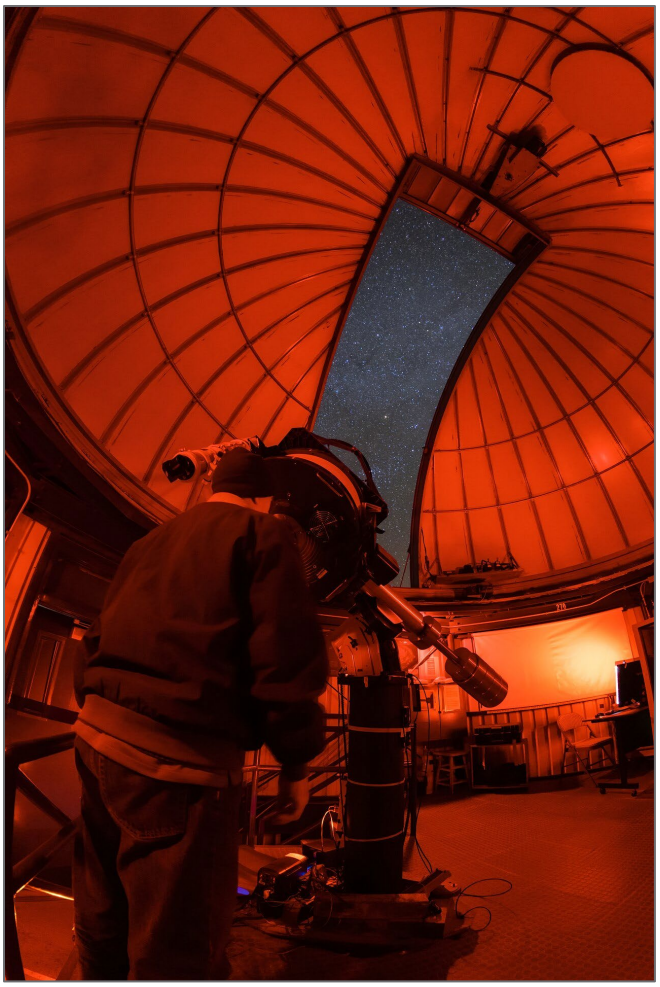
Other buildings

- 4 Telescopes
- Visitor galleries
- DESI exhibition
- KPVC main buildings
- HQ offices

Signage

All signage leading to the mountain will be renewed, respecting the traditional style of the wooden signs, available to guests upon their arrival, providing directional and wayfinding information for guests to navigate the site, as well as identifying the various facilities throughout the site with updated information plaques.

Monthly schedule (in full operation)



Opening hours:

- KPVC (148 monthly activities + X Special events (e.g., meteor showers, lunar eclipses, family nights etc.):

Activity	Day	Max. number of participants	Number of guides
8 OTOPs	Around new Moon	4 per activity	1
30 NOPs	Daily	50 per activity	2 and 3 above 30 participants

10 DSDPs	10 days around new Moon	10 per activity	1
10 MMs	10 days around Full Moon	10 per activity	1
90 daytime tours	7 days a week except Christmas Day, Thanksgiving Day, and New Year's Day	20 per activity	1
1 VIP tour	On demand	4 per activity	2

+ Windows
    - X Planetarium shows
    - X shows in the SoS

Door to the planetarium is closed before each show. Operator checks tickets and lets people in.

Business Systems

This ensures maximum efficiency and synergy with the rest of NOIRLab all IT-tools will be standardized.

All KPVC staff would use the **standard NOIRLab ITOps-provided workplace software**. All staff and volunteers would receive SSO login credentials and use Google Workplace (Gmail, Google Chat, Google Calendar, Google Slides, Google sheets and docs).

The Windows on the Universe project adheres to AURA's Password Policy and NOIRLab's Cybersecurity Program Master Policy and Procedures for the project's cyber-infrastructure and security.

All files would be stored in a **simple Google folder hierarchy** under the CEE folder structure.

The Visit Kitt Peak **website** has been rebuilt as a standard NOIRLab "mini-site" and maintained by CEE's webteam in collaboration with the KPVC Operations Manager.

The standard CEE **booking system** and/or Eventbrite would be installed. This is the same system used for the public visits in all other NOIRLab locations as well as taking payments for conferences etc.

The current KPVC **Point of Sale** system would be included in the standard tools maintained by CEE.

Food & Beverage Services

Currently there are no food and beverage (F&B) services on site. Contractually NOIRLab/AURA is obligated to contract F&B services to the TON. A cafe would be beneficial to the day-and night-time visitors, also to provide shelter and heating to shield from the elements.

We can start small and simple (add a couple vending machines) and then expand it in the future as more funds come in

TON food trucks/stalls
“Shipping Container” near VC entrance that could sell food during high traffic times/days

Won’t make any money off of food services directly below 250k visitors but it lengthens visitors’ stay on the mountain and will be made up for in gift shop purchases

Need something that’s there permanently, small things like granola bars and fruit

Visitor Flow and ticketing

The parking availability creates the upper limit of the visitors. If we have ~45 parking stalls, ~5 disabled stalls, the estimated maximum visitors per year for daytime activities is ~40,000. The budget assumed 26,000 paying visitors, which means that less than 100 visitors a day on average will arrive at the KPVC. We will capture people at 90% level to inform them of the rich opportunities and capture as much revenue as possible.

We have developed a model that considers cost per visitor, the entirety of visitor experience, looks at the full range of possibilities, and assesses what can be free and what needs to be ticketed to demonstrate value for money.

The visitor flow:
The Visitor Centre building should be the first point of contact for visitors.

1. Visitors park at the VC parking lot

2. Entry into VC building
3. Move through the ticketing office to pay their admission.
   Comparison undiscounted adult entrance fees:
   a. Titan Missile Museum ($16.50)
   b. Desert Museum ($29.95)
   c. Tohono Chul ($15)
   d. Colossal Caves ($22, only tours!)
   e. Biosphere 2 ($25)
   f. Discovery Park
4. Accept the Liability and Safety forms through a QR code
5. Understand the history and significance of the mountain to both the Tohono O'odham Nation as well as to astronomical research
6. Have access to basic services such as food and restrooms
7. Access a memorable and plentiful selection of items for purchase in the giftshop
8. Orient themselves to the site and what they can do during their visit
9. Visitor got a wristband? (Flandrau Science Center method)
10. Browse while waiting for a tour, move to the Windows Center or go on self-exploration

Ticketing online Sales kiosk w/ QR

- Highly consider ticketing everyone who enters
- Need to consider the funds that are required for the maintenance and upkeep of the exhibits
- We are a nonprofit so free programs should be considered and free access to the mountain should be maintained
    - Would need external funds to supplement
    - Have 1 main attraction/exhibit that visitors can do for free
    - Gift shop is a part of the end-to-end visitor experience and is an important source of income

Ticket prices set a precedence for the experience that visitors are expecting. A balance between ticketed programs and general visitors to the mountain must be found,

The KPVC exhibition is an important component of visitor experience and needs to be developed soon after the Windows Center. A small amount of funds could be spent studying up what we already have and then plan for what we want the VC ideally doing in the future

Sounds & Acoustics

On-site assessment of the “Windows on the Universe” center, currently under renovation, was taken in April 2023. Excessive reverberance was observed throughout the museum. Speech intelligibility/clarity was challenging, especially in the exhibit gallery. The exhibit gallery, planetarium, front lobby, control room, astronomy classroom, NSF exhibit room, and theater were assessed. The goal of the assessment is to improve current acoustical conditions by decreasing excessive reverberance via sound absorptive treatment.

The recommendation is to install sound absorptive panels in the rooms listed above. Distributing sound absorptive treatment throughout a space as opposed to installing it contiguously in one place will increase its effectiveness. The recommendation is to have approximately 70% distributed on the ceiling and 30% distributed on walls. Wall panels are most effective at listener height and do not need to extend lower than 2 ft above the floor.

Full Report from McKAY CONANT HOOVER INC

Content production strategy (during construction as well as operations)

Staffing

“Standard CEE services” (defined in the CEE Service Catalog) will not be charged to the KPVC accounts as this would be “double-dipping”, but would be absorbed in CEE’s standard operations.

KPVC has the following staffing:

- Fixed staff
    - KPVC Operations Manager (TBH)
    - KPVC Shop Coordinator
    - KPVC Guide/Cashier (0.5 FTE)
    - KPVC Observatory Technician (0.5 FTE)
    - Guide Supervisor (TBH)
- Guides: ~2.7 FTE, variable
- Docents: ~0.6 FTE, variable

In total: 7.3 FTE

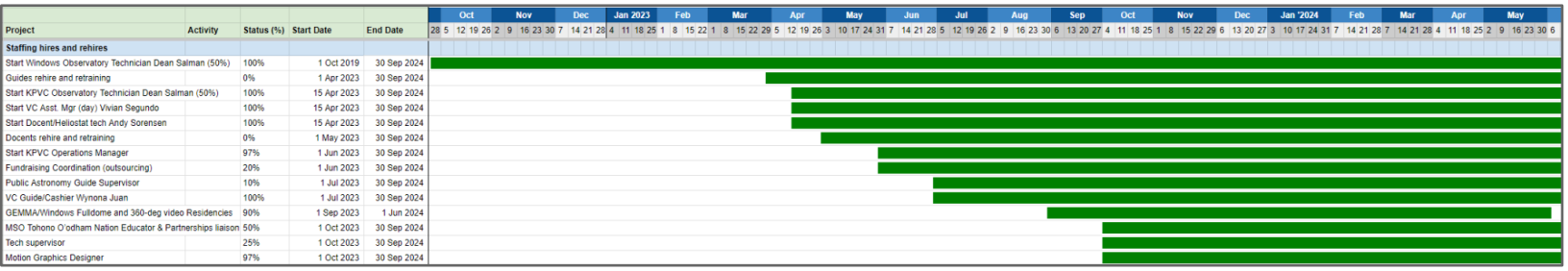
New “standard operations” staff would be hired to absorb the Windows work:

1. Tech supervisor
2. Tech (0.5 FTE Windows)
3. Motion graphics designer (to develop fulldome planetarium shows and 360 videos for the Science on a Sphere (SoS).
4. MSO Tohono O’odham Nation Educator & Partnerships liaison (0.5 FTE Windows)
5. Educational Programs Developer
6. Guides: ~1.0 FTE, variable
7. Docents: ~0.5 FTE, variable

In total 5.5 FTE.

+ Fundraising Coordination (outsourcing)

Most of the associated costs for these positions would only incur from the start of FY25.



Project	Activity	Status (%)	Start Date	End Date
Staffing hires and rehires				
Start Windows Observatory Technician Dean Salman (50%)		100%	1 Oct 2019	30 Sep 2024
Guides rehire and retraining		0%	1 Apr 2023	30 Sep 2024
Start KPVC Observatory Technician Dean Salman (50%)		100%	15 Apr 2023	30 Sep 2024
Start VC Asst. Mgr (day) Vivian Segundo		100%	15 Apr 2023	30 Sep 2024
Start Docent/Heliostat tech Andy Sorensen		100%	15 Apr 2023	30 Sep 2024
Docents rehire and retraining		0%	1 May 2023	30 Sep 2024
Start KPVC Operations Manager		97%	1 Jun 2023	30 Sep 2024
Fundraising Coordination (outsourcing)		20%	1 Jun 2023	30 Sep 2024
Public Astronomy Guide Supervisor		10%	1 Jul 2023	30 Sep 2024
VC Guide/Cashier Wynona Juan		100%	1 Jul 2023	30 Sep 2024
GEMMA/Windows Fulldome and 360-deg video Residencies		90%	1 Sep 2023	1 Jun 2024
MSO Tohono O'odham Nation Educator & Partnerships liaison		50%	1 Oct 2023	30 Sep 2024
Tech supervisor		25%	1 Oct 2023	30 Sep 2024
Motion Graphics Designer		97%	1 Oct 2023	30 Sep 2024

Hiring plan, from KPVC Full Operations Budget.

Business Model

In the past, the Kitt Peak Visitor Center (KPVC) has acquired other facilities at Kitt Peak National Observatory (KPNO) once prior tenant operators ceased supporting them. Three of our four visitor center-operated observatories were acquired in such a manner. The KPVC became the new operator of each, enabling us to grow the number of public telescopes on the mountain, host larger nighttime audiences or provide small telescope solar viewing to our daytime visitors. We recovered the new costs associated with operating each facility through new program revenues and gift shop sales triggered by the acquisition and modification of those facilities for public use. In a similar manner, we have taken over the recently retired MMP Telescope and transformed it into a major new astronomy outreach asset to be operated by the KPVC.

The Windows Center will bring in additional revenue as well as a significant improvement in the service level for the guests. For example, while nighttime programs are our primary revenue generator

for the KPVC, they are impacted by weather conditions. The presence of a fully equipped facility will enable us to offer compelling, attractive alternative programs on cloudy nights when we might otherwise lose a fully-booked program. The planetarium will be particularly important for presenting alternative cloudy night programs. Audience members for cloudy night programs also make significant purchases in the gift shop.

Built in 1964 and funded entirely or largely by the NSF for most of its history, the KPVC funding model changed over a decade ago when NSF funding was withdrawn. The KPVC successfully operated a vigorous program on program fees, tour tickets, gift shop sales, and small donations from 2010–2020. However, an increasing need to integrate the KPVC in the standard AURA model with adherence to compliance, accounting and cost-model standards has facilitated the need for a new budget using standard staffing costs (using HR competitive analyses), standard procurements and a general integration into NOIRLab.

Financial Assumptions

The KPVC financials will be ring fenced from the rest of NOIRLab's operations. All income and expenses (incl. payroll) will be charged to KPVC account numbers.

The aim is to get as close as possible to a break-even situation for the operational part of KPVC in a steady-state scenario 1 year after Windows opening, and limit the costs to the organization capped at $200k. This will be achieved by:

1. Planning the operations meticulously, using standard tools.
2. Tracking the expenses meticulously using a standard dashboard.
3. Maximizing synergies with existing EPO operations and tools in CEE (to avoid building a parallel EPO structure and realize cost savings).
4. Being as flexible as possible and as prudent as possible with expenses, for instance by adjusting our expenses according to fluctuations in attendance. If a season's revenues run slower than predicted, then we decrease part-time staff hours and other expenses. Conversely, when visitation is unexpectedly strong, we quickly ramp up staff hours to accommodate the surge.
5. To be innovative with revenue-giving activities and marketing.
6. To raise funds as a core activity.

Windows Construction

As of 20 March 2023 $954k was left on the Windows grant (as per CAS):

Project:	CSA 1839157 - WUCAO	
Date Prepared:	3/20/2023	
	Total Funding	
	as of 3/17/2023 (NSF Amendment 011)	**4,499,578.00**
	Total Expenditures	
	FY2019	192,500.41
	FY2020	232,699.65
	FY2021	1,049,284.48
	FY2022	1,755,747.99
	FY2023 - through Jan '23	85,901.69
		3,316,134.22
	FY2023 - Feb '23 (indirects not yet posted)	20,760.08
	Total Expenditures	**3,336,894.30**
	Total Commitments	
	through Feb '23	**208,448.17**
	BALANCE	**954,235.53**

A further $83k will be spent on staffing through FY23:

Windows Budget Expenditure FY19-FY23

Grant:	
	$4,500k
Construction:	
	$2,340k
SOS:	
	$200k
Staff & Contractors (FY19-23):	$535k
Miscellaneous	
	$554k

```
Remaining funds:                                    -$871k (end FY23)
========================================
```

The funding spent on Windows Construction in the first four years of construction, leaves less than $100k for the exhibitions outfitting:

Windows Budget Expenditure FY24

```
Remaining funds:
-$871k
---------------------------------------------------
Staffing FY24:                                              $451k
Facade Design/Installation:                                 $100k
Exterior improvements
                              (power switch, heat exchanger,
landscaping etc.):                                           $50k
Acoustics:                                                  $100k
Exhibit Phase I Design, Development,
                              Construction, Installation,
community assessment
```

	$0k + fundraising
Solar Facility Operator Consultant Advisory Panel meeting	5k
	$4k
Astronomy Lab	
	$65k
Marketing	
	$96k
Contingency	
	$0k

Total:	
	$0k
==========	

This demonstrates the need to raise funds urgently already in FY23.

KPVC and Windows Operations

KPVC and Windows will remain an integral part of the overall KPNO operations. The following operational revenue sources are planned:

1. Activities

   a. OTOP
   b. NOP
   c. DSDP
   d. MM
   e. Daytime tours
   f. VIP Tours
2. Entrance tickets
3. Donations
4. Memberships

A ”realistic scenario” has been simulated to show expenditure and income.

The only increase in income comes via entrance tickets sales as well as some 2700 additional day-time tour tickets sold. It is here conservative assumed that the night-time and shop activities remain at the 2019-level, which is likely a lower estimate.

It is planned that Windows will open in June 2024 with an exhibition in all areas, which in places will be “basic” (non-interactive) until sufficient funds are available.

An admissions policy will be established (see Appendix D) that maximizes earned income, while providing for the needs of high needs participants: KPVC will move from a fully “pay-per-activity” model to an “entrance-based” (day-time) + “pay-per-activity” (night-time) model in June 2024. This will add revenue and simplify operations. Free access for TON tribal pass holders will continue.

Hiring will be slightly staggered over a 7 month period from June 2023. Until the end of FY24 several Windows people will be paid via the Windows grant. After this period they will be paid out of the operational revenue and fundraising.

In full operation the KPVC & Windows will be close to self-sustaining, and this remains the goal: in full operation the project expenditure in a realistic end-state is ~$1,785k/yr and the income ~$1,360k/yr. The ~$425k cost to the organization will be offset by considerable fundraising (which in any case will be necessary to bring the Windows Center to full completion).

There is plenty of room in the planned activities to attract more people to Kitt Peak and to eventually break even (provided the infrastructure, operations etc. allow). (break-even occurs at 75% events implemented at 72% occupancy, without additional donations/fundraising).

The KPVC will be the starting point for programs and tours of any kind for arriving guests. Visitors

opting for Windows-based programs, such as a SOS presentation, after purchasing their entrance tickets may choose to walk from the visitor center or be driven by staff or docents using one of the three shuttle vans budgeted in this proposal.

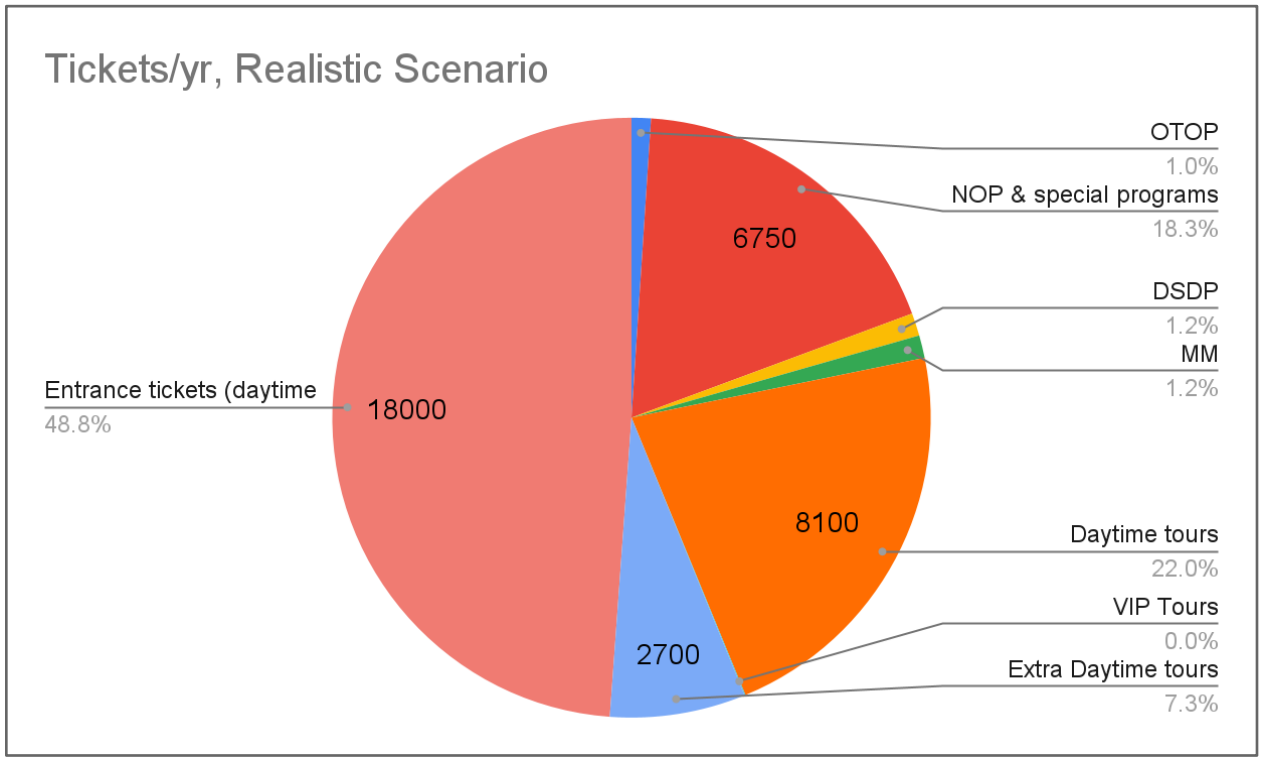
The KPVC operates in such a way as to minimize the impact of visitors upon daytime and nighttime KPNO operations. All financial transactions will remain within the visitor center.

Income

Attendance projection

The ~16k visitors/yr in 2019, and another reported ~15k visitors/yr that did not partake in any programs, is used as baseline.

In the simulations used the KPVC & Windows operation will, during full operation from Oct 2024, host 26k paying visitors/yr (roughly 10k more than in 2019).

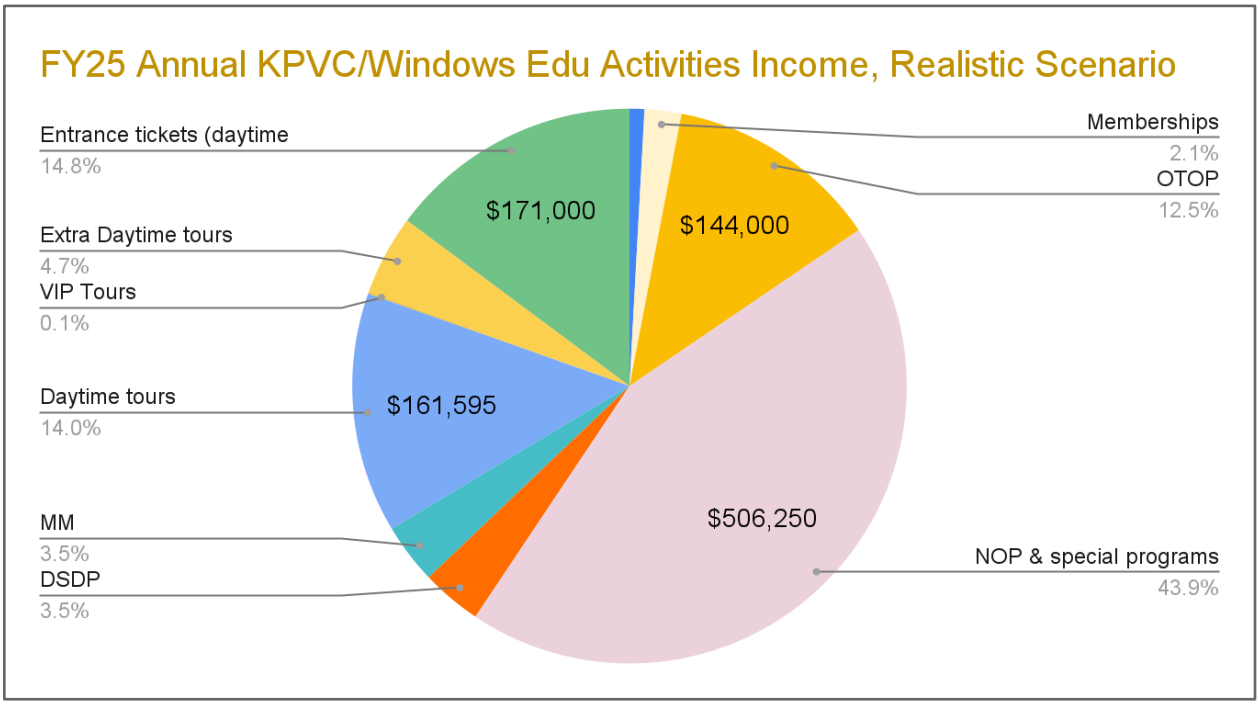


Tickets sold per year from FY25 for the 26k visitors/yr. The sum of sold tickets is larger than the number of visitors.

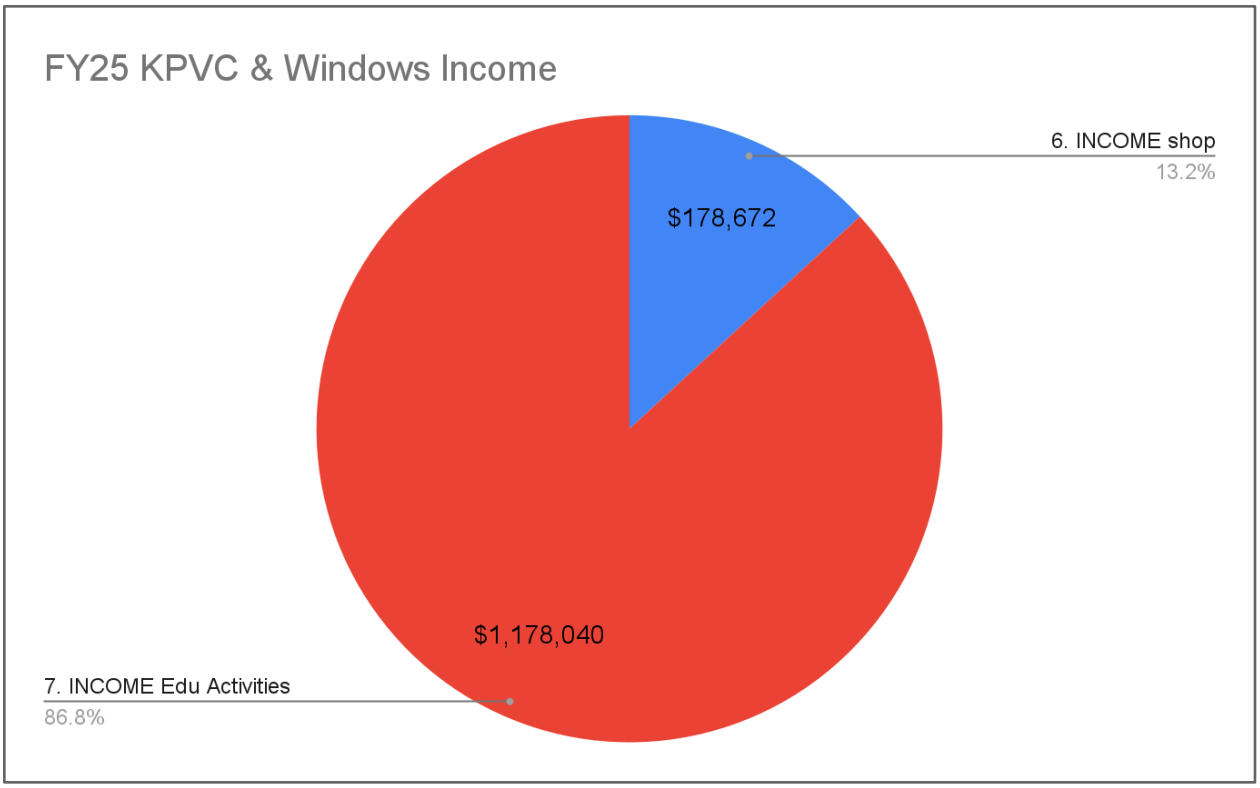
We expect attendance in the first two to three years to be less than originally forecast in our original

2018 business plan as we rebuild public awareness and visitation following the COVID-19 pandemic. The pandemic significantly impacted museums, planetariums, observatory visitor centers, and other informal science education venues across the USA. Prolonged closures have affected cultural attractions' audiences, public profiles, finances, and staffing resources. The KPVC was no exception and was impacted as well by a prolonged public closure and staff furlough.

Our original business model was built upon the assumption of a fully operating, growing visitor program led by a core of highly experienced staff. We believe many aspects of the original business model are still valid but the COVID-19 pandemic has impacted the timetable to reach self-sufficiency and the level of support required during the first several years of operations.



KPVC and Windows income distribution on Activities

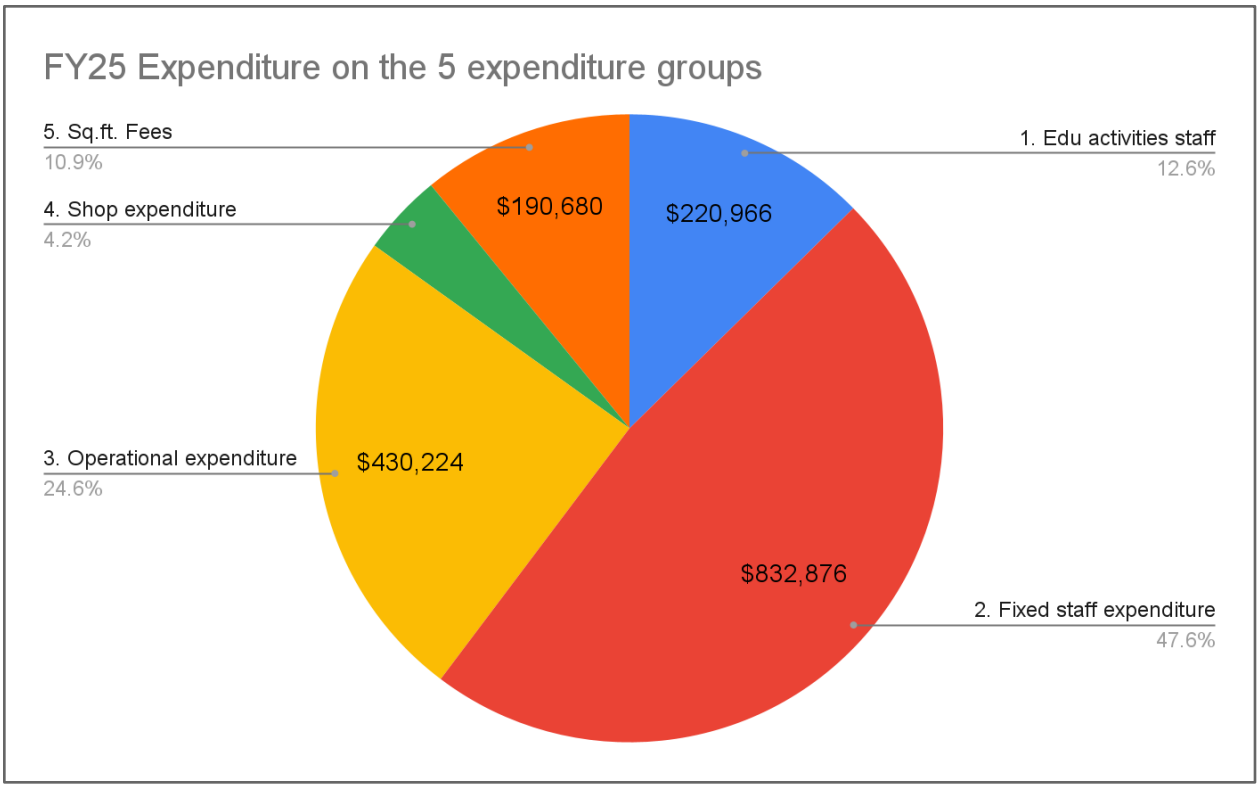


KPVC and Windows total income.

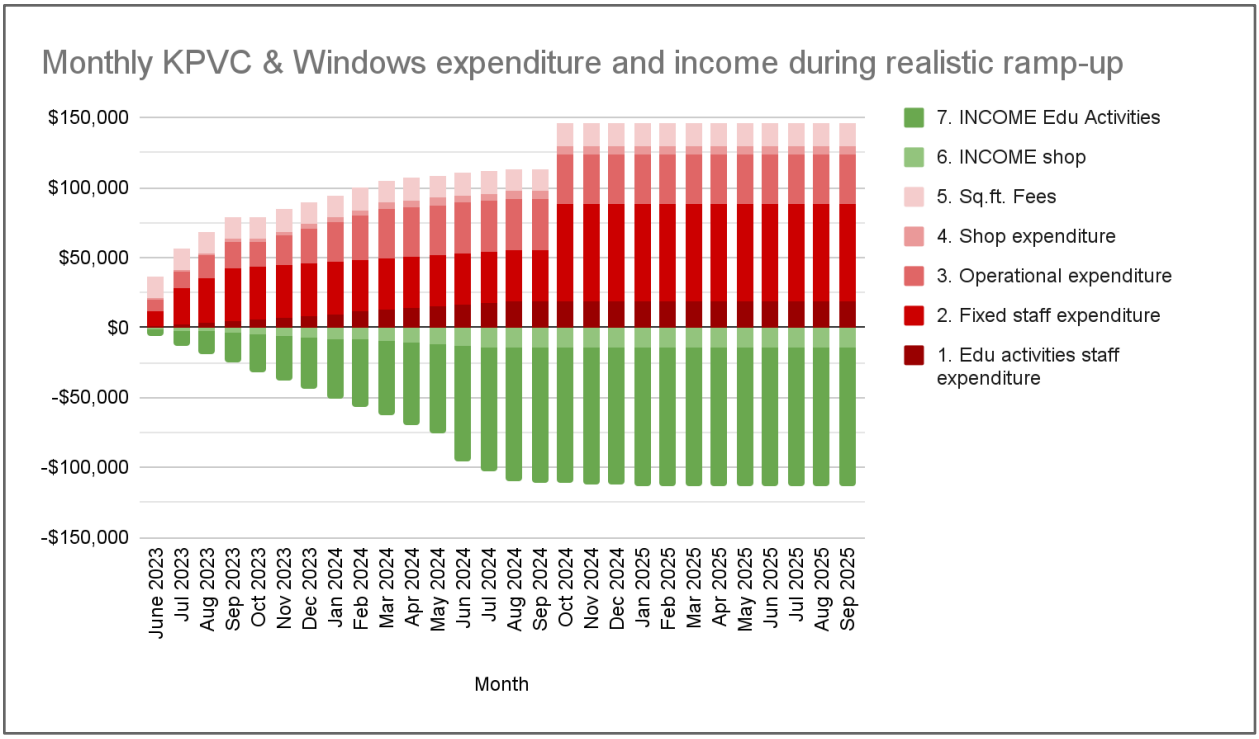
Expenditure

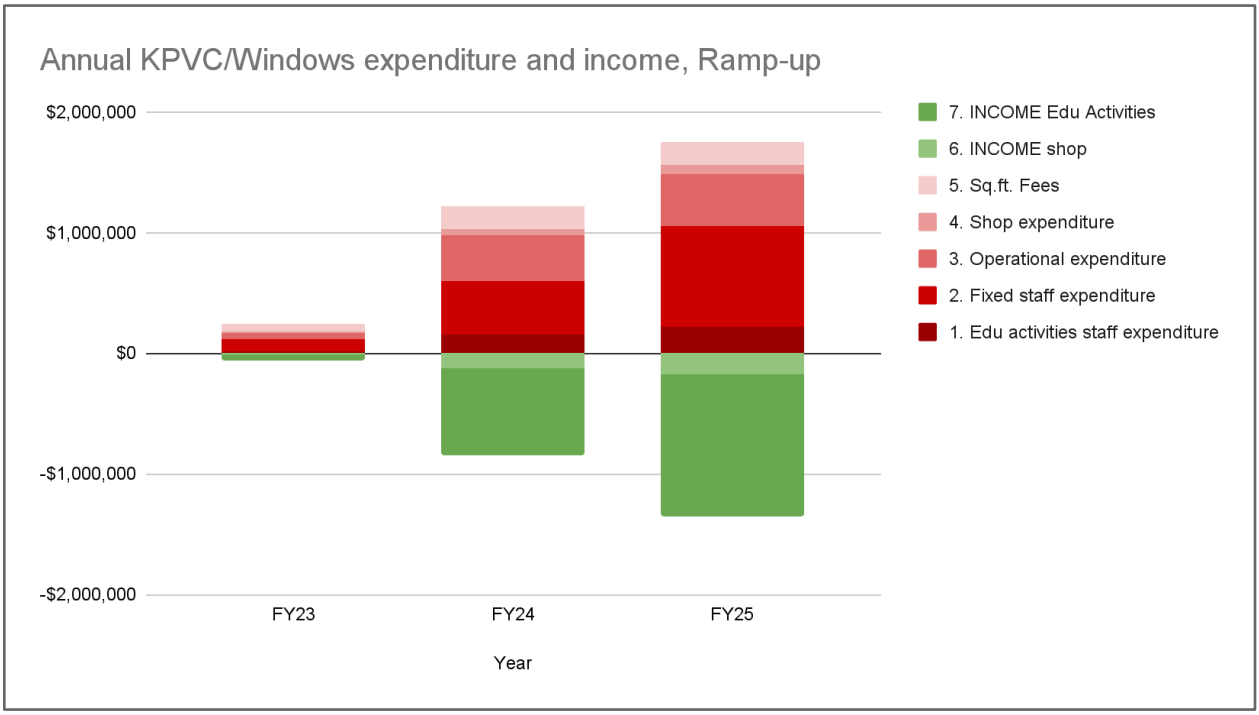
5 Expenditure Groups:

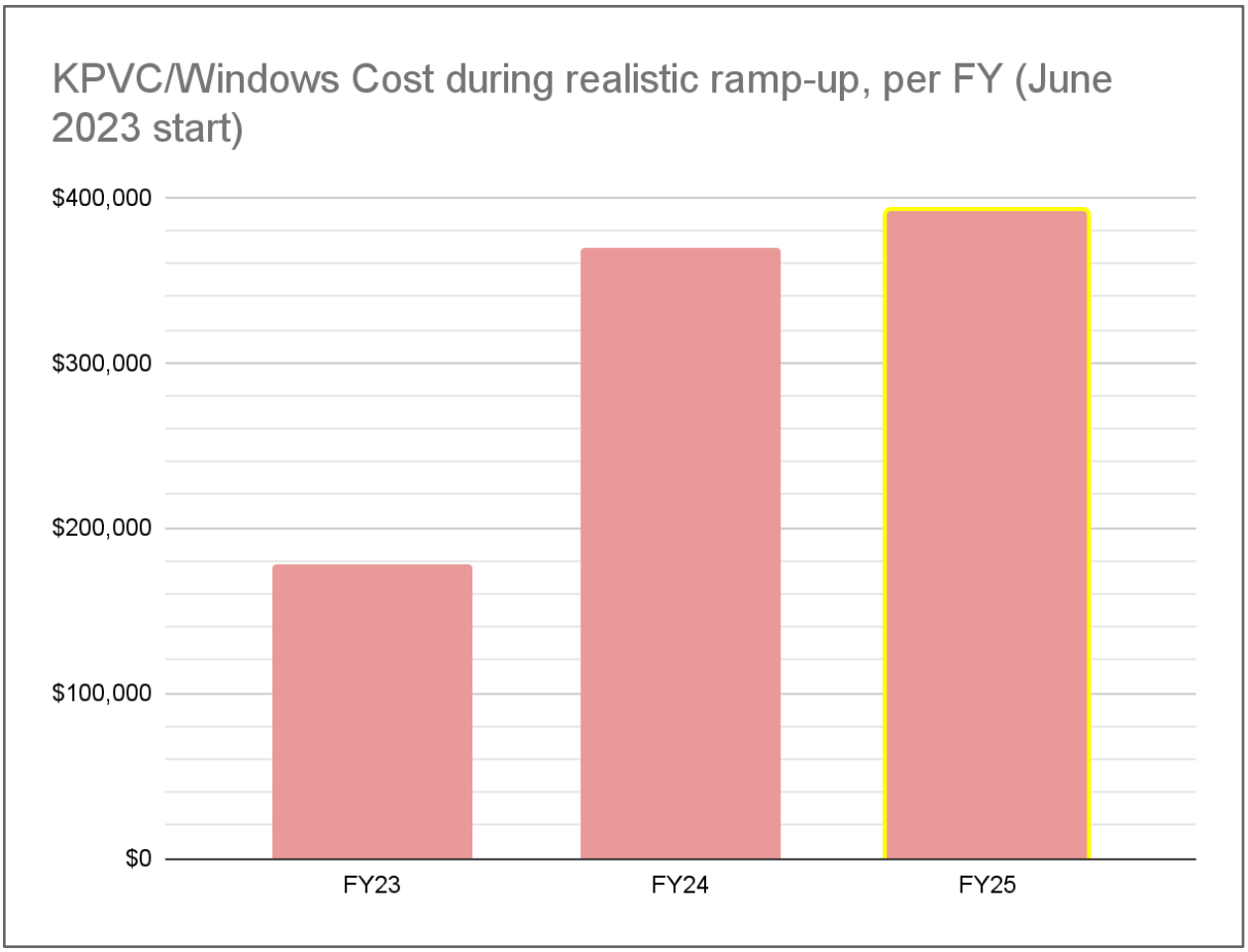
1. Edu activities staff expenditure
2. Fixed staff expenditure
3. Operational expenditure
4. Shop expenditure
5. Sq.ft. Fees


FY25 Expenditure on the 5 expenditure groups
5. Sq.ft. Fees
10.9%
4. Shop expenditure
4.2%
3. Operational expenditure
24.6%
1. Edu activities staff
12.6%
2. Fixed staff expenditure
47.6%
$190,680
$220,966
$430,224
$832,876

Balance


Monthly KPVC & Windows expenditure and income during realistic ramp-up
$150,000
$100,000
$50,000
$0
-$50,000
-$100,000
-$150,000
June 2023
Jul 2023
Aug 2023
Sep 2023
Oct 2023
Nov 2023
Dec 2023
Jan 2024
Feb 2024
Mar 2024
Apr 2024
May 2024
Jun 2024
Jul 2024
Aug 2024
Sep 2024
Oct 2024
Nov 2024
Dec 2024
Jan 2025
Feb 2025
Mar 2025
Apr 2025
May 2025
Jun 2025
Jul 2025
Aug 2025
Sep 2025
Month
7. INCOME Edu Activities
6. INCOME shop
5. Sq.ft. Fees
4. Shop expenditure
3. Operational expenditure
2. Fixed staff expenditure
1. Edu activities staff expenditure


Annual KPVC/Windows expenditure and income, Ramp-up
$2,000,000
$1,000,000
$0
-$1,000,000
-$2,000,000
FY23
FY24
FY25
Year
7. INCOME Edu Activities
6. INCOME shop
5. Sq.ft. Fees
4. Shop expenditure
3. Operational expenditure
2. Fixed staff expenditure
1. Edu activities staff expenditure



Year	1. Edu activities staff expenditure	2. Fixed staff expenditure	3. Operational expenditure	4. Shop expenditure	5. Sq.ft. Fees	6. INCOME shop	7. INCOME Edu Activities
2025	$220,966	$870,031	$430,224	$73,530	$190,680	-$178,672	-$1,182,315

Expenditure and Income

Marketing Strategy

Marketing should be viewed as a necessary and welcomed investment in building relationships with potential visitors and donors:

1. KPVC will engage in vigorous marketing and promotion, making a significant effort with dedicated staff to draw people to its programs and exhibits.
2. It will offer a membership program to build a constituency of support.

Name

The name Windows on the Universe Center will confuse guests, and, while it was obviously a good placeholder name for a grant application, it should be set aside as a venue name. The simplest approach could be to calling the venues:

- The Kitt Peak Visitor Center (existing visitor center)
- The Exhibition Center (facility at the McMath-Pierce Solar Telescope)

A donor's name may be added to each, as well as venues within when a naming level gift is made.

Marketing Plan

The marketing plan aims to capture the attention of several key audiences including Arizona residents, the tourists, students and educators, youth groups, amateur astronomers and families.

The unique repurposing of this iconic former astronomical observatory will garner significant public attention. We have a broad based plan (and budgeted funds) to market and advertise it beginning in the months leading up to the Opening Ceremony, and then during operations. Visible from over 100 km (60 miles) away, its ten-story tall optics tower and 60-meter (200 foot) diagonal light tunnel is captivating even at great distances. Up close, its form is impressive and unforgettable for audiences who have experienced guided tours within its striking structure. The conversion of it from a limited access scientific observatory to an open access outreach center with new exhibits, a digital planetarium, and Science On A Sphere (SOS) theater will be the first of its kind transformation of such a large scientific asset to an astronomy education center. The continued operation of the heliostats at the top of the tower to project live, very large size (3 feet) images and spectra of the Sun for public viewing is an additional, unique aspect of our plan.

We have a robust plan for developing new revenue-generating programs that will utilize one or more of the features of the facility. The appeal of the new programs and facilities is being combined with the KPNO's brand recognition and the KPVC's existing assets — four telescope enclosures, auditorium, exhibits, gift shop, telescope galleries, DESI exhibition —and its existing successful day and evening programs. At the end of the 5-year period, the Windows Center will be a self-sufficient asset operated as part of the visitor program.

We expect first year attendance to be strong for a number of reasons. The Windows Center will be a major, new attraction in Arizona, particularly southern Arizona. Public demand for astronomy-based programs and experiences is very high in Arizona. There is a significant astronomy-related industry in Arizona, particularly in astronomy tourism. The Kitt Peak brand is well recognized among the general public and particularly among astronomy-interested audiences in the US and around the world.

There are a large number of area residents who have not visited KPNO at all, or at least not recently, who have the impression that there is nothing new to see. We believe we can attract many of those with such a belief back to Kitt Peak. We will work with our current tourism promotion partners such as the Tucson Chamber of Commerce, the Southern Arizona Attractions Alliance, Visit Tucson, and the Arizona Office of Tourism to promote the new programs and exhibits. We will produce news releases for significant news for Windows and KPVC, and utilize the webpage (https://kpno.noirlab.edu/), our social media channels and those of our partners to generate interest and spread enthusiasm. Our linkages to professional peer groups such as the Association of Science & Technology Centers will also be utilized to promote the new center.

In previous years the KPVC spent about $70K annually on all aspects of its advertising and marketing efforts. We intend to more than double this in the first year of Windows. This will generate significant new public awareness of Kitt Peak and the development of the Windows Center. We intend to cultivate a number of Arizona writers, journalists, radio, and television newscasters to provide top-level, no cost coverage. They will be provided special behind the scenes pre-opening tours as part of that cultivation effort.

We anticipate continuing our model that utilizes an external advertising contractor company. We currently work with *Davidson Advertising* to locally and regionally promote KPVC programs. We also use *Certified Folder* to stock and maintain brochure racks located in the lobbies of thousands of restaurants, hotels, and attractions across much of Arizona. We plan to continue our relationship with these companies and contract with additional companies that have unique specialized skills or market reach to grow our web and social media presence, as well as develop new communication tools. We will produce advertising videos including video-based animated facility walk-throughs and tours. We will continue to design brochures, posters, and flyers promoting existing and new programs. We use external, low cost online printing companies to print these products.

We will have two built-in perpetual marketing assets within the Windows Center in the form of the SOS and planetarium systems. As we create and internationally distribute branded playable data sets to museums and other institutions equipped with one or both systems, we gain additional marketing attention to potential visitors. Each time we acquire a new image from a KPNO, or another NOIRLab

Program and transform it into files to distribute among these user groups, we gain new exposure around the globe in museums that are so equipped. As with past KPVC operations, the combined marketing, promotion, and advertising strategies are focused on turning public interest into revenues that will sustain and strengthen the operation.

We will have significant options for expanding our fee-based programs to increase the duration of visits and the revenue generated by each guest (see Appendix B). Presently, most daytime guests have only one or a small set of tours to select and may spend money in the gift shop. With the Windows Center, the tour options expand, there will be an array of SOS and planetarium shows, exhibits, and special events or demonstrations to select in addition to our current offerings. The options available for a customized visit for groups (schools, youth groups, seniors, tourist travel companies, etc.) and potentially special events will be similarly enhanced. New nighttime programs will be developed as well. When combined with existing KPVC assets and programs, we will provide a menu of one-of-a-kind experiences for visitors to select. Such a menu will stimulate target audiences to plan a visit.

In order to control crowds and keep daily operations within capacity, we will use a new sophisticated booking tool in Eventbrite.

In addition to the revenue directly linked with each new program, tour, or presentation, there will be significant impacts on existing programs and revenue-generating activities, such as the gift shop, by the expected surge in public attendance.

Visual Identity

The branding of KPVC will follow the standard NOIRLab Visual Identity, which will be augmented as needed to give strong visibility to the “Visit Kitt Peak” message if possible without introducing the KPVC as yet another tertiary brand in addition to NOIRLab, KPNO and AURA.

Tentative Fundraising (FR) Strategy

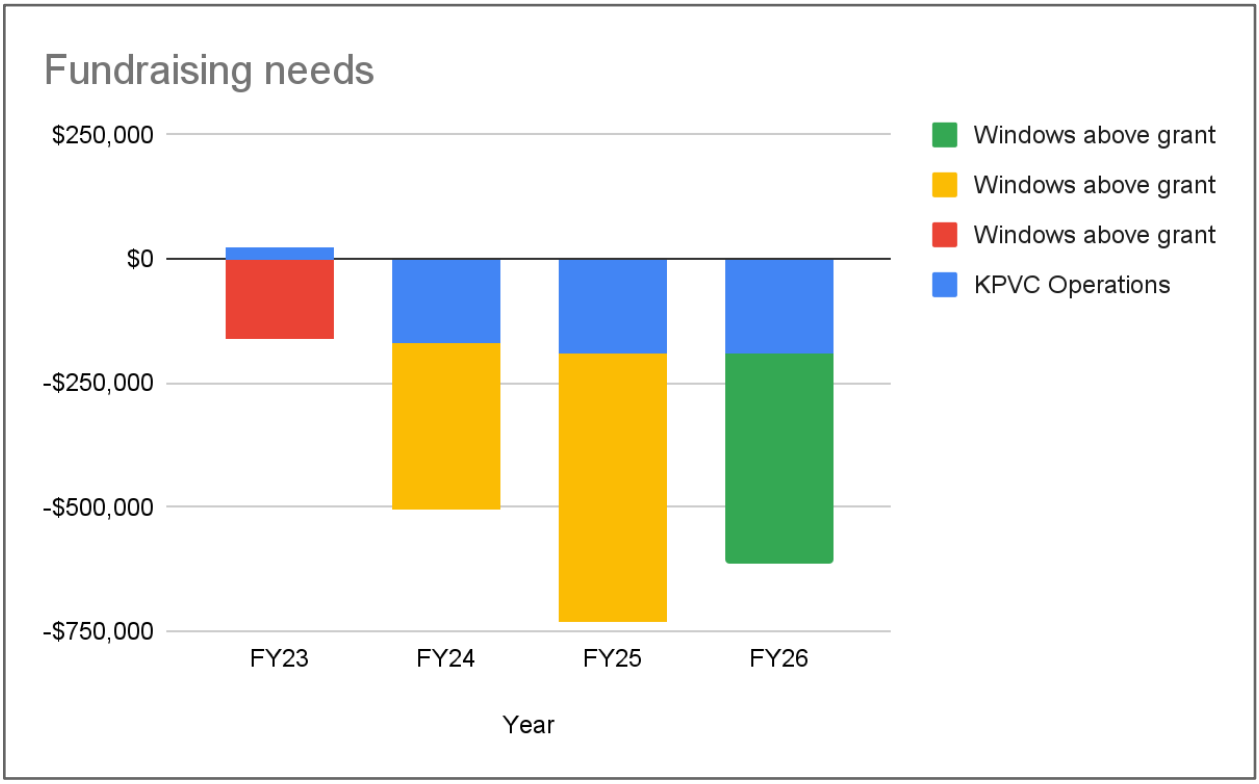
“Don't be limited by the money we have now, plan for the money we will have in the future”

“We’re here for scientific research. Your fees pay for public education.”

FR Rationale & Potential

It will not be possible for the KPVC to fully support even basic visitor activities on Kitt Peak with its current NSF support and earned income alone. NOIRLab can neither successfully complete the exhibits at the McMath-Pierce Solar Telescope nor run its KPVC Operations without support funding

beyond that currently provided or budgeted by the National Science Foundation.



If the cost of KPVC and Windows are capped at $200k/year there is a need for fundraising both for the Windows exhibition and the KPVC operations.

Given the success of benchmark Arizona organizations in raising funds for public education, NOIRLab has the potential to raise the funds it needs.

We recognise that fundraising success is based upon two factors:

- A great deal of hard work
- Talent and know-how — so the hard work yields strong results in a timely manner.

A "culture of philanthropy" is crucial to fundraising and philanthropy planning and implementation:

1. Fundraising is extremely complicated and challenging work.
2. Private philanthropy is often the main driver of nonprofits' high mission-impact and transformational outcomes.
3. In organizations where a large fraction of operating revenues comes from a sole source (i.e., federal funds), private philanthropy supplies the margin of excellence that leverages and significantly extends the impact of the largest funder.

A strong culture of philanthropy embraces this framework and assigns high priority, high visibility, and high prestige to philanthropic gift work. Senior leadership, staff, volunteers, members, friends, and donors accept that success comes more easily to organizations where philanthropic gift work is prized and supported.

FR Implementation

Past barriers to fundraising need to be removed and services and support required to effectively raise funds need to be put in place. NOIRLab will ensure that its campaigns are professionally staffed and managed. Persistence, patience and the advice of experts who have a strong success record in fund development for public destinations and museum-like organizations is important. A “plan for a plan” has been developed with external support to get the fundraising process started:

1. Get approval from AURA CFO to start the fundraising process.
    a. Get the right people from AURA CAS, AURA Corp (Dana) to be involved in the FR planning process.
    b. Advisory committee
    c. AURA board to also endorse (in the end?)
        i. The board already knows[2] that FR is part of the Windows (substantive discussion was had).
2. Our very first step is to get the assistance of an exhibitions planning and design firm to assist us in **setting up a funding development program, do a basic community needs assessment and provide guidance for this Master Plan**.
3. We will work with an external company to perform a **Fundraising Campaign Readiness Study** and develop a plan. These expert advisors will evaluate our preparedness to raise funds and put in place a plan for NOIRLab to launch into those efforts.
4. **A fundraising plan will be elaborated upon,** split in Windows and KPVC activities:
    a. Listing fund raising activities for KPVC and Windows:
        i. Solicitation of donations on KPVC website
        ii. Direct solicitations to those who have made contributions before
        iii. Fundraising activities
        iv. KPVC Memberships
        v. Naming sponsorship
        vi. Events
        vii. Online store
    b. FR budget for these activities with expenses and projected revenue received

[2] "The Board" - the AURA fiduciary entity - has already approved the concept that fundraising would be required by AURA to operate the Windows Center. They approved that concept during their review of the Windows proposal. That action of the Board is durable.

c. Identification of which accounts expenses will be charged to (incl. Windows).
    i. It is important that Windows construction funding cannot go to KVPC.
    ii. Also note: *"The costs of solicitation are chargeable to AURA's corporate funds only and shall not be charged to any Federal contract, grant, or cooperative agreement. Subject to this guideline, fund raising may be performed within or outside of normal working hours including vacation or special leave time;"*
d. Listing of the states in which fundraising (solicitations) will occur.
e. Listing who is responsible for carrying them out.
f. Description of online fundraising software planned: what it does and how it works to protect AURA by allowing fundraising in states where AURA is registered or does not have to register and blocking third parties located in states where AURA is not registered from being solicited.
g. List of states where we plan to solicit residents and registration for fundraising is required.
h. Copies of all written Cases for Support/solicitations and sponsorships so they can be approved in advance by the AURA President pursuant to the AURA Fundraising Policy before implementation.
i. Request approval from AURA President and VP Science.

5. **A letter will be sent to KPVC from the AURA President** (sample in Appendix E) to delegate legal authority to KPVC personnel and others to engage in fundraising activities.
6. **AURA Corp to (hire lawyers) to register FR activities** in 39 states plus the District of Columbia. (Barb believes this is important)
7. Together with the external experts above and the Exhibitions Planner we will improve the Master Plan and develop one or more highly evocative **Cases for Support**
8. ~~In order to remove barriers and assure donors and sponsors that their funds will be applied as intended in the long-term, we will in collaboration with CAS ***consider*** **creating an ancillary legal entity**, such as a foundation, not-for-profit or trust to support its fundraising efforts[3]. Expert planning advice should include an examination of this, and make recommendations.~~

Like institutions of higher education, NOIRLab will not run one-off campaigns, but will **always either be in campaign mode or preparing for the next campaign**. It may, sequentially operate capital campaigns to build its infrastructure and reserves as well as run an annual campaign to support its programs and day-to-day operations. (One-off campaigns are excessively costly, neither do they build and maintain valuable long-term relationships, nor do they provide for the long term needs of an organization.)

[3] Lowell Observatory has had notable success with its ancillary entities.

Grants, donations, and sponsorships

The following strategies provide an initial vision of how increased funding will be organized and applied.

- The aim is to fund operations with a balance of earned income and support (in the form of grants, donations and sponsorships) with no less than 25% of operating costs from support.
- Eventually, an endowment (or other type of permanent fund) sufficient to provide (very approximately) half the annual monies needed to support operations should be in place.
- Risk management reserves will be built to sustain the operation through challenging economic periods and provide funding for urgent, uninsured (self-insured) capital repairs.

There are two main needs for fundraising:

1. Operational fundraising
    - $225k/yr in full operation
2. Fundraising to cover the Windows Exhibition
    - Exhibits Phase I: $636k (2023)
    - Exhibits Phase II: Enhanced Exhibits: $540k (2024)
    - Exhibits Phase III: Augmented Exhibits: $424k (2025)

Naming sponsorship

As part of its capital campaigns we will put in place a naming sponsorship procedure and vigorously pursue naming sponsorships.

Events

Facility events, rentals, meetings, film location will be an important pillar of operation as a revenue source. The scientific operations will remain undisturbed by these events, and a procedure will be developed to ensure the orderly operation of these events (e.g. no alcohol, no stag/hen nights, no tobacco commercials etc.)

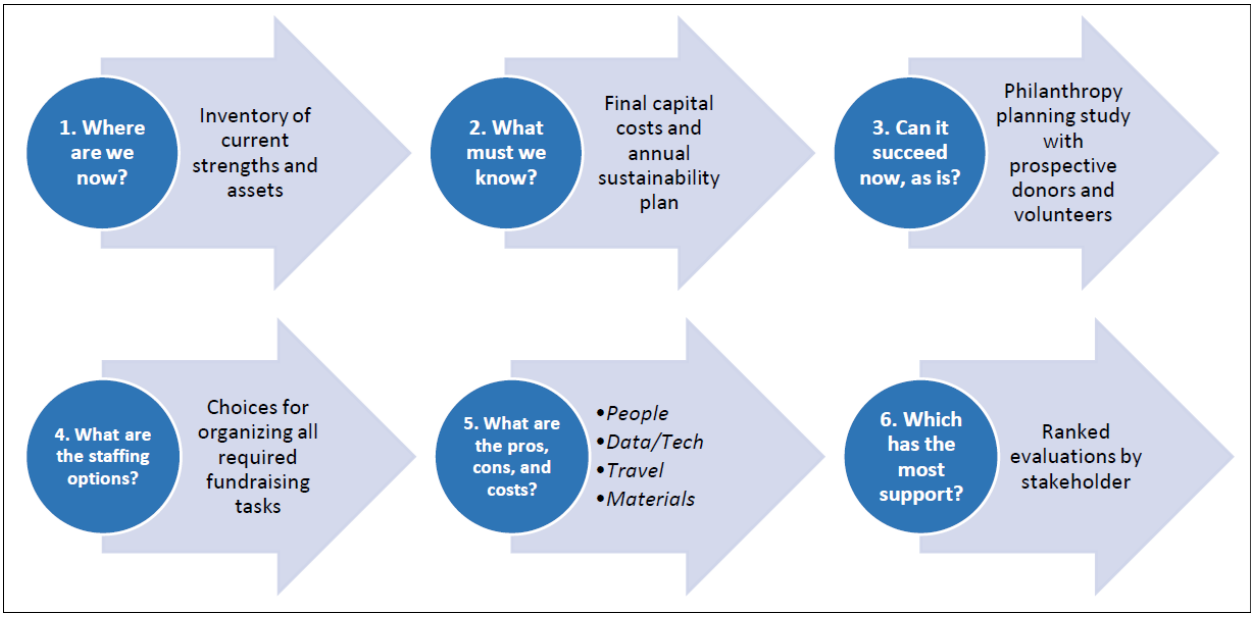
Memberships

Expansion of the existing membership program — members receive free or discounted program admission — current categories range from $50 to $5,000/person, with varying levels of additional benefits. Our participation in the Association of Science & Technology Center's Passport program enables our members to receive free or discounted admission to hundreds of participating science museums. We plan to fully capitalize on this opportunity. Our Windows staffing and marketing plans will support this effort.

Developing a Case for Support

These building blocks are considered the most critical assets in securing private gifts and grants:

- Positive opinion of and admiration for the organization (external)
- Enthusiastic response to the perceived benefits of the project seeking investment (external and internal)
- Sufficiently large pool of qualified gifts prospects[4]
- Full engagement from organizational leadership, volunteers (board of directors), and staff
- Realistic fundraising goal
- Sustainable plan for the program when the money has been raised
- Realistic campaign strategies and proper tools for efficiency and effectiveness
- Skilled, experienced philanthropic gift professionals to plan, drive, and complete the fundraising effort



It is imperative to understand and be able to communicate the full scope of the Windows' program, benefits, impacts, financial and operational features. The following questions must be answered in detail, and when assembled in plain language, form your campaign case for support:

1. How will private funding take the project to a new level of excellence?
2. What components of the visitor experience will be enabled with private gifts?
3. What are the benefits of visiting the Windows in person?
4. What type of virtual programming will be developed and what benefits will it provide?

[4] Qualified means that these three characteristics are present: 1) a capacity for gifts in the range required for success, 2) known linkage to the organization (frequently through volunteer's spheres of influence) and/or to the nature and anticipated outcomes of the project, and 3) known or revealed inclination to participate in the success of the organization/project.

5. What are the larger impacts and community benefits?
6. How will NOIRLab/AURA measure these desired outcomes?
7. Once constructed, how will the Windows be funded and used?
8. How will stable income be secured and sustained?
9. How will the Windows be positioned to attract in-person and virtual visitors, donors, educators, and other stakeholders?
10. How will the Windows be integrated into other NSF astronomy education and outreach efforts?
11. What opportunities are there for the Windows to assume a productive role in meeting NSF's long-term goals?
12. What does the staffing plan for the Windows offer to NSF?
13. Are there unique skills and talents among the staff?
14. Is there leadership succession for the future?

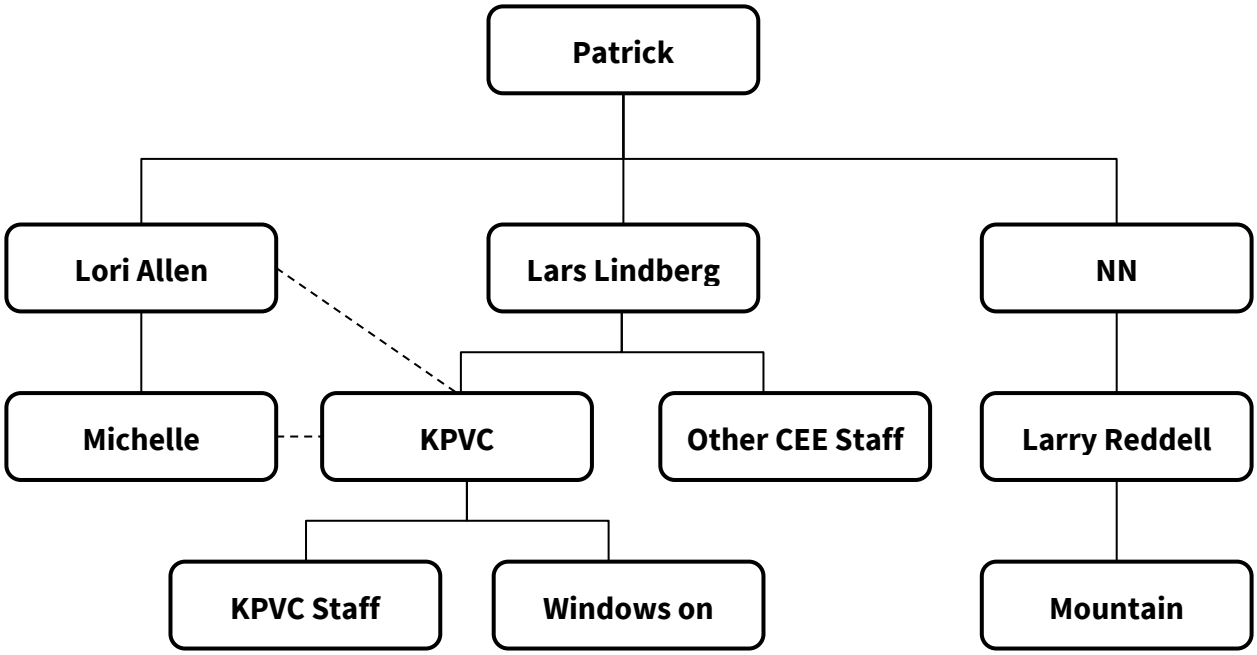
Project Management

Key Roles and Responsibilities

Roles and responsibilities within Windows are as follows:

Leadership	
Director of NOIRLab	Provides top-level oversight and governance for the project.
MSO Director	Has been championing the project from the beginning and is responsible for the strategic leadership of the MSO program incl. the KPVC. Is responsible for the TON interactions and local engagement. Is responsible for Windows Construction, and responsible for fundraising for Windows and KPVC. Is responsible for the interactions with the staff and visiting scientists.
Associate Director of KPNO	Oversees Mountain Operations, manages scientists and tenants. Is responsible for the day-to-day operations interface with the KPVC and the KPVC Operations Manager. Has the ability to stop the KPVC operations at any point. Is responsible for the interactions with the staff and visiting scientists.
Head of CEE	Is responsible for the overall safe, orderly, and scientifically accurate implementation of the NOIRLab visits program at KPNO incl. framework, processes, educational content, communication, marketing and overall workflows.

KPVC Operations manager	Responsible for the day-to-day operations of the KPVC (incl. Windows), and ensures the continuous operation of the KPVC within the given framework.
KPVC Staff	
Project Designer	Provides key support in construction project management, task scheduling, budget tracking, and report generation. Serves as the main point of contact and organizer with site partners and contractors. Prepares documentation and graphics. Drives reviews of designs and construction drawings.
Development & Fundraising Coordinator (TBH)	Seeks additional support and sponsorships and raises funds for general operations after public opening. Cultivates donor base; develops and responds to funding opportunities. Recruitment began August 2019, but has since been postponed due to COVID-19.
KPVC Tech Supervisor (TBH)	Programs, operates, and leads the maintenance of the SOS, Heliostats, KPVC Telescopes and Digital Planetarium. Leads development of playable datasets on either system using images or other data from KPNO and other NSF-funded astronomy facilities.
KPVC Technician (KPVC)	As one of two primary operators of the SOS, Heliostats, KPVC Telescopes and Digital Planetarium. Maintains these facilities also.
MSO Tohono O'odham Nation Educator & Partnerships liaison	
Educational Programs Developer	
Administration (0.5 FTE)	
Guides	Part of KPVC pool
Docents	Part of KPVC pool
NOIRLab Central Facilities Operations (CFO)	
Construction Site Manager	Oversees demolition and construction by general contractors and subcontractors, interfaces with Kitt Peak Mountain Operations.



Internal Governance Organization Chart

External Stakeholders

AURA Central Administration Services (CAS) Staff	
Sherri Abney	Contracts Officer
AURA Corporate Office Staff	
Shari Lifson	Corporate Communications Coordinator
National Solar Observatory (NSO) Staff	
Detrick Branston	McMath-Pierce Operator (former)
Jack Harvey	National Solar Observatory
Advisors (potential)	
Jeff Hall	Lowell Observatory
Jacelle Ramon-Sauberan	TON and NSF'S NOIRLab
Keith Norris	Himdag Ki:
Ed Krupp	Griffith Observatory
Suzy Gurton	NRAO, head of EPO
Frank Summers	AURA/STScI
Claire Raftery	(former AURA/NSO)
Jorge Perez-Gallego	UC Boulder
Rick Fienberg	Formerly S&T, AAS
James (Jim) Sweitzer	Consultant
Ian McLennan	Consultant

Ryan Wyatt	California Academy of Sciences
Robert Hurt	IPAC/NASA
Tohono O'odham Nation Educators	
Thomas Cupis	Astronomy, High School
Ayesha Brewster	Chemistry and Biology, High School
Lucinda Begay	Science, 7th Grade
Cherri Church	Science, 8th Grade
Dominic Alvarez	Science, 6th Grade
Myles Gallagher	Tohono O'odham Cultural Center

Project Management Control Plan

The Windows Project Management approach has been organized to conform to guidance resulting from the NOIRLab Director's Project Review (May 2020) while providing a structure that will efficiently deliver the required elements of the project. The project also conforms to guidance contained in the various NSF management and oversight documents. The project team is led by an Integrated Product Team overseen by a Management Team.

Windows Center Integrated Product Team

An integrated product team (IPT) is a multidisciplinary group of people who are collectively responsible for delivering a defined product. The Windows Center IPT is responsible for the design and construction of the Windows Center. The IPT will be extant until the completion of the construction and installation of the initial suite of exhibits. The IPT will stand down prior to the start of operations of the Window Center. The IPT lead will call and conduct regular meetings of the team. Agendas will be set in advance and brief minutes will be kept. The chair of the Windows Center Management Team will attend meetings of the IPT as schedules permit.

Windows Center Integrated Product Team (IPT) (Construction)

Dr. Lori Allen (Lead)	Acting Project Director of Windows on the Universe Director of Mid-Scale Observatories (MSO)
Dr. Michelle Edwards	Associate Director of Kitt Peak National Observatory
Sherri Abney	CAS
Mei Starns	Project Designer
Floyd Librea	Construction Site Manager for Windows on the Universe Head of NOIRLab Facilities Operations, Arizona

Windows Center Integrated Product Team (IPT) (Exhibition)	
Dr. Lori Allen (Lead)	Acting Project Director of Windows on the Universe Director of Mid-Scale Observatories (MSO)
Dr. Michelle Edwards	Associate Director of Kitt Peak National Observatory
Sherri Abney	CAS
Mei Starns	Project Designer
Lars Lindberg Christensen	Head of CEE

Windows Center Management Team

The Management Team oversees the overall work of the IPT and holds the top-level configuration change authority for the project. The Windows Management Team will meet monthly to review progress, prepare quarterly reports to the NSF, and approve changes to the overall budget, scope, and schedule. The Management Team Chair and IPT Lead will report to the NSF monthly during regularly scheduled meetings between the NOIRLab leadership and the NSF.

Windows Center Management Team	
Patrick McCarthy (Chair)	Director of NOIRLab
Heidi Hammel	AURA Vice President for Science
Lori Allen	Director of Mid-Scale Observatories (MSO)
Michelle Edwards	Associate Director of KPNO
Lars Lindberg Christensen	Head of CEE
TBD	Associate Director of Administration and Finance for NOIRLab

Configuration Control

The project team will be using two separate change control plans — one for construction, the other for exhibits.

Construction

The Technical Representative and On-Site Construction Manager during the demolition and construction process is Floyd Librea. The Site Representative is Larry Reddell.

The Construction Manager will check in with the general contractor three times a week for at least two hours each meeting to review the project and resolve any issues or questions the general contractor may have. The Construction Manager will send a written report to the Project Director after each meeting about the status of the project, progress, schedule, and matters arising. The Construction Manager will be on call during regular business hours.

All questions and issues will be resolved by the Site Representative, followed by the On-Site Construction Manager if deemed necessary. All RFIs will be answered by the On-Site Construction Manager. Should the Construction Manager have any questions or concerns, they can be presented to Advantech A&E, the Project Designer, and/or the Project Director. The Construction Manager will determine if Advantech A&E needs to be consulted, advised, or brought on-site for discussion.

A "RACI" chart assigning roles and responsibilities for each milestone or decision of the construction process is shown below. The definition of RACI is as follows:

- Responsible — Does the work necessary to complete the task. At least one party per task.
- Accountable — Delegates work and is the last to review the task before it is deemed complete. Limit to one party per task.
- Consulted — Provides input based on how the task will impact their future project work and/or their knowledge and expertise on the task itself. No minimum or maximum.
- Informed — Needs to be kept updated on project progress rather than included in the finer details of each task. No minimum or maximum.

Project Activity/ Deliverable	General Contractor	On-Site Construction Manager	A&E Firm	Project Designer	Project Director	Windows Integrated Project Team*	Windows Center Management Team*

Define Functional and Aesthetic Needs	C	C	R	R	A	C	I
Define Functional and Aesthetic Needs	C	C	R	R	A	C	I
Assess Risk	R	R, A	R	R	R	R	R
Define Performance Requirements	C	A	R	R	R	C	I
Execute Construction	R	A	C	C	C	I	I
Approve Construction Work	C	R, A	R	R	R	C, I	C, I
Change Orders >$1K	R	R	C, I	C	A	C, I	C, I
Change Orders >$10K	R	R	C, I	C	C	C	A

RACI Chart — Demolition and Construction

Exhibits

All questions and issues will be resolved by the Public Programs Supervisor and the Digital Astronomy Programs Associate. Should these team members have any questions or concerns, they can be presented to the Project Designer and/or the Project Director. The Project Designer will determine whether or not the Exhibit Design Build Firm needs to be consulted, advised, or brought on-site for discussion.

A RACI chart assigning roles and responsibilities for each milestone or decision of the exhibit design and development process is shown below.

Project Activity/ Deliverable	Exhibit Design Firm	Project Designer	CEE Head	Windows Development Team*	Windows Center Management Team*
Define Aesthetic Needs	C	C, R	A	C	I

Define Functional Needs	C	C, R	A	C	I
Assess Risk	R	R	R	R	C
Define Performance Requirements	C	R	A	C	I
Execute Design and Installation	R	C	C	I	I
Approve Design Work	R	C	A	C, I	C, I
Change Orders >$1K	C	R	A	C, I	I
Change Orders >$10K	C	R	C	C, I	A

RACI Chart — Exhibit Design and Development

Meetings

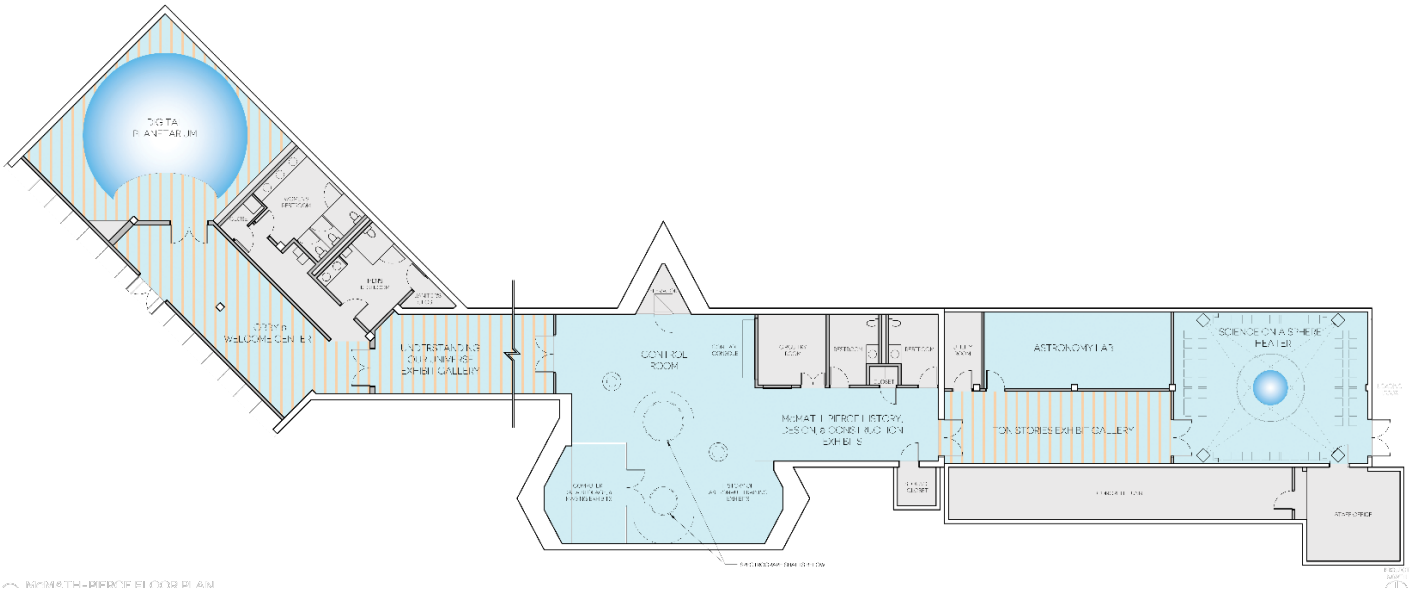
- Windows Center Management Team: as needed.
- Windows Integrated Project Team: weekly.
- Windows Development Team: weekly. Includes MSO, KPNO and CEE management
- Windows Steering Committee meetings: Monthly. Includes NOIRLab director, MSO management, AURA corp leadership
- Advisory Panel meetings (quarterly)
- Owner/Architect/Contractor (OAC) Construction Meetings

Windows Project Schedule

Current level of resources dictates that we will carry the project out in three separate phases as described below. The initial public opening will feature the east wing fully developed, with SOS, TON Stories, classroom, and control room exhibits. The lobby will be equipped, but the planetarium and the enhanced Understanding Our Universe exhibits will be populated with basic exhibits.

The phases include the following:

- Phase 1: Front façade, Lobby (first iteration), Understanding our Universe (first iteration), McMath Solar Telescope Control Room, ~~Kitt~~ Peak I'itoi's Garden, Astronomy Lab, SOS Theater, Windows building improvements, limited exterior signage (incl. a TON “Welcome to Our Sky



Island" sign by the parking lot).

- Phase 2/3: Hearing Loop, Building Audio System, Outdoor Exhibits, Optical Viewing Tunnel Gallery, Lobby (second iteration), Understanding our Universe (second iteration), Planetarium

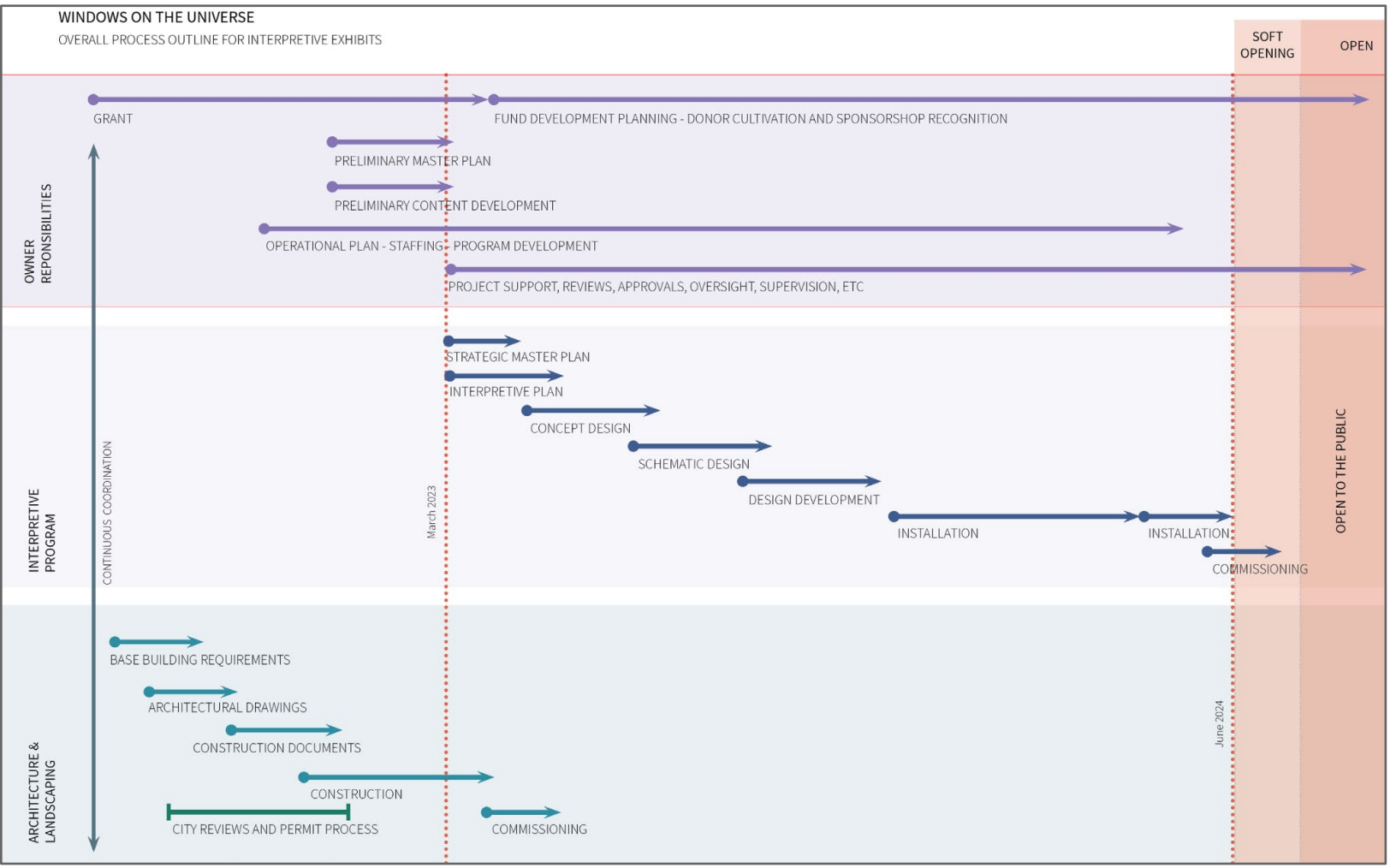
Locations of Phases. Phase 1 — Blue. Phase 3 — Orange.

The figure above maps out the locations where these phases would occur throughout the project.

Project	Activity	Status (%)	Start Date	End Date
Windows Observatory Technician Dean Salman (50%)		100%	1 Oct 2019	30 Sep 2024
Guide documentation and training presentation		10%	1 Mar 2023	1 May 2023
KPVC Guides rehire and retraining		0%	1 May 2023	30 Sep 2024
Start KPVC Observatory Technician Dean Salman (50%)		100%	15 Apr 2023	30 Sep 2024
Start VC Asst. Mgr (day) Vivian Segundo		100%	15 Apr 2023	30 Sep 2024
Start Docent/Heliostat tech Andy Sorensen		100%	15 Apr 2023	30 Sep 2024
Docents rehire and retraining		0%	1 May 2023	30 Sep 2024
Start KPVC Operations Manager		97%	1 Jun 2023	30 Sep 2024
Fundraising Coordination (outsourcing)		20%	1 Jun 2023	30 Sep 2024
Public Astronomy Guide Supervisor		10%	1 Jul 2023	30 Sep 2024
VC Guide/Cashier Wynona Juan		100%	1 Jul 2023	30 Sep 2024
GEMMA/Windows Fulldome and 360-deg video Residencies		90%	1 Sep 2023	1 Jun 2024
MSO Tohono O'odham Nation Educator & Partnerships liaison		50%	1 Oct 2023	30 Sep 2024
Tech supervisor		25%	1 Oct 2023	30 Sep 2024
Motion Graphics Designer		97%	1 Oct 2023	30 Sep 2024
Exhibition Phase 1			1 Mar 2023	1 Jul 2024
Bidding preparations (SoW, CAS)		90%	1 Mar 2023	1 May 2023
Bidding		0%	1 May 2023	1 Jun 2023
Strategic Master Plan		60%	1 Mar 2023	1 May 2023
Interpretive Plan		5%	1 May 2023	15 Jun 2023
Concept Design		0%	1 Jun 2023	15 Jul 2023
Schematic Design		0%	15 Jul 2023	15 Sep 2023
Detailed Design development incl. Scopes of Work		0%	1 Sep 2023	15 Oct 2023
Installation		0%	1 Nov 2023	15 Apr 2024
Commissioning		0%	15 Apr 2024	15 May 2024
Fundraising			15 Apr 2023	30 Sep 2024
Fundraising set-up, community needs assessment & Master Plan consultan			15 Apr 2023	1 Aug 2023
Fundraising project Exh I + FY23/24 ops			1 May 2023	30 Sep 2024
Advisory Board			1 Jun 2023	15 Jun 2023
Friends of Kitt Peak			1 Jun 2023	1 Jul 2023
Donor Cultivation			1 Jun 2023	1 Jan 2024
Fundraising project Exh II + FY25 ops			1 May 2024	
Fundraising project Exh III + FY26 ops			1 Oct 2025	
Opening preparations			3 Mar 2024	1 Jun 2024
Opening marketing campaign			3 Mar 2024	1 Jun 2024
Soft opening			1 May 2024	1 Jun 2024
Grand opening			**1 Jun 2024**	**1 Jun 2024**

Schedule as of 1 April 2023.

Exhibition phases:



Owner responsibilities:

- Fund development planning - Donor cultivation and friend raising, capital and operating fundraising, endowment
- Project support, reviews, approvals, oversight, supervision, etc.
- Operational plan - Staffing - Program development

Interpretive Program:

- Strategic master plan
- Interpretive master plan
- Purpose of an Interpretive Master Plan

- Adds to, and extends the Strategic Master Plan
- Identifies and considers all interpretive opportunities available
- Clarifies purpose, learning goals and objectives for guests
- Establishes key themes and messages for exhibits and programs
- Determines how the stories will be communicated (delivery media)
- Establishes design approach for exhibits, AV content & graphics
- Provides a concept level description of the exhibits, theater shows, other experiences and programs
- Clarifies what is possible and best way to complete the project based on constraints like schedule and budget.

- Concept design
- Schematic design
- Detailed design
- Fabrication
- Installation
- Commissioning

Architecture & Landscaping:

- Base building requirements
- Architectural drawings
- ~~City reviews and permit process~~
- Construction documents
- Construction
- Commissioning

Exhibition Development phases

0. Initiation
    - ~~Site visit with Bill Peters on 12 Feb.~~
    - ~~Fundraising kick-off (Alice Ferris): internal stakeholders: **Pat McCarthy, Lori Allen, Michelle Edwards** => fundraising product~~
    - ~~DNA draft~~
    - ~~Conceptual budget draft~~
    - ~~Offer workshop~~
    - ~~Workshop (**Juan, Bill**, Ian, **Rachel**, **Mark**, **Justine**, **Rob**, Peter M, **Lars,** Dean, Andy) - ~16-17 March in Tucson/hybrid:~~
        i. => Report + Presentation to internal stakeholders: **Pat McCarthy, Lori Allen, Michelle Edwards** + Dean, Andy, Mei + advisory committee
    - Statement of Work

1. Iteration
    - Strategic Master Plan
    - Interpretive Master Plan
2. Design
    - Concept => fundraising
    - Detailed concept
3. Build phase

Primary Points of Visitor Interaction

Visitor Center:

- Ticketing
- Giftshop
- Site Orientation
- Exhibits
- Mini-theater
- Restrooms

Site:

- Telescopes
- Visitor Galleries
- Mountain Environment
- Tohono O'odham Nation

McMath-Pierce Telescope:

- Welcome Area / Lobby
- Planetarium
- Understanding our Universe
- MMP Telescope Control Room
- NSF Astronomy Showcase
- Astronomy Classroom
- Science on a Sphere Theater
- Sundial
- Webcams
- Optical Tunnel Viewing Gallery

Governance after opening

After the opening the Windows Center Integrated Product Team will be disbanded.

The Windows Center Management Team will meet monthly.

The Advisory Board will meet quarterly.

The MSO Director, KPNO Associate Director, Head of CEE and KPVC Operations manager will meet weekly.

Abbreviations, Terms, and Definitions

NOIRLab CEE has developed an abbreviations and acronyms list to support authors in finding the most used terms and their descriptions.

Terms	Definition
ADOT	Arizona Department of Transportation
AZ	Refers to NOIRLab locations in Arizona: HQ and KPNO
CL	Refers to NOIRLab locations in Chile: Recinto, Cerro Tololo and Cerro Pachón
EPO	Education and Public Outreach
HP	Hale Pohaku
HI	Refers to NOIRLab locations in Hawai‘i: HBF and Gemini North at Maunakea
HQ	Refers to the buildings at 950 Cherry Av, Tucson, USA
KPVC	Kitt Peak Visitor Center
MSO	Mid-scale Observatories
OTOP	Overnight Telescope Observing Program
POS	Point of Sales system
RPAS	Remotely Piloted Aircraft Systems (drones)
TON	Tohono O'odham Nation
A&E	Architecture & Engineering
ALMA	

	Atacama Large Millimeter/submillimeter Array
AURA	Association of Universities for Research in Astronomy
CAS	Central Administration Services (AURA)
CCB	Change Control Board
CEE	Communications, Outreach, and Education (NOIRLab)
COSO	The Committee of Sponsoring Organizations of the Treadway Commission
CSI	The Construction Specifications Institute
CTIO	Cerro Tololo Inter-American Observatory
DKIST	Daniel K. Inouye Solar Telescope
DOE	Department of Energy
Gemini	Gemini Observatory
GONG	Global Oscillation Network Group
IceCube	IceCube Neutrino Observatory
IPT	Integrated Product Team
KPNO	Kitt Peak National Observatory
KPVC	Kitt Peak Visitor Center
LIGO	Laser Interferometer Gravitational-Wave Observatory
MMP	McMath-Pierce Solar Telescope
MSO	Mid-Scale Observatories (NOIRLab)
NMOC	NOIRLab Management Oversight Council

NOIRLab	NSF's National Optical-Infrared Astronomy Research Laboratory
NSF	National Science Foundation
OSTI	Office of Scientific and Technical Information
PB	Project Baseline
PEP	Project Execution Plan
R&D	Research & Development
Rubin	Vera C. Rubin Observatory
SOS	Science On a Sphere
TERO	Tribal Employment Rights Office (Tohono O'odham)
VLA	Very Large Array
WBS	Work Breakdown Structure
Windows	Windows Center, Windows on the Universe Center for Astronomy Outreach

Appendix A: Ancillary opportunities

- Replacement of all non-wooden signs on site
- DESI exhibition area artifacts (petal or similar).
- Picnic area
- Basketball Court
- Native Plant Garden
- Pad next to Roll-Off-Roof
- 24” telescope + dome in shipping containers
- Burrell-Schmidt 0.6-meter from Case Western, with a wide-field CCD: http://burro.astr.cwru.edu/Talks/ICL/Schmidt.html
- 2.1-m gallery
- Mayall visitor gallery dome
- Mayall visitor gallery top
- Shipping containers with MMP pieces
- Room with instrumentation (Katy G., Dick Joyce)
    - List: Third_floor_census_V3_20230314.docx
    - Photos: Mayall 3rd Floor
- Gemini model
- RAZDOW
- 14” Celestron Telescope (was going to be installed in the Razdow dome)

Appendix B: Bill's Potential Future Windows Center Educational programs:

Star Tales (Night time): New interdisciplinary, extended length, multi-format constellations and stargazing program. $85/person x 43 people. The fee is reasonable, especially in comparison to existing programs. Our Nightly Observing Program, our most heavily attended evening program, is $55/person. Both Dark Sky Discovery (DSD) and NMM are $80 per person.

Special Windows center Astrophotography Workshops (Day/Night time): Annual workshops focused on capabilities of the McMath-Pierce day and evening capabilities. Ramp up in second year to 11 people x $750/person. This is the same fee for our existing astrophotography workshops which often fill to capacity.

MP YGO & Camp-In Programs (Day/Night): Overnight camp-in programs within the Windows center for scouts. Escalate by year 3 to $125/person x 76 people. Camp-In programs are one of the most popular offerings at science centers across the United State; however, KPVC space and staffing limitations have prevented us from offering a robust version of this program. The increase in enclosed space within the Windows center and the additional staffing and marketing resources will allow us to avail ourselves of the revenue opportunity while providing a program we believe will be very popular with youth groups, particularly scouts.

Shreve Scope Private Viewing (Night): New night programs featuring exclusive viewing with new ~~Early~~ Shreve 24-inch telescope. $95/person x 10 people/night x 42 nights by year 3. The launch of our small group programs, DSD and the NMM, have made clear that there is a strong regional demand for intermediate and advanced level, smaller group experiences. With the assembly of this donated facility, we will have the larger aperture telescope and additional dome to offer this program. A component of this program will include a planetarium session in the Windows center. It will also bolster our ability to meet demand for the Overnight Telescope Observing Program, OTOP, which we routinely turn away potential guests. This program is $685 to $1,085 per person, depending upon which program options a guest chooses.

Special Interdisciplinary Events (Day/Night): Astronomy & arts themed concerts, workshops, classes. Average fee of $18/person x 545 people in year 3.

School Programs (Day): Organized daytime school group programs ramping up to annual visitation of approximately 350 Middle School/High School students x $9/each, and 400 Elementary School students.

Windows center-Focused VIP Tours (Day): Addition of one VIP Tour per month, similar in format to our existing VIP Tour, but uniquely focused on this unique facility. We conservatively estimate one such group per month X $500/group per month x 12 months. Our current demand for this program is for about two such programs every month. The pricing is the same as our existing VIP tour.

Corporate VIP Experiences (Day/Night): Special afternoon and evening group event. Assumes a ramp up to 6 to 7 events per year, $5K/each event. We began offering a scaled down version of the proposed program in fall, 2018 as an experiment, using our existing antiquated facilities. We have since offered several with terrific success. This, too, was developed and offered with no special advertising or other investments. There is clearly a demand for such an offering. Groups so far have been space- and technology- related professional groups.

Science Educator Workshops (Day): Externally sponsored small group educator workshops, conducted in close partnership with NOIRLab CEE personnel. The combination of existing KPVC assets, planned assets for the Windows center, and the enticing mountaintop environment will make interdisciplinary workshops very compelling to educators in southwestern states.

Long Range IAOC Programming		
Primarily Visualization-Based Programs		
Primarily in the Planetarium	**Planetarium + SOS**	**Primarily in the SOS**
Spring Stargazing	Exotic Worlds: Exoplanets	Worlds Beyond
Scales of the Universe	The Speeding Cosmos: Dark Energy	Mercury Rising
Ultimate Field Trip: Black Holes	Heavy Universe: Dark Matter	Sister Planet
Desert Skies	Southern Skies: Views From Telescopes in Chile	Mars Field Trip
Lord of the Rings: Saturn	Making Waves: What Gravity Waves Reveal About Stars	Grand Tour of the Solar System
Visualizing the Cosmos	Latest & Greatest: Astronomy from Around the Globe	The Colossus: Journey to Jupiter
Summer Stargazing	*A Grand History of the Universe Asteroids, Comets, and Life on Earth*	Blue Marble: Fragile Planet
The Reason for the Seasons		Around the Earth in 48 Minutes
Flashes in the Night: Transient Events		Climates & Astronomy
On the Edge: Kuiper Belt Objects		Water Worlds: Moons of Ice with Oceans of Water
Things That Go Bump: Impact Threats		Astronomy on the Rocks: Geology of the Southwest
Autumn Skies		*Beautiful Selene: Our Moon*
Meteor Mania!		
Trekking Across the Winter Sky		
The Birth & Death of Stars		
The Original Superheroes: Heroes in the Night Sky		
River of Light: the Milky Way		
Events: These Use Multiple Capabilities of the IAOC (telescope, SOS, GeoDome, exhibits, classroom, outdoors)		
Interdisciplinary	**Other Special Events**	**Temporary Exhibits**
Family Astronomy	Desert Makers: O'odham Crafts	Colors of the Cosmos
Robots, Galaxies, & DESI	Sun-Earth Day	O'odham Views of the Cosmos
Natural History of Kitt Peak	Astronomy Day	Space Federation Partnership
Space in Popular Culture	May The Fourth Be With You: Gravity	Arizona Museum Partnership
Masters of the Night: KP Fauna After Dark	Rainwater Harvesting: KP and You	Inspiring Skies: Art & Astronomy
Colors of the Cosmos	Soaring: Birding on Kitt Peak	
The Peak: Wildflower Walks	Harmony of the Worlds: Concerts	
Sky Islands & Astronomy	Guest Scientist Speaker Series	
Secrets Lost in Light: Smart Lighting and Bad Lighting	Desert Sings: O'odham Music Days	
	Celestial Gala	
	Member Preview Days	

Ideas for future SOS, planetarium etc. programs.

Astro Detective: the Scientific Method
Space Weather
Astro Pioneers: Women in Astronomy
Our Nearest Star
Architecture & Astronomy: the M-P
Weather on a Mountain: Microclimates and Kitt Peak
Setting Sun, Rising Moon
Across the Waves: Light, Color, Spectrum!

Denotes school and public program
Extensive connection to one or more NCOA or tenant facility
Special O'odham connection

Ideas for future educational programs.

Appendix C: Issue and Opportunities Identification

As a basis for planning, an issues and opportunities exercise was conducted at the outset of the workshop. In addition, several issues and opportunities were identified as we progressed through the workshop.

Tohono O'odham Nation

Kitt Peak National Observatory is located on the land of the Tohono O'odham Nation and the Observatory has both legal obligations though its lease and other agreements and moral obligations to the Nation.

1) Inclusion in the planning process
4) Representation in NOIRLab KPVC
5) Identification of, and response to Tohono O'odham needs
6) Reflect Tohono O'odham culture
7) Partnership with Tohono O'odham cultural center
8) Increased Tohono O'odham engagement
9) Provide employment opportunities+ for Tohono O'odham youth
10) Tohono O'odham story (as told by Nation members)
11) Enhance Tohono O'odham K-12 education
a. Provide after school youth programs
b. Transportation for after school youth to Kitt Peak

Relationships

2) More NOIRLab scientist involvement
3) Buy-in from scientists
4) High level championship for EPO versus “acceptance” at AURA and most senior leadership levels
5) Marketing to get more people on site
6) Role of CEE in Windows Center Operations
7) Light pollution — both a challenge and opportunity
8) Telling the story of diverse communities in astronomy
9) Ability to share with the wider community (i.e., streaming astronomical events, etc.)
10) Synergy with Sky Island Ecology
11) Training for teachers to bring information to their classrooms
12) Collaboration with other Arizona Observatory and astronomy/science outreach organizations.

Funding

Lack of access to both operating and capital funds has been a chronic issue for KPVC
1) Sustainable funding
2) Point of Sales system that allows for tickets to be bought on-site and via the Internet
3) Developing fundraising and sponsorship opportunities
4) Permission to fundraise (there are bureaucratic barriers and leadership concerns)
5) What are possible methods of fundraising?
6) Paying for modern, interactive exhibits
7) How to fundraise enough to run a “normalized Kitt Peak Visitor Center” with all the overheads. (Meaning operating without on-going financial stress.)
8) A small place but large costs and ambitions
9) Funding to complete the McMath-Pierce exhibition at high quality to attract visitors.

Staffing

There are three main staffing concerns:

1) Hiring and staffing for renewed KPVC operations
2) Staff development and training
3) Having sufficient staff — which is a funding issue. In addition, there is specific concern about:
1) Staff training to assure accurate presentations
2) Having enough staff in building to protect exhibits and serve guests
a. Enough staff to present a high-quality visitor experience
3) Including Tohono O’odham Nation members among key staff
4) Salaries to attract and maintain a quality staff.

Site Capacity

Kitt Peak is the National Observatory, an advanced research facility that includes some of the world's most sensitive scientific instrumentation. Time to do science on the telescopes and instruments is extremely valuable. In spite of the relative proximity to the City of Tucson, the site is a remote, high-altitude location with a combination of terrain, weather, infrastructure and wildlife that presents hazards.

There are questions about the number of visitors that may be appropriately hosted at the site.

1) Safety in general, and fire safety in particular
2) Parking
3) Large enough septic facilities?
4) Water reservoirs — sufficient water?
5) Safety of an increased number of guests?
6) How do we manage visitor flow?
7) Lack of appropriate signage and wayfinding.

For visitor serving organizations, not served by public transit, parking is a fundamental limitation. If visitors cannot locate a parking stall, they will either invent a stall, for example along a road — or leave. As a guideline, 100 parking stalls are required for every 100,000 annual visitors. This is an approximate guideline and should not be used for planning — only used as a check to understand if planned or existing parking is roughly consistent with attendance expectations.

In order to confidently plan, a parking study that takes the following into account is needed:

· Hours of operation
· Seasonality
· Visitor dwell time on site
· Peak (design day) attendance and utilization by time interval
· Average number of visitors per vehicle, etc.

Infrastructure

McMath-Pierce Windows on the Universe Exhibition (working title):

1) Space issues for Science on a Sphere, Planetarium and exhibits
a. Limited ceiling heights
2) Acoustics (there are distracting echoes in the McMath-Pierce spaces)
3) Leaks and water intrusion
4) Age of facility — implying possible, on-going maintenance issues
5) Painting — the exterior paint is peeling and repainting is needed, using an expensive infrared reflective paint to avoid daytime heat buildup that will blur solar images. This is a substantial building and needs considerable surface preparation and a lot of paint.

6) Small classroom feels claustrophobic. Rectangular shape is awkward for the size of space.
7) Serious concern about restoring the heliostats, that is returning the solar telescope to operation. The telescope systems are operated by complex 1950's technology that has been out of service for some time as well as disassembled and stored while renovations have taken place.

Exhibit Development

1) How to represent all relevant National Science Foundation facilities in a small space
2) Updating content to keep it up-to-date in future years
3) Development of layered exhibit content (geared to varying levels of interest and ability
4) Exhibit and Programs — updates and evolution
5) Creation of Educational Programs
6) Creation of Science on a Sphere and Planetarium programs (in-house and external sources)
7) Use of center for teacher workshops and related professional development
8) Very dark space in main corridor (remedial strategy; exhibit content may help slightly)
9) Education geared for different levels — K-12
10) Integration of Tohono O'odham stories
11) Specific opportunity for the Map stone

Visitor Experience

1) Need for a Campus Master Plan for KPNO EPO
2) Access and Circulation
3) Route planning and visitor flow across the summit
4) Circulation (various paths — clear choices); wayfinding and graphics plan
5) Long walk between Visitor Center and McMath-Pierce Solar Telescope
6) Marketing and Promotion
7) Online presence
8) Landscaping
9) Wildlife (opportunities for ancillary interpretation)
10) Current visitor center crowded, confusing, worn out, inadequate
11) No washrooms (one ADA only) in current Visitor Center
12) Lack of, or limited, ADA compliance
13) User experience for diverse guests
14) Uniqueness of experience
15) Landscaping needed — themed and regionally appropriate

Services

1) Ticketing — need a modern point of sale system; capture most, rely on honor system

2) Windows (McMath-Pierce) gift shop
3) Lack of food for visitors as well as attractive place for eating/ refreshments
4) Travel for school groups

Issue and Opportunities Prioritization

Workshop participants prioritized these categories in order from those of greatest interest and concern to least:

1) Funding
2) Tohono O'odham Nation
3) Exhibit Development
4) Relationships
5) Visitor Experience
6) Infrastructure
7) Staffing
8) Services
9) Site Capacity

Funding was considered by far the most significant issue. After all, nothing else happens, at least not very well, without increased funding.

Documenting these issues and opportunities provided the background for the strategic planning exercise which follows.

Appendix D: Admissions Strategy

In the past, visitor access to Kitt Peak has been "free." Only charges for tours and special programs have been made. After a close-down due to the COVID-19 pandemic and fires, re-opening offers the opportunity to reconsider the admissions policy.

In assessing whether to levy a charge at the gate, it is first important to understand there is no "free" admission even though that terminology is used. The cost of supporting visitation has to be covered. Those institutions that offer "free" admissions, such as Great Britain's government museums, have the visitation costs covered via public funding. Other museums cover this cost via a donation – typically a large enough gift to endow removal of the admissions charge.

A common misconception is that offering free admission will attract high-needs or underserved

audiences. There is abundant research verifying the failure of this approach. (Ref. 1 and Ref. 2, below) One of the authors of this report (Peters) learned this first-hand when, as Director of a major museum, he had a free family admission distributed with each of the local food bank's 7,800 Christmas hampers. Twelve of the passes were used. His museum then started working with community organizations and social service agencies and, over time, became a well-respected partner in meeting the needs of underserved communities, with excellent utilization from these communities. Free or low-cost admission was provided to these users but in a very targeted manner as opposed to a blanket approach.

The lesson here is that in order to serve communities with specific needs and stresses, it is vital to get to know those communities at a personal level, to listen thoughtfully and respond in ways that truly address the needs and stresses.

Another common misconception is that a lower price will attract increased attendance. This is not the case and price has little impact on attendance. Effective marketing has a greater impact on attendance than does price. Recently, we advised an institution that was agonizing over increasing its $12 admission by a dollar, recommending that it instead increase it to $15. The institution increased it to $16, based upon our further advice that they could do promotional pricing if the increase pushed them over the "price resistance point" where complaints in social media went up and attendance declined. Also, its price was benchmarking low when compared with other regional destinations. The result was an insignificant number of complaints and an increase in attendance.

Studies of cultural organization attendance have shown that people value what they pay for, that time is more valuable to most visitors than cost, and that free admission does not significantly affect the intent to visit.

Asking for donations in lieu of an admission fee tends to confuse, or even annoy guests and often yields little. Not recommended. However, a donations box that visitors encounter toward the end of their visit, one that works with a card tap, may produce a useful yield. Consider specifying where such donations would be directed may result in increased participation.

In addition to increasing earned income, there are other business reasons to consider an admission; for example it enables the museum to participate in tourism sector promotions by providing a "commissionable add-on" opportunity for tour operators and travel aggregator websites.

Another policy that is becoming more common among science museums and visitor centers is a single admission charge to all venues. Having multiple admission charges causes confusion at ticketing and forces people to work out the math of a visit. Visitors hate this. The rule for ticketing is to keep it as

simple as possible – even to the point of having only two prices, one for adults and a single discounted price for all others, i.e., seniors, young children, military etc., with certain special audiences such as members admitted "free" (they have essentially prepaid) or in Kitt Peak's case, those in the Tohono O'odham Nation.

In order to ticket general admissions, Kitt Peak visitor center operations will have to make adjustments to its ticket counter operation, signage and wayfinding. Stringent barriers are not required, though some limited fencing as visitors approach the entry location to get the point across that they are leaving the free zone and entering the ticketed area, may be desirable. In general visitors will honor the need to be ticketed, even if there isn't strict entry control. The division point between the free zone and the ticketed zone should be discussed with planning and wayfinding consultants.

While setting an admission fee should be based upon thoughtful and rigorous benchmarking among comparable institutions, workshop participants were asked whether a visit to Kitt Peak was considered to be worth less than lunch at McDonalds or worth more. The strong consensus that it was worth more. This gives a perspective on whether there should be a price, and if so, in what range.

Comparable adult, undiscounted fees

- Titan Missile Museum ($16.50)
- Desert Museum ($29.95)
- Tohono Chul ($15)
- Colossal Caves ($22 for a tour)
- Biosphere 2 ($25 for a tour)

References:

1. Dilenschneider, Coleen; Do Free Museums Attract Lower Income Visitors? (DATA) https://www.colleendilen.com/2018/03/14/free-museums-attract-lower-income-visitors-data/ Accessed 2018 September 17. See also Ref. 7.
2. Dilenschneider, Coleen; How Free Admission Really Affects Museum Attendance (DATA) https://www.colleendilen.com/2015/08/12/how-free-admission-really-affects-museum-attendance-data/ Accessed 2018 September 17.

Appendix E: Sample letter to AURA

Date:

July 13, 2021

To:

Bill Buckingham, Manager, KPVC

From:

Matt Mountain, President, AURA

Subject:

Delegation of fundraising authority under the AURA Fundraising Policy

According to the AURA Fundraising Policy, all delegation of fundraising authority must be approved in advance by the AURA President.
As the Manager for KPVC, you are hereby delegated authority on behalf of AURA to raise funds for the KPVC as provided for in the attached KPVC Fundraising Plan which has been approved by the NOIRLab Center Director. This includes the following fundraising activities as more fully described in the attached plan: establishment and operation of online store, the solicitation of donations on KPVC website, sending solicitation letters to those who have made direct solicitations to the KPVC previously; and the development of a business plan and budget for the foregoing activities.
You may delegate fundraising authority to those who report directly to you per the terms of the attached plan.

Sincerely,

Matt Mountain, President
Attachment
Cc:

Pat McCarthy, Director, NOIRLab
Beth Willman, Deputy Director, NOIRLab
Barb Lam, CFO and Vice President of Operations