Final Report of the Yerkes Study Group

30 November 2007

Yerkes Science Center: Options for Management and Funding

The Interim Report of the Yerkes Study Group (YSG) of August 2007 provides background and arguments for a transformation of the Observatory from a research center to an education center relating to science, technology, engineering, and mathematics, featuring continued use of the telescopes. The Interim Report, appended to this Final Report, addressed a number of the points of the original Charge to the YSG. Based on discussions since August, we can now complete the Charge by outlining a set of options for the management of the science center, with comments about how the operations of the center could be funded. The options described here are not exhaustive, of course. Promising new options should also be considered that are consistent with the general vision developed so far.

Option 1: independent new organization

The Report of the Department of Astronomy & Astrophysics Committee on the Future of Yerkes Observatory (February 2006) presented a concept of a partnership of institutions, each of which would contribute resources and each of which would obtain a benefit. "The larger the consortium, the more resources are potentially available. Funding requests for educational programs would be more competitive if those programs served a broader constituency. Many large astronomy research projects are university consortia ... and could realistically be extended to the operation of an educational center."

According to this model, the consortium would be governed by a Board with representation from member institutions such as nearby colleges and planetaria. The Board has responsibility to appoint the Director and to secure funding. The Director proposes an annual spending plan and reports to the Board. Institutional participation is attractive for reasons that naturally depend on the interests of the partners, but may include the unique history of the Observatory, its location, and its potential to provide education and public-outreach services connected to research grants.

A consortium can take advantage of a diverse network to support the costs, and it can create and serve a broad base of clients: K-12 students, their teachers, undergraduates, adult learners, and the general public. Each participating institution would contribute its special expertise with respect to the clients. A consortium could bring significant resources to bear in terms of designing and implementing the programs. A consortium could collectively have substantial resources for writing grant proposals to state and federal agencies, and the member institutions could pursue targeted fund-raising efforts.

However, a consortium may tend to diffuse the responsibility for the long-term success of the venture, and perhaps for this reason few science centers are managed as this kind of cooperative venture. The initial effort to establish the consortium could be substantial.

A different version of this option is that Yerkes is reconstituted as an independent 501(c)(3) non-profit organization with a strong science-based educational mission. A Board of Trustees is selected to maximize experience in governance, fund-raising capability, and management; Board members are selected without regard to any connections to potential partners. The position of Yerkes Director, reporting directly to the Board, would have overall responsibility for developing and managing users of the facility as well as for any partnerships for operational management and support. By maintaining organizational independence, Yerkes would be in a position to develop and maintain productive relationships without being tied too tightly to any particular stakeholder, which might allow greater flexibility in programming.

Option 2: Aurora University operates Yerkes

In this option, Aurora University (AU) operates Yerkes as an extension of their adjoining George Williams College (GWC) Campus. The Yerkes facilities would augment the existing GWC facilities for current AU programs, and would provide valuable new capabilities for programs that AU undertakes in the future. However the details of these initiatives may develop, it is important for the success of the vision that programs at Yerkes include astronomical observations with the telescopes.

This option is natural for several reasons. No new entity and management structure would need to be created, and the overall effort would be more cost-effective. The academic administrative functions are already in place, and AU is

already undertaking several of the kinds of programs (e.g. teacher professional-development workshops) that the YSG has identified as a good match. Environmental sciences could provide a natural bridge between AU's traditional pursuits, and astronomy and other technical/engineering fields appropriate for use of the observatory. AU also has the physical infrastructure (including classrooms and provision for room and board) to support a broad variety of educational efforts. The combination of the existing GWC and Yerkes facilities, capabilities, and programs (some of which are already cooperative) holds considerable promise, where the physical proximity can be fully exploited.

If AU were to assume the responsibility to operate Yerkes as a science education center, it would require additional financial resources to support the new programs and the ongoing maintenance costs. Moreover, new funding will need to be identified to support the up-front costs that will be incurred to modify the building for an educational mission.

This option has a clearer path for the administration of the Yerkes science center than Option 1, but the sources of funds are more restricted than would be potentially the case with Option 1. Also, the programming might have a narrower focus, and a way must be devised to tap into any necessary astronomical expertise.

Option 3: hybrid of Option 1 and 2, where AU has the primary responsibility for operating the Yerkes physical plant, and where there is provision for other institutions to participate by bringing in their own programs, which could be run cooperatively with AU.

This option potentially solves some of the problems inherent in the others. Illustrative ideas of how this might work include the following. The Illinois Institute of Technology (IIT) could benefit by engaging their engineering students in real-world projects related to the Yerkes telescopes: maintaining them, modernizing them, building instrumentation for them, and otherwise extending the scientific and educational capabilities of the telescopes. Labor and materials could be contributed by IIT with no exchange of funds. The Observatory would benefit from being able to tap into engineering expertise (maintenance of the telescopes and instruments).

Other examples include participation by other institutions in the form of one-day to two-week workshops for continuing-education students or for teacher professional development. The Graham School of General Studies of the University of Chicago

has expressed an interest in this kind of participation, and the Space Place of the University of Wisconsin at Madison may similarly wish to organize tours or more extended workshops for teachers. Adler Planetarium has organized members events for many years, which could easily be expanded in a number of directions. All of these programs are self-supporting. The workshops would be hosted by GWC, and all costs incurred by GWC would be covered from these outside sources. Significant new educational opportunities could be created for groups beyond those normally served by AU, while in the process expanding the customer base for both AU and Yerkes.

The participation of these other institutions should not be problematic since AU is already experienced with working with outside groups, and since groups such as the ones just mentioned all bring organizational support with them. Also, it would be reasonable to suppose that the outside expertise could be coordinated with AU academic offerings, expanding the programs AU could offer its students. For example, if the Graham School were to organize a class in astronomy or atmospheric physics, the class could be attractive to local students as well as students recruited from Illinois. This kind of cooperation could lead to a productive synergy between local experts and visiting instructional staff.

Funding Plan

Funding is needed for routine maintenance of the facility, for initial upgrades to the main building to support its educational mission, for salaries for the staff, and for other expenses related to the educational programs. These costs are described in the Interim Report. The Interim Report also described some ideas for the source of these funds. For example, ongoing maintenance of the physical plant could be funded via an endowment, and the endowment could be established from sale of the lake-front property and other property not needed for the operation of the science center and not part of the Olmsted landscape plan. As for many other science centers, potential sources of income include entrance receipts and direct charges to cover the costs of programming; applications for state and federal funds in response to announced opportunities; and raising funds from private sources. It would also be appropriate for involved institutional partners to assume a portion of the operations costs.

The YSG encourages The University of Chicago to explore the feasibility of these and other options that may be forthcoming. We note that, in any option, it will be necessary to plan for a transition that protects ongoing research projects of the Department of Astronomy & Astrophysics. We also recommend that The University of Chicago foster ways to involve the Williams Bay and the broader Geneva Lake communities as the plans take shape.

Interim Report of the Yerkes Study Group

August 2007

1. Introduction

The Department of Astronomy & Astrophysics of The University of Chicago has appointed the Yerkes Study Group (YSG) to devise a plan for the long-term future of the Yerkes Observatory, located in Williams Bay, Wisconsin. The goals are to ensure the preservation of the building, telescope, and landscape; to ensure that the Observatory and its surroundings continue to be a valued asset to a broad community; and to demonstrate a sustainable funding model that will enable the University to direct its resources to research programs elsewhere. The Yerkes Study Group is taking advantage of earlier work, including but not limited to land-use proposals submitted to the University, reports by the faculty of the Department, and studies by architectural firms.

The YSG was organized in February 2007, and has met roughly eight times since then. The composition of the group is given in Appendix A. The members were appointed to provide a range of expertise and viewpoints, and to facilitate communications with a much wider circle of interested parties. An Interim Report (this document) to the Chair of the Department of Astronomy & Astrophysics describes progress to date. A final report is anticipated in the Fall of 2007. The Charge to the YSG is given in Appendix B.

The YSG has concluded that the best future option for the Yerkes Observatory is a science education center. Such a mission addresses current needs in US education; it is consistent with past use and builds on current strengths; and it accommodates historical preservation. There are abundant examples of other science education centers that can be used as models for management and funding.

An appropriate early step is to understand the educational needs of the community via one or more assessment workshops. Once these assessments have been accomplished, the match between the needs and what the Observatory facilities can realistically provide can be determined. One workshop was conducted on

June 14, the results of which are described in Section 13. This step will allow us to understand the range of programs that can be realistically undertaken, from which an approximate budget can be derived. Once the general scale of the operations is understood, we can proceed with the management and funding plan.

The potential sale of non-essential parcels would support the future mission of the Observatory and provide a return to the Department. The nature of the programs may place some constraints on what property can be divested and how that property can be developed. Moreover, the Village of Williams Bay and others in the local community are concerned about environmental issues and the impact of visitors on the community. These issues are elaborated in Section 11.

The final report of the YSG will frame a plan based on the above series of steps.

2. Desirable Outcomes

The intent is that the process outlined in the preceding section will accomplish the goals of the University of Chicago as outlined there. We seek to create a center for science education that will benefit science teaching and learning, in both formal and informal applications. In so doing, we will increase the number of students pursuing careers in science, technology, engineering, and mathematics, and we will enhance science literacy among the adult population. The results of the efforts of center may have a broad reach (national and international). The transition from a research center to an education center bridges between the traditional mission of the University and Observatory and the perceptions of current needs in science education in the US.

Along the way, we seek to identify or build an organization to take responsibility for the operations of Yerkes Observatory, bringing in new groups with new ideas, and serving a much expanded community of learners. In the future, the ultimate impact of the Observatory on science can be as significant as it has been in the past.

3. Background

3.1 The Site

Yerkes Observatory is located two hours drive northwest of the main campus of

The University of Chicago, 90 minutes drive from O'Hare Airport, one hour from downtown Milwaukee, and 90 minutes from the Madison campus of the University of Wisconsin. The property comprises 77 acres of land surrounding the single major building. The land includes undeveloped frontage on Geneva Lake, dense woods, and open lawns. The main building is atop a plateau with a relatively steep slope down to the lake.

Neighboring property, including most of the nearest lake frontage, is owned by Aurora University. The site is operated as its George Williams College campus with various undergraduate and graduate academic programs, including programs for professional development for teachers.

Geneva Lake is the largest and deepest of a number of glacial lakes in the area. Its lake frontage has featured stately homes since Victorian times. In addition to private residences, the lakefront consists of not-for-profit camps, publicly accessible beaches and boat launches, private clubs, and a small number of established commercial entities. A path provides a public right-of-way around the 22-mile perimeter of the lake. Towns immediately on the lake include Fontana, Williams Bay, and Lake Geneva. Seasonal tourism is an important part of the economy immediately surrounding the lake. Otherwise, the region is essentially small-town with some light industry, and rural.

The community of Williams Bay has a population of 2400. It is mostly residential with a small number of small businesses. A notable part of Williams Bay is the Kishwauketoe Nature Conservancy, a 231-acre tract featuring wetlands. The property is owned by the Village and maintained by volunteers. Kishwauketoe is the largest natural area with public access in Walworth County.

Because of the longevity of the Observatory, it is natural that it has become a local icon. Since the domes can be easily seen from the lake, it is literally a landmark. Most staff have chosen to live locally and many have been active members of the Village, as evidenced by the library, a park, and various streets named in honor of Yerkes astronomers. The Quester Museum inside the Observatory documents the connections between the astronomers and their families and the local community. The Observatory grounds offer an environment for strolling and picnicking. There are free weekly tours of the interior of the building, and active involvement in establishing educational connections to local schools is increasing.

3.2. Summary Information about Yerkes Operations

Main building sq. ft.

Great dome	6,650
North dome	710
South dome	530
Building	11,330
Total footprint per floor	19,220

There are three floors, so the total number of square feet is three times the above number.

Basement: electronics lab, cryogenics lab, machine shop, instrument assembly labs, adaptive optics lab, offices, darkrooms, storage, infrastructure

Main level: reception, offices, display area, library, lounge, plate vault

Upper level: library stacks, computers and workshop space, Palomar Sky Survey plates and prints, plate vault, dormitory, storage

Other buildings:
Facilities Services garage and shop; former steam plant (to be demolished); south observatory building including classroom with Internet access; nine residences (rents paid to UC)

Telescopes
main building: 40-inch refractor, 40-inch reflector, 24-inch reflector
rooftop robotic telescopes operable via the Internet; south observatory: 12.5-inch remotely operable telescope; 8-inch Schmidt camera

approximate annual operations expenses:

Facilities Services personnel salaries and benefits: $110,000
Facilities Services outsource: $81,700
utilities and telephone: $57,800
approximate average annual capital improvements: $150,500

total annual operating cost (building maintenance, not programs): $400,000

total annual revenues from combined education/outreach efforts: $250,000

personnel and support:

1 emeritus faculty
3 active faculty (2 part-time at Yerkes)
4 management and staff (UC, UCEC, other)
3 education, outreach, and tours (grants and revenue from programs)
2 buildings and grounds (UC Facilities Services)
1 Senior Research Associate (HAWC/SOFIA)
1 senior engineer (mostly retired)
6 technical and engineering (UCEC)

3.3 Historical Importance of Yerkes Observatory

Yerkes Observatory is the ancestral home of the Department of Astronomy & Astrophysics. It was conceived by the first professor of astrophysics, George Ellery Hale, at essentially the same time that The University of Chicago was itself established. Hale's vision of the world's greatest observatory was realized with the financial backing of Charles Tyson Yerkes and the donation of the property in Williams Bay by John Johnston, Jr. The building and main telescope (the 40-inch refractor) were dedicated in 1897. All of the Department's staff and research and teaching activities were located at Yerkes until 1965. By the mid-1960's, intellectual ties with other elements of the University, especially the physics community, compelled greater proximity, and some faculty began to relocate to the main campus. In the 1970's and 1980's, the Observatory gradually devolved the academic programs to the main Chicago campus, and the research efforts transitioned from using the telescopes to using the laboratory space to build instruments for telescopes elsewhere. Up until the mid 1980's, the telescopes were used to train graduate students in the Department of Astronomy & Astrophysics in practical observing techniques. In the 1990's a number of educational programs were established in conjunction with major research grants, which have matured and transformed as described later. At present, three active faculty use offices at Yerkes and have residences on the grounds. One faculty member takes advantage of the laboratory facilities for his research program. One faculty member works at Yerkes full-time.

In the national context, Yerkes Observatory is historically significant as being the site of the last of the great refracting telescopes (the Lick Observatory of the University of California, with its 36-inch refractor, was founded a decade earlier), while at the same time helping to spawn the development of giant reflecting telescopes. G. E. Hale, with other Yerkes staff members such as George Ritchey, subsequently left to build the Mt. Wilson Observatory with its 60-inch and 100-

inch reflecting telescopes, which in turn provided the impetus for the construction of the 200-inch telescope on Palomar Mountain. Yerkes is thus the ancestral home for a major portion of US astronomy, not just in the technical development of ever-more-powerful telescopes, but also in the intellectual work that Yerkes Observatory fostered, even long after its great refractor became overshadowed by much more powerful instruments.

The list of astronomers who have passed through Yerkes at one time or another reads like a "Who's Who" of astronomy. The influence of Yerkes on astronomy in the 20th century is far out of proportion to the capabilities of the telescope. G.E. Hale's legacy includes starting the Astrophysical Journal (which was edited by faculty at Yerkes until 1965), and founding the American Astronomical Society, which held its inaugural meeting there. In the 1930's Otto Struve and Subramanyan Chandrasekhar rejuvenated Yerkes by attracting faculty and students whose research would have world impact.

The history of Yerkes Observatory has been chronicled by Donald E. Osterbrock ("Yerkes Observatory 1892 - 1950, The Birth, Near Death, and Resurrection of a Scientific Research Institution," University of Chicago Press). More recently the story of Yerkes has also been featured in a film documentary of Hale's career ("The Road to Palomar," not yet released). The McDonald Observatory in Texas was administered from Yerkes from 1934 until 1963, and there are naturally deep connections with the story of the McDonald Observatory ("Big and Bright: A History of the McDonald Observatory," D. S. Evans and J.D. Mulholland, University of Texas Press).

These historical connections between various major US observatories were explored for the National Parks Service by Harry Butowski ("Astronomy and Astrophysics: Excerpts from a National Historic Landmark Theme Study" (1989) http://www.cr.nps.gov/history/online_books/butowsky5/index.htm)

The telescope structure, dome, and elevating floor were constructed by Warner & Swasey of Cleveland, Ohio, a firm responsible for many other large telescopes in the US during roughly the interval 1880 - 1940. All of the major mechanical systems of the 40-inch refractor and its dome are original.

The main building was designed by Henry Ives Cobb, with terra cotta ornamentation in a unique fanciful Romanesque style. Cobb's firm also designed some of the residences on the grounds. The landscaping plan was devised and implemented by the firm of the Olmsted brothers, spanning the decade of 1905 -

1915. Much of their original plan is still evident, for example in the long entryway and the oval on the north side. The calculated (and well documented) integration of the main building with the landscape is a signature attribute of Yerkes Observatory. The preservation of these original plans is highly unusual for a property 110 years old, thanks to the long-term stewardship of The University of Chicago for a single-purpose mission. As such, the building and property are important for the history of landscape architecture in the US.

The Charge to the Yerkes Study Group included a request to specify "the core physical attributes of the site that must be maintained in order to fulfill the mission." The mission relates to science education, but what allows Yerkes to make unique contributions is its history and the ambiance of the site. In that regard, the following minimal set of core physical attributes needs to be maintained: the 40-inch refractor and elevating floor, the main building (including its three domes), and the property important to the Olmsted landscaping plan.

3.4 Department of Astronomy & Astrophysics

The Department of Astronomy & Astrophysics is one of the highest-ranked research astronomy departments in the country, including strong observational and theoretical programs. The Department is well known for its leadership in the field of cosmology, the study of how the Universe and the structures within it have evolved. The Department of Astronomy & Astrophysics enjoys close and productive connections with Argonne National Laboratory and Fermi National Accelerator Laboratory. There are also joint appointments of astronomers with Adler Planetarium. The faculty come from diverse academic backgrounds (physics, chemistry, engineering, history) which leads to a unique vitality. Research is conducted across a wide range of topics, spanning from high-energy cosmic rays, to sources of gamma and X-rays, to low-energy radiation at infrared and radio wavelengths. Some research is done from space observatories, some from ground-based observatories, and some via large-scale computational modeling.

Other strengths of the Department of Astronomy & Astrophysics include leadership in instrumentation: the development of new technologies for the detection of faint radiation is often more important for discoveries than the size of a telescope. A specialty of the Department is instrumentation that allows very weak heat (infrared) signals to be measured. These instruments must be deployed where there is very little interfering water vapor, and accordingly faculty in the Department have pioneered airborne telescopes and telescopes at the South Pole.

Much of this activity originated at Yerkes. The laboratory facilities at Yerkes continue to be used to support this research.

The University of Chicago is a founding member of the Astrophysical Research Consortium, the organization that runs the Apache Point Observatory (APO) on a mountain near Sunspot, New Mexico. This facility has provided the Department with access to a 3.5-meter telescope (having twelve times the light-gathering power of the Yerkes 1-meter telescope) and powerful instrumentation in a good location for astronomy. The arrangement (shared use of a moderately large telescope) began in 1994 with the founding of the observatory. In 2000, the Sloan Digital Sky Survey began collecting data with another telescope at the same site. Chicago astronomers also have access to the SDSS facility, recently named the world's most productive observatory. The telescopes at APO have replaced the need for access to telescopes at Yerkes, at least as far as research programs are concerned. The Department has made heavy investments in instrumentation at APO, and none in recent years at Yerkes, because the scientific return for the investment is much better at APO.

To position itself for the future, the Department is now considering options for placement of its resources beyond the programs at APO. Access to a much larger telescope, from 6.5 meters to 10 meters aperture, is being actively discussed, options that will take significant capital resources to realize.

3.5 Current Use of Yerkes Observatory by The University of Chicago

The laboratories are being used for the development and assembly of the HAWC (High Angular resolution Wide field Camera) for NASA's Stratospheric Observatory for Infrared Astronomy.

The University of Chicago Engineering Center (UCEC) and Central Shop are managed from Yerkes (one administrator is on campus). The UCEC provides a pool of engineers and other technical support to projects in the Division of Physical Sciences and elsewhere in the University and beyond. A significant fraction of the engineers are resident at Yerkes, with others located on the main campus and at Argonne.

The Kavli Institute for Cosmological Physics (KICP) conducts hands-on physics experiments for minority high school students in a week-long institute in August, and again for a few days after Christmas each year – see http://kicp.uchicago.edu/education/explorers/index.html. This is one instance of a

connection between a major research grant and education and outreach, where Yerkes is providing important support.

The Office of Special Programs recruits the students for the KICP institutes and provides other instructional opportunities for the students.

The Graham School of General Studies organizes groups of adults to tour the Yerkes building and grounds about once per year.

Undergraduate classes in the Physical Sciences and Natural Sciences series have field trips to Yerkes with an opportunity for evening viewing.

Large volumes of storage space are used at Yerkes, mostly but not exclusively by the Department of Astronomy & Astrophysics. Examples include many decommissioned instruments used at the South Pole (e.g. the SPIREX telescope) as well as decommissioned instruments used on airplanes. Archived items include a very large collection of astronomical data stored on glass plates.

4. Improving Science Literacy

An ongoing national concern is the declining position of the US in science with respect to other countries. Students in the US demonstrate relatively poor performance on science and mathematics standardized tests. A separate concern is the relatively small number of students who choose to pursue a career in science, technology, engineering, and mathematics (often called STEM but hereafter called "science"). Finally, adults in the US score low on tests of science literacy, namely knowledge of science deemed necessary to participate as an informed citizen.

The reasons for this situation are varied, but among them is the quality of K-12 science education. K-12 science education can be enhanced with teacher professional development in the sciences by enabling teachers to work alongside scientists in a science facility. A career in science does require significant motivation and systematic preparation. In general one cannot decide to major in physics, for example, as a junior in college, since prerequisite courses need to have been taken in earlier years. To address the problem of too few students entering the pipeline for eventual careers in science, one must feed the pipeline no later than middle school.

The low level of science literacy in the US, and the small number of students in science, have far-reaching implications for the economy in the context of global competition, the pervasive importance of technology, and increasing interconnectedness of disparate elements of society. The argument has been made that it is not just a concern for the health of the national economy, but also for national security. This argument underlies the American Competitiveness Initiative, as detailed for example in the so-called Augustine report of the National Academies ("Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future" http://www.nap.edu/books/0309100399/html). The Augustine report specifically outlines steps that can be taken in grade schools.

Federal agencies such as NSF and NASA have embraced science education for many years. NSF has numerous programs that support K-12, undergraduate, and graduate education, as well as informal education such as exhibits at museums. Efforts supported by NASA often feature materials and projects that are designed to be used in classrooms. The American Competitiveness Initiative has already had an effect on the funding of science education via the federal agencies.

5. Current Educational Activities at Yerkes

Yerkes Observatory has been aggressively pursuing science education since about 1989, when the NSF grant that created the Center for Astrophysical Research in Antarctica stipulated an outreach component. This early experience established a model of faculty involvement in the design and implementation of outreach programs. Besides the resident faculty, the education staff at Yerkes includes professional educators and a tour guide. The programs also involve engineers and other technical staff, as well as researchers from elsewhere contributing ideas and effort. Experience has shown the enormous value of having a team that combines science educators and professional researchers. Teachers who have been active in various projects at Yerkes have become an important source of staff support.

In this section we describe the range of programs already undertaken to illustrate potential for the future. Most of the programs are on-going, but some that have terminated are included here to document the acquired experience.

Free tours are offered to the public on Saturdays throughout the year, with annual attendance totaling over 4000 people. In addition, thousands of others participate each year in arranged tours. Most of these are field trips for schools in Illinois and Wisconsin, but a variety of other groups of adults or children also visit. Some of

these special tours are in the evening and include viewing with small telescopes. Observing events for the general public are scheduled occasionally, e.g. when planets are especially well placed for evening viewing. The most notable example was the close Mars opposition of 2003, attended by 1000 visitors spread over a few nights (despite only local announcements of the observing opportunity).

Funds have been obtained via the NASA IDEAS (Initiative to Develop Education in Astronomy and Space Science) program. One such project developed science guides for teachers and students using the small remotely operable telescopes at Yerkes. Approximately ten teachers from Illinois and Wisconsin were involved in helping develop and test the science guides. Building on the experience with visually impaired students, another proposal was prepared to work with deaf and hearing impaired students at the Wisconsin School for the Deaf, located about eight miles from Yerkes, the ideas from which fed into the YAAYS program discussed later.

Hands-On Universe (HOU) provides software and astronomical images (many taken at Yerkes) that enable high school students to do astronomical research. Yerkes has for several years hosted the annual weeklong workshop for 20-25 HOU lead teachers from around the country and overseas. Through Yerkes, the HOU program has also become involved with outreach connected to the Sloan Digital Sky Survey.

Starting with HOU there has developed a cooperative arrangement between Yerkes and the Science Museum in Tokyo. Teachers and their students in the US and in Japan have reciprocal opportunities to use remotely operable telescopes at Yerkes and in Japan, which, due to the time difference, can be used for night observing during normal daytime class hours in the respective countries. Twice each month, Yerkes staff conduct a live observing program over the Internet from Yerkes ("Live from Yerkes"). The YAAYS program for groups of teachers and students features the opposite, with Tokyo doing live observing sessions about twice a month.

Outreach activities involving about 20 students and their teachers from three local high schools have been designed to coordinate with NASA's SOFIA (Stratospheric Observatory for Infrared Astronomy) mission, for which a major instrument (HAWC) is being constructed at Yerkes.

A major grant from the Illinois State Board of Education (ISBE) has supported intensive teacher workshops (two weeks in the summer plus follow-up weekends

during the school year). This is a Math-Science Partnership grant, requiring partnerships between a university and at least one needy Illinois school district. In this case, the grant is to The University of Chicago; Aurora University is a key partner and grants graduate credit to the teachers. The program includes about 30 Illinois teachers and is called "Astronomy Resources Connecting Schools." A small grant from the Wisconsin Space Grant Consortium allows two Wisconsin teachers to participate.

Chicago Public Schools, with funding through the Museum Partners Science Program, has sent teachers to one-day workshops at Yerkes (10-20 teachers per workshop, two workshops per year).

A number of education outreach programs at Yerkes involve students directly. The Space Explorers program of the University's Office of Special Programs and the Kavli Institute for Cosmological Physics (begun under CARA almost two decades ago) brings 30 high school students from Hyde Park, Kenwood, and Woodlawn to Yerkes for a week each summer and a few days each winter. The Adler Planetarium's Astro-Science Workshop generally brings 15-20 high school students from the Chicago area to the Observatory for several days each summer. Project SEE, an astronomy program for the blind and visually impaired run by the NASA center at DePaul University has brought seven blind students from Wisconsin (and a similar number of their teachers) to Yerkes to use the telescopes. This effort is now absorbed into YAAYS. Some colleges send students to Yerkes for in-depth field trips, including Carthage College, the University of Wisconsin (primarily the neighboring Whitewater campus), Valparaiso University, and the College of DuPage.

Most of these educational outreach programs involve students or teachers staying near Yerkes for at least a few days, with housing and meals at Aurora University's George Williams College campus. Many of the programs also use computer labs, classrooms, or other meeting space at Aurora. As noted above, for some of the programs Aurora provides academic credit for participants. Yerkes personnel also occasionally serve as instructors for other courses at George Williams College.

The NSF-supported Cyberinfrastructure Team Demonstration Project is led by the Adler Planetarium and includes Yerkes as a partner, along with Northwestern University (Collaboratory Project), Lawrence Berkeley National Laboratory (Hands-On Universe), and Johns Hopkins University (SDSS and National Virtual Observatory). The premise of the project is to build tools such that researchers, teachers, and students can work together effectively by exchanging data and ideas

on the Internet. In this way, students can be brought into a bona fide research environment, regardless of where they are. Yerkes has hosted a first workshop of a dozen teachers from across the country where they learned how to use the SDSS database.

The NSF-supported Yerkes Astrophysics Academy for Young Scientists, in partnership with Aurora University, is developing after-school programs to promote interest in science in students from kindergarten through eighth grade. The program includes over 40 teachers and over 200 students in local schools. The grant period is through 2009. Teachers will take a series of four one-graduate-credit classes to give them the background in astronomy they need to work with their students. Twice each month the students work on activities that the teachers have developed. Twice each semester the students and teachers come to the observatory to use the telescopes or link up with the Tokyo Science Museum to carry out remote observations. The students will also attend a five-day camp during the summer in 2007 and 2008.

A proposal (working name: ARCS-WMSP) was submitted in June 2007 to the Wisconsin Department of Public Instruction for a Mathematics and Science Partnership three-year program. It will provide professional development for 25 Wisconsin teachers and reach at least 1900 students. The project will begin in 2008 with summer institutes in 2008, 2009 and 2010, and follow-up workshops two weekends a year. The Wisconsin proposal will extend opportunities for more Wisconsin teachers, involving districts other than those involved in YAAYS.

It is anticipated that the Illinois State Board of Education will issue a Request for Proposals next Spring for its Mathematics and Science Partnership program, and there are plans to respond to it.

6. Rationale for Yerkes as an Educational Science Center

Many of the most important attributes of Yerkes Observatory - the telescope, the building, the grounds, and the history - lend themselves naturally to a future science education center. Collectively these features are immensely inspiring. The telescope is huge yet approachable; the building is majestic yet functional; the grounds promote contemplation of nature; and the history is everywhere. By bringing teachers and their students to a working science facility with an opportunity to interact with researchers, they can see directly how science is done in this unique context.

The telescope can be easily adapted for educational programs, and there are numerous research topics it is capable of undertaking. On a clear night, the large enclosed space inside the main dome is awe-inspiring, and there is ample room on the main floor to accommodate groups. The main new requirement for educational use of the telescope is appropriate instrumentation, but that is not difficult (e.g. a video camera for observations of planets). Because of the large focal ratio of the telescope, the light from the night sky does not impose a limitation for such use, either currently or into the foreseeable future.

The location of Yerkes is outside of major population centers, but this can be argued to be an advantage because the setting provides a change of environment for many visitors. In particular, it is far enough away from large cities that the Milky Way can be viewed at night, enabling an important experience for students. The location is roughly midway between the cities of Chicago, Milwaukee, Madison, and Rockford, all less than 2 hours away and thus accessible for day trips. Since there are no other science centers in Walworth County, Yerkes can be expected to draw heavily from local school districts.

Yerkes is located in a geographic area that lends itself to education in other scientific disciplines such as geology, limnology, meteorology, and environmental sciences. An interdisciplinary approach to exploring science may be an attractive model. Traditional boundaries between sciences are blurring, and the setting at Yerkes may prove to be a major asset. Moreover, the area is known for its vacation and recreational facilities; it would easily attract educators from around the country for summer institutes and follow-up sessions during the school year.

In addition to neighboring Aurora University, other colleges and universities in the region could provide Yerkes with additional resources and opportunities.

7. Mission Statement and Desirable Features of the Center

The nature of the educational programs to be undertaken at Yerkes depend on a careful assessment of the needs of the community that would be served, and this work is ongoing. In the meantime, the YSG is considering the following broad mission statement:

"Excite and engage students, teachers, and the public in science, technology, engineering, and mathematics by promoting access to the resources of Yerkes

Observatory and its unique history."

A number of features are likely outcomes of the continuing study and discussions, and it is helpful to list these to frame a more detailed vision:

1) use the refractor and other telescopes
2) conduct teacher professional development workshops carrying credit
3) include engineering & technology
4) connect teachers with researchers
5) maintain and promote historical heritage
6) maintain surrounding grounds
7) enable meaningful access by the public
8) help address needs of local schools and colleges
9) maintain vitality and flexibility to adapt to changing needs
10) become a center of excellence in a recognized aspect of science education
11) establish and promote national and global partnerships
12) maintain potential to branch to science education beyond astronomy
13) foster wider impact with programs and materials that can be used off-site

8. Association of Science-Technology Centers Survey

The Association of Science-Technology Centers is an organization that serves science centers in the US and Canada, and also internationally. There are about 400 members in the ASTC, representing a broad range of institutions that can be classified as a science center or museum, including some observatories.

The ASTC recently completed a survey of their membership to ascertain basic statistics about operations - number of people served, number of employees, expense categories and amount, income categories and amounts, etc. The survey presents statistical information (medians and quartiles) broken down into numerous categorizations. The basic categories are size of the center (reckoned as the square footage of exhibit area), and operating expenses. The ASTC survey provides a convenient and quantitative way to evaluate the proposed operations of the Yerkes science center in the context of other ventures in the US and abroad.

The metric of "square footage of exhibit area" may not be a good match to the actual eventual programs at Yerkes, but it is a start. The ASTC centers typically had 35% to 40% of their gross building size dedicated to "exhibit space." The footprint of Yerkes Observatory is about 19,220 square feet (main floor). This is

the only floor with high ceilings and uniformly good windows. Space on other floors could be used for a science center, but it is not likely to be prime exhibit space. Thus for comparison purposes we take 7,200 square feet as a reasonable estimate of the space potentially available for exhibits. On this basis, Yerkes is close to the median of the "very small" category of science centers.

Considering the approximately 40 responding institutions in the category of "very small," the following lists median values of some aspects of potential interest. Where available, the number quoted is for US institutions.

gross building size: 17,000 sq. ft.
interior exhibit space: 6,925 sq. ft.
memberships: 1,081
on-site attendance: 50,000
paid on-site attendance: 42,316
students served in school groups on-site: 8,757
total FTE: 13.3
personnel expenditures per FTE: $33,754
hours worked by volunteers: 2,160
total operating revenue: $943,243 (40% earned income, 28% public funds, 29% private funds, 3% endowment income)
revenue from admission fees: $139,780
endowment: $300,000
operating expenses: $814,570 (57% personnel, 6% fund raising, 37% other)

One of the quantities that stands out here is small size of the average endowment. In our view, a much larger endowment is necessary to provide a secure future for the institution and to attract the best qualified individuals to lead the effort.

9. Examples of Science Centers

The YSG has studied other science centers to understand the breadth of programs offered, the nature of the groups being served, and the business models. Some of the centers are major enterprises that are far beyond the scale of what would be realistic for Yerkes, but even so there may be elements of their programs that can be adapted. Partnerships can yield other opportunities: Yerkes is already working cooperatively with the Adler Planetarium, the Tokyo Science Museum, and the Lawrence Hall of Science.

The following paragraphs provide some aspects of other science centers (specifically, observatories) that can inform our discussion of possibilities.

The Mt. Wilson Observatory (www.mtwilson.edu) faces some similar challenges: at Mt. Wilson (near Pasadena, CA) there are telescopes of historical importance but not currently used for research in a location outside a population center. In partnership with the Griffith Observatory in Los Angeles, they have found that they can provide observing opportunities to groups of 25 on the 60-inch telescope for a fee that allows the operation to break even. It is likely that a similar market exists in Wisconsin for the 40-inch refractor. A problem to be addressed is that the weather at Mt. Wilson is more dependable than at Yerkes.

The Cincinnati Observatory (www.cincinnatiobservatory.org/COC/) was founded in 1843 and revitalized as the Cincinnati Observatory Center, a not-for-profit organization, in 1999. It is owned by the University of Cincinnati which has granted a long-term lease to the COC. The University of Cincinnati is providing $150k per year for 10 years to get the COC onto a sound financial footing. The COC conducts a range of public events: it offers classes for credit (via Xavier University), it conducts teacher workshops, and it rents space for private events, among other programs. There are only four staff members (Director, Outreach Teacher, Scientist, and Historian), but the programs are heavily supported by volunteers (amateur astronomers and members).

The Chabot Space and Science Center (www.chabotspace.org) has a history extending back to 1883 but its current location and organization began in 2000. It is managed jointly by the city of Oakland, CA, the Oakland Unified School District, and the East Bay Regional Park District. It is located on 13 acres in park-like setting in the Oakland hills. It is a full-service science museum that includes a planetarium as well as telescopes. It conducts summer institutes for teachers, summer camps for students, and it runs an NSF-funded program for girls in technology fields, among many other programs.

The Dyer Observatory of Vanderbilt University (www.dyer.vanderbilt.edu) does not have a 19th-century telescope but it is an example of a facility that has been transformed from a research institution into an educational institution. Dyer programs have support from NASA and NSF, and include video conferencing so that experts elsewhere can be connected with school groups. An unusual feature of Dyer is the program of summer evening concerts, which introduce large numbers of people to the site who may not otherwise consider visiting a science

museum. Although Vanderbilt still owns the facility, most of the costs are covered by operating revenues and grants.

10. Preliminary Research into Stakeholder Concerns and Interests

It is evident that the future of the Yerkes Observatory concerns many people, and for many different reasons. The high level of interest is a reflection of its perceived value: historically, culturally, and its promise to continue to serve science. Despite the natural differences in perspective between people holding a stake in the future of Yerkes, many aspects of the situation suggest considerable common ground, not the least of which is that everyone wants to see the observatory preserved and to flourish in a sustainable way.

To understand the range of stakeholder interests and to explore the common ground, the YSG retained Mr. Douglas Sarno of the Perspectives Group to conduct interviews of representatives of various groups; to synthesize the responses; and to capture and summarize key concerns and issues in the form of recommended points to be considered by the YSG. In the process, additional stakeholders are identified, and the first steps are taken to build a collective sense of purpose that may develop into the future organization.

Mr. Sarno conducted extensive interviews in May, mostly in person, of a wide range of individuals known to have significant interests or who could represent groups with potential interests. His findings up to this point are included as Appendix C. His findings are input to the YSG deliberations, not at this point recommendations by the YSG.

11. Constraints on Land Use

Although the Yerkes Study Group was not charged and not constituted to make detailed recommendations concerning land use, we were charged to consider topics that are related, such as preservation of physical attributes and identifying funding streams.

The two proposals submitted in 2005 to The University of Chicago and all three of the architectural firm's reports recommended that some of the Yerkes property be sold to achieve the goals of funding the operations of the science center and providing a return to the Department of Astronomy & Astrophysics.

From the perspective of the operations of a future science center, the constraints on land use include maintaining the dark environment around the telescopes and around the south lawn (no street lights, no automobile headlights, no residential or other lights). From the perspective of honoring the Olmsted landscape plan, the lawns surrounding the observatory and the north side entrance should not be encroached upon, which is (not coincidentally) fully consistent with the astronomical constraints. Prohibiting development in this area preserves the ambiance and signature attributes of Yerkes Observatory.

From the perspective of the Village of Williams Bay, land use is currently restricted by zoning (mostly I-1), and there is a designated environmental corridor that runs through much of the undeveloped wooded areas to the east and south. There is also a significant community concerned about the environmental status of Geneva Lake and its shoreline. Since the Yerkes lake front property is one of the largest remaining undeveloped tracts on the shore, there are naturally sensitivities about its disposition and ultimate status.

We agree with the studies of the architectural firms that it should be possible to devise a plan whereby some property is sold for residences with minimal impact on the Village, on the lakefront, and on other aspects of the environment.

The property of highest value for private residences, the 552 feet of lake frontage, is not part of the Olmsted landscape plan, and it has never been used for astronomy. It is however part of the environmental corridor. Environmental concerns can be mitigated with appropriate development since lots can be made to be quite deep (725 feet) and residences can be located away from the shore. Recently a tract of land immediately to the east of the Yerkes lakefront property was rezoned from institutional to residential and sold for single-family large-lot homes. Scaling by linear lake frontage, the Yerkes property, if it were similarly rezoned and if the real estate market were flat, would sell for about $8.5M. (This estimate can be checked by comparison to other lake frontage which has recently sold in Williams Bay for $14,800 per linear foot of lakefront, suggesting a total of $8.2M for the Yerkes lakefront property.)

Additional property could also be sold, for example the 11-acre tract on the east

side called Frost Woods, a small portion of which is already zoned residential. Once again, this property is not part of the Olmsted plan and is not needed for astronomy. As for the lake frontage, the development of Frost Woods would not affect the character of the surroundings of the Observatory. This tract is fully inside of the environmental corridor. A rezoning to RS-1 limits development to 0.7 residence per acre. At the current market, the total tract would sell for $1M to $1.3M. This is a conservative estimate; if RS-2 zoning were allowed (1.0 residence per acre), the total could amount to $1.4M to $1.9M.

There are nine residences already on the Yerkes property and in principle these lots could also be sold. The four houses and lots on or near Geneva Street do not have a significant value; if they were not replaced, or if they were removed altogether, the impression of the Olmsted plan as seen from Geneva Street would be preserved. The remaining five houses and lots that surround the Observatory could support activities of the future science center. This aspect should be considered before deciding to sell these lots.

12. Involvement by Other Institutions

The Yerkes science center could be operated as an independent entity that serves schools, colleges, and universities; it could be managed by a consortium of educational institutions; or it could be managed by a single educational institution for its benefit and for the benefit of a broader group. In all cases it is worthwhile to explore the level of interest by institutions other than The University of Chicago in potential future operations at Yerkes. Clearly, the level of interest depends on the nature of the programs, the costs, and other aspects that are not yet known, but we can speculate about some possibilities.

Besides the neighboring Aurora University, several colleges in the region have used or are using Yerkes telescopes in their undergraduate programs, including Carthage College, Valparaiso, UW Whitewater, and the College of DuPage. The Ryerson Astronomical Society of the University of Chicago, the student astronomy club, has also used telescopes at Yerkes. Field trips are a natural extension of class work. Yerkes can contribute research telescopes and a unique physical and historical environment.

Research universities such as IIT, UI Urbana/Champagne, UW Madison, and Northwestern may also determine that Yerkes can contribute to their ongoing programs. These could include supporting undergraduate field trips (as for the

colleges), providing a regional meeting venue for small groups of researchers, and enhancing existing public outreach programs based at those universities.

There is much at Yerkes that neighboring science centers such as Adler Planetarium could readily take advantage of (potentially also the Museum of Science and Industry and the Milwaukee Public Museum, for example). Field trips for members groups would be an obvious example, including night-time viewing in a location much darker than in an urban site.

13. Education Needs Assessment

A workshop was held on June 14 that included invited representatives from the formal and informal education community: school superintendents; teachers at middle school, high school, and college levels; an undergraduate student; a parent of a high school student; a planetarium director, and a consultant for technology used in planetaria. The 16 individuals were from both Wisconsin and Illinois; most but not all had some prior exposure to Yerkes Observatory.

The point of the workshop was to elicit the education needs of this group. The results of the discussion inform the scope and nature of the programs at Yerkes, at least to the extent that this particular group is representative.

Among the many ideas generated by the process, the potential of a broad reach (national and international) was highlighted. There was enthusiasm for serving a wide range of ages, and to do so by including several ways to approach learning about science, including technical aspects (engineering). Also mentioned was the desirability of using astronomy to feed in to other sciences, specifically environmental sciences. The continued involvement of researchers in the delivery of content was important to this group. There was interest in having students learn how to use telescopes and instruments. In general there seemed to be real excitement about Yerkes providing a rich suite of opportunities: extended teacher training programs in the summer, follow-up programs during the school year, many kinds of programs for students, public events, etc. Yerkes could have an especially broad influence by acting as a coordinating hub, where individuals trained at Yerkes would branch out to train others. It was felt by this group that Yerkes has valuable attributes that are unique, and that these should be fostered and made a key part of the new institution. There was interest in expansion of the existing facilities to accommodate new programs. Finally, there was interest in opportunities stemming from partnerships with other observatories or science centers.

Appendix A

Members of the Yerkes Study Group

John Anderson (Anderson Enterprises LLC)
Marge Bardeen (Fermilab)
Lucy Fortson (Adler Planetarium)
Harold Friestad (Kishwauketoe Nature Conservancy)
Jim Gee (Yerkes Observatory)
Richard Kron (University of Chicago, Chair)
Jim Lattis (University of Wisconsin at Madison)
Don York (University of Chicago)

Advisors to the Yerkes Study Group

Bill Duncan (Aurora University)
Ted Parge (Aurora University)

Appendix B

Charge to Yerkes Study Group

1. develop strategic goals for the Yerkes education center, and draft a mission statement that incorporates those goals.

2. develop possible management frameworks for how the center would work, including how a partnership of public and private entities would participate together in a non-profit organization. Who are the likely partners, and how can they be recruited? What are the criteria for partnership?

3. given the mission plan and a plan for how the center would be managed, what are the core physical attributes of the site that must be maintained in order to fulfill the mission?

4. develop a business model, or plan for a funding stream, that is adequate to support both the educational programs themselves, and also the general maintenance of the observatory infrastructure (buildings, instruments, and grounds). The business model should ensure a future that is self-sufficient over the long-term.

5. throughout the process of drafting the report, ensure that there is effective communication with the Board of Trustees of the Village of Williams Bay and its relevant committees.

Appendix C

Preliminary Report on Stakeholder Concerns and Interests (Revised)

TO: Yerkes Study Group

FROM: Doug Sarno, The Perspectives Group

DATE : June 14, 2007

RE: Findings to Date

To date I have interviewed approximately 30 stakeholders from the community, Yerkes staff, University of Chicago, other universities and educational programs, observatories, science centers, and consultants. I am continuing to catch up with additional individuals. I have not yet talked specifically to Yerkes Study Group members, but wanted to file this next version of this report prior to the June 15 YSG meeting.

I have organized this report to provide an overview of the findings and observations from the interviews that I find most significant and important to the work of the YSG. Following Key Findings, I have presented some key conclusions that appear to me to be most significant to the YSG's work.

Key Findings About Land Sale and Future Land Use

- Transition of any land must be done in a way that is consistent with the residential nature of Williams Bay.
- There is no outright resistance to selling lakefront and outer parcels for low-density residential development.
- There is some concern about the environmental and historical value of the lakefront property and the impact of residential development. It has been characterized as the last significant parcel of undeveloped lakefront.
- There is some concern that Yerkes not relinquish all of its access to the lake because of the educational and other potential future opportunities that could be provided by lake access.

Key Findings About Using Yerkes for Science Education

- There is near universal acceptance that this is the best and most likely future use of the facility.
- Yerkes is a wonderful facility for teaching science to young kids, particularly bringing kids from the inner city and having the country/lake experience as part of the program.
- Science education, by itself, is unlikely to provide sufficient long-term resources to maintain the facility and desired programming.
- Must maintain an active research component. Access to and participation of working scientists has been a major draw at Yerkes, losing this will diminish the value of the facility and on-site scientists are important for much federal funding.
- Access to the telescopes must be an important part of any future programming and will be the only real way to draw students.
- The potential combination of astronomy and earth sciences possible at Yerkes provide a very powerful and needed combination.
- The telescopes have got to be brought up to snuff with real users manuals and people who can help to make use of them.
- The historic nature of the facility is a real draw.
- A world-class education coordinator needs to be hired to create the energy and quality of education required of a facility like Yerkes.
- Create museum-quality exhibits about the history of Yerkes.
- The main building as it now exists does not lend itself to science education, would need significant investment to create a state-of-the-art facility.

Key Findings About the Yerkes Facility

- Yerkes is an important local and national icon/landmark
- The main Yerkes building must be updated and preserved
- The main Yerkes telescopes must be updated and preserved
- Some extent of the grounds sufficient to protect the aesthetic nature of the facility and provide needed darkness must be preserved
- The history of Yerkes must be preserved and celebrated
- The existing building has significant shortcomings for education, including space for larger groups and classroom environments.
- Yerkes is too far from Chicago to make it an attractive day trip for conferences or events.
- It is time for Yerkes to pursue national landmark status.
- Unpredictable weather can be an impediment to scheduling education programs.

Potential Users and Partners

- Yerkes must be aggressive about getting Wisconsin institutions involved.
- It would be useful to create a more formal relationship with other observatories going through similar struggles as all will be seeking similar resources.
- Many educators have expressed strong interest in creating and delivering programming at Yerkes, but their institutions are unlikely to be major ownership partners. Need to create a strong partnership among education providers to make sure that they are not competing against each other. Create complementary programs.

- University of Chicago continuing education certainly wants to continue programming at Yerkes, creating summer institute type programs.
- Yerkes has always been operated at a distance from the community, with very limited access. It is important to reverse this quickly and significantly and find ways to engage the community in all facets of Yerkes activities.

Potential Uses Beyond Science Education

- Environmental education and programs.
- Telescope uses outside the educational context.
- Rental of the facility for events, particularly outdoor events.
- Small conferences.

CONCLUSIONS

1. Science Education Makes Sense but a Formal Business Plan is Needed

There is little doubt that Yerkes would make a world-class science education destination and that enormous interest in being part of such an institution from a programming standpoint exists. However, it is unclear that such a use is financially sustainable.

Before Yerkes can move forward on any decisions, it must create a formal business plan that sufficiently addresses the following challenges:

- Is there a realistic financial model for science education that will allow Yerkes to sustain itself?
- What level of endowment would be necessary to make Yerkes viable and how would that endowment be achieved?
- What type of initial endowment can be expected based on likely real estate transactions and commitments from the University of Chicago?
- How will Yerkes raise money and enhance its endowment over time?
- What other fundraising will be conducted?
- Identify a realistic assessment of national fundraising prospects for the facilities and programming.
- Could Yerkes manage world-class educational activities with the existing limitations of the building? What enhancements would be required and at what costs?
- What investment is required in the existing facilities and telescopes to make them ready for a science center?
- How will Yerkes be able to continue to provide the low-cost educational opportunities it has in the past without University of Chicago maintenance of the facility?
- How will Yerkes be able to offer and fill year-round programming when summer is the only viable season for residential teacher and student programming?
- How will Yerkes be able to continue to attract working scientists to be part of the working environment at the Observatory?
- What part of the science education market will Yerkes pursue and what is the potential for the market to generate income?
- What types of educational programming will Yerkes provide to those audiences and how do those programs fare financially at similar institutions?

- How will Yerkes use its existing assets to the maximum extent?
- What types of activities and programs beyond science education will be pursued and what are the potential incomes?
- Identify existing models of successful science centers and identify the components that make sense for application at Yerkes.
- Mt. Wilson Observatory has recently completed a business plan which may serve as an example.

2. Lakefront and Frost Woods Parcels Can Be Sold

Selling these parcels for low density residential with clear advance notice and coordination with the local community should not cause an extreme concern within the community. In doing so, however, the following issues should be considered:

- Maintaining some type of lake access for future educational uses at the Observatory.
- Giving a conservancy right of first refusal to purchase and/or create an easement on the Lakefront property based on a fair market valuation.
- Conducting a preliminary archeological survey of the properties to ensure that they are not home to highly valuable Native American sites.

3. Place Focus on Ownership and Partnerships, Detailed Programming Can Wait

It will be important to create a grand and bold vision for Yerkes, but to leave the details flexible to allow new ownership and leadership to implement the vision. It will be important to engage a high-powered Board of Directors who can lead Yerkes into the future and ensure its financial security. Making detailed programming choices and decisions will make little sense before ownership is established and in place, and the Board can establish real leadership for Yerkes.
In establishing future ownership and management, the following actions should be considered:

- Ensure long-term direct interaction with a parent institution of higher education
- Engage a broad consortium of institutions to create and deliver educational programs
- Consider a broad range of programs that take advantage of all of Yerkes assets on a wide range of science issues
- Ensure the long-term presence of researchers and ongoing research activities
- Maintain direct access to the lake
- Engage in a formal consortium with other observatories in different regions of the country
- Create a strong Wisconsin presence on the Board and in programming
- Create a formal Yerkes membership program
- Create local partnerships to raise the awareness and use of Yerkes among residents of Williams Bay and the entire Lake Geneva area.

4. Consider Ways to Create a University of Chicago and Local Partnership to Make Final Decisions

There is still much healing to do with the local community, but it appears that a solution consistent with the YSG report and the above findings will find much common ground. By bringing the University and community together to finalize key decisions and identify the formal grand vision for Yerkes, much of this healing can be achieved and moving to the next phase of Yerkes future planning can commence with a broad sense of ownership and excitement.