

## Peterson Planetarium: Six decades of informal science education delivery and outreach at Emporia State University

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The Peterson Planetarium serves as more than a virtual classroom to augment on-campus instruction; it has provided an informal science education medium and a means of significant outreach to patrons in the Emporia community and region. The initial objective of the Peterson Planetarium was to address fundamental science literacy concerning Earth's spatial relationship to other celestial objects in the universe. However, more recently, the Peterson Planetarium has become an important means to stimulate and nurture interest in the sciences as well as careers in science, technology, engineering, and mathematics (STEM). This six-decade history of the Peterson Planetarium chronicles its development and services with an emphasis on its contributing personnel, programming philosophies that have evolved with new presentation capabilities, and the audiences it has served since its installation in 1959 concurrent with the construction of Cram Science Hall.

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### INTRODUCTION

The development of citizen science literacy has been an ongoing goal of science professionals for decades and perhaps since early in the twentieth century (American Association for the Advancement of Science, 1993; Anderson, 2007; Bybee & DeBoer, 1994; National Research Council, 2011). This trend was most apparent following the successful deployment of Sputnik I by the Soviet Union in October 1957. During the Cold War, mounting tensions between the Soviet Union and United States provided the basis for dramatic reform efforts in mathematics and science education in the United States (Bybee & DeBoer, 1994). Within these contexts, Emporia State University (ESU), then the Kansas State Teachers College (KSTC), planned to replace the aging Norton Science Hall which housed the biological and physical sciences. In 1959, Cram Science Hall was completed as the first wing of the current science hall complex (Fig. 1). Less than a decade later, Breukelman Science Hall was completed and occupied by the biological sciences in early 1968. Norton Science Hall was razed shortly after the construction of these two science halls.

The Peterson Planetarium, Johnston Geology Museum, and Schmidt Natural History Museum, all housed in the new science hall complex, have provided informal science education programming opportunities to complement the formal K-12 curriculum associated with the goal of mass education which increased expectations for post-secondary education. In addition to this complementary role for those engaged in formal education pursuits, science programming often targets a different clientele—the off-campus general public.

Multiple objectives characterize the programming efforts of informal science education and outreach entities; however, the following foci are typically most central: (a) *to instill an awareness and interest* in youngsters for the potential excitement of being involved with the science, technology, engineering, and mathematics (STEM) fields, and the pervasive presence and utility of these fields in our daily lives; (b) *to nurture and sustain that interest* toward continuing formal education pursuits and ultimately STEM careers, i.e., the development of an adequate technical workforce; and (c) *to provide the citizen base to enable the United States to maintain a leadership role internationally* in the STEM fields through societal decisions provided by a scientifically and technically literate citizenry. However, these objectives are not universal for all patrons served, nor are they exclusive to mechanisms that deliver informal STEM education programs. Rather, they are also shared with the formal education community.

The conscious effort to “take” these subject realms from the campus to a range of patrons is often characterized as “outreach.” While the volume of collections or sophistication of audio and video presentation capacity found in university museums and planetariums attracts visitors to campus, these informal means of education are also intended to achieve the objectives and goals typically associated with outreach (National Governors Association, 2010; Shropshire, 2012).

### THE EARLY YEARS

In 1959, a planetarium was included as an element in the planning, design, construction, and ultimately the furnishing



Figure 1. Newly completed Cram Science Hall in 1959. S. Winston Cram is in center, flanked (on left) by then KSTC President John E. King, and (on right) by architect Warren Corman, Architectural Services of State of Kansas.

and occupancy of Cram Science Hall. Both academic units, mathematics and physical sciences, vacated their quarters in Plumb Hall and Norton Science Hall, respectively. Initially, responsibility for the administration and programming of the Peterson Planetarium was vested with the Department of Mathematics, and Oscar Peterson was Department Chair at that time (pers. com. 2012). George Downing, who had begun his KSTC faculty career in 1958, was designated as the first Director of the Peterson Planetarium as he had completed course work in astronomy while a student at the University of New Mexico. Downing also taught a descriptive astronomy course as part of the mathematics curriculum at that time. On November 7, 1970, the planetarium was officially dedicated and named Peterson Planetarium in conjunction with other dedications during the KSTC Homecoming. The naming honored Oscar Peterson as Chair of the Department of Mathematics from 1928-1963, which was surely one of the longest continuous tenures of any university department chair.

During the 1958-1959 academic year, technicians from Spitz Incorporated installed the A-2 instrument and provided some initial orientation and training prior to the occupancy and full use of Cram Science Hall beginning in the fall 1959 semester. The initial planetarium installation included a second generation Spitz A-2 two-axis star projector. This primary projector was complemented by several auxiliary projectors: the Sun, five naked-eye planets and Moon; equatorial system coordinates (right ascension, partial declination, and the ecliptic); celestial meridian; geocentric Earth; zenith; morning and evening twilight; and an adjustable astronomical triangle.

The Spitz A-2 instrument was located with the operator under the center of a 24-foot (diameter) hemispherical fiberglass dome. Designed with a 72-seat capacity surrounding the operator's console and instrument, the planetarium consisted of bench-style seats arranged in a circular pattern. Three concentric rows of benches with padded seats were inclined, and those closest to the center had the greatest inclination. This provided more comfortable viewing of a greater portion of the simulated sky. With a two-axis system, daily motion of celestial objects could be simulated based on one axis, and with the other axis, the sky could be visualized from different observing latitudes (the equator to the terrestrial poles).

These technological capabilities provided the bases for program presentations concerning star and constellation identification; constellation mythology and the associated cultural heritage; changing Sun, Moon, and planet positions; seasonal patterns of change; observing circumstances unique to different latitudes; and, based upon different colors and intensities of star projections for the more prominent stellar objects, star magnitudes and spectral classes. This technology was useful to reinforce formal class objectives for certain campus courses, and for less formal goals appropriate for off-campus patrons with a range of ages and affiliations, i.e., pre-college (elementary through high school) students; Cub, Girl, or Boy Scouts; and various civic group members, as examples. A presentation staple for many off-campus groups were "live" presentations which focused on the "current sky."

George Downing provided some details concerning the early history and circumstances of unique features characterizing the development of the facility. For example, George Shully, a painter in University Facilities, took a special interest in the installation. He was among those who oversaw the assembly and placement of the Peterson Planetarium dome, which was suspended in the two-story structure located under the south lobby of the Cram Science Hall wing. To increase the “reality” of the planetarium setting, the campus horizon as viewed from the rooftop of Cram Hall was silhouetted at the base of the dome. Downing, Shully, and the campus photographer took a series of 360-degree panoramic photos, scaled the photos, produced a metal cut-out, painted it flat black, and installed the horizon silhouette at the base of the dome. Cove lights provided back-lighting as an accent when beginning a live presentation (perhaps following a simulated sunrise or sunset) (pers. com. 2012). The combination of the silhouette and back-lighting provided a striking aesthetic touch.

#### TRANSITIONS TO THE PRESENT

##### **New administrative responsibility and programming philosophy**

In May 1972, the responsibility for Peterson Planetarium shifted from Mathematics to the Division of Physical Sciences (Backhus, 1973). This change resulted from a number of factors. First, conceptual and emphasis changes occurred in the discipline of astronomy from classical position astronomy (astrometry) to an application of the disciplines of physics, chemistry, and geosciences to interpret the message of light from celestial objects that enables inferences concerning the nature and development of these objects that populate the universe, i.e., “space science.” Further, the exploration of space, which began dramatically in 1957, utilized the tools and expertise from the fields of the sciences more directly than the disciplines of mathematics and classical astronomy for interpretations. Program and consequent staffing priorities also shifted in the Department of Mathematics, which resulted in the transfer of the planetarium administrative and programming responsibilities. S. Winston Cram was Chair of the Physical Sciences Department from 1945 to 1969 and retired in 1972, when this change took place.

As a faculty member since 1967, I was trained in planetary and space science through graduate degree work at Harvard University. I taught the upper-division space science course for the Division of Physical Sciences and assumed responsibility for the descriptive astronomy course as part of the physical sciences curriculum. I was also designated the second Director of the Peterson Planetarium. Consequently, I spent June 1972 in residence at the Abrams Planetarium at Michigan State University in order to obtain familiarity with contemporary planetarium programming. This proved to be an extremely valuable and beneficial experience. Bob Victor, the Abrams Planetarium staff astronomer and a monthly feature

writer for the celestial calendar section of *Sky and Telescope* magazine, provided daily (and evening observing) supervision and directed study. Abrams Planetarium Director Von Del Chamberlain, who subsequently became the Director of the Smithsonian Air and Space Museum in Washington, D.C., provided a sense of awe and inspiration. Especially obvious from this experience was the evolving presence of programs developed around specific themes which were presented with automated audio and video technologies.

Fundamentally, a planetarium is a unique facility for simulating planet Earth’s spatial environment. Thus, prior to the late 1960s and early 1970s, planetarium programming was directed toward “naked-eye” identification of celestial objects, for example, the planets, stars, and their associated constellations; descriptions and explanations of the daily and longer-term motions of stars, Earth’s Moon, the Sun and planets; demonstrations of various aspects of celestial positions, utilizing such projection devices as the celestial coordinates, celestial meridian, and the astronomical triangle; or discourse on the fundamentals of time-keeping based on rhythms in the sky. The majority of planetariums utilized their facilities for these types of presentations; indeed, the predominance of programs presented in the Peterson Planetarium previously were characterized by these topics and related objectives.

Changes occurred in planetarium programming philosophy and execution as a consequence of developments in presentation technologies. However, in addition to advancements with presentation technologies during the late 1960s and early 1970s, ostensibly in response to a changing social dynamic and related expectations for “entertainment,” and in some cases to bolster sagging attendance at traditional planetarium programs for the general public, planetarium personnel began to augment the presentation capability of the primary star projector with auxiliary projectors of a great variety and the finest state-of-the-art audio systems. Laser-generated light or strobes flashing light alternating with darkness to the throb of a background rhythm was projected on the star dome. “In the extreme of instances the planetarium was transformed into a weekend ‘theater’ to project ‘psychedelic’ [images] to the beat of the hardest of rock music” (Backhus, 1987, pp. 2-3).

From this range of programming, a “middle-of-the-road” philosophy seemed to emerge. The new programming philosophy embraced two principal objectives: one was to be fundamentally *educational*, but the counterpart was to ensure an aura of *entertainment*. Consequently, many programs were developed by planetarians (planetarium personnel) that were pre-programmed for an automated presentation, using a combination of auxiliary projectors to create a 360-degree panorama or setting ranging from the terrestrial to a conception of an extra-terrestrial environment. In this way, the planetarium patron could be virtually transported to the Moon, planet Mars,

or beyond in a *Star Trek* fashion. These programs were accompanied by a tightly written script with appropriate audio effects and music. Such programming remained credible among most professionals in the planetarium community. However, the fundamental, classical capabilities of the planetarium and related programming continued as viable program options targeted to certain patrons.

A staple for presentations in the Peterson Planetarium during the 1970s and 1980s was “current sky” programs presented live by planetarium personnel that were tailored to the circumstances for the day and night sky of the actual date that a patron group visited. At the beginning of each season, the Peterson Planetarium featured the “seasonal” constellations characterizing the autumn, winter, spring, and summer skies that were generally scheduled for at least two evenings as closely as possible to the respective equinox or solstice dates. Another live show presented the zodiacal constellations (titled “Constellations of the Zodiac and Age of Aquarius”). This presentation was augmented with “still,” 35-mm slides projected on the dome.

In addition to reflecting the evolution of programming philosophy, modest projection capability and audio systems were acquired or developed to enable some automated productions in Peterson Planetarium (Fig. 2). These included a “Star of Bethlehem” program presented annually in early December; a “Copernican Revolution” program developed for presentation in 1973 to coincide with the 500<sup>th</sup> anniversary of the birth of Copernicus; a “Taurus Incident” program that featured some of the developments in the understanding of stellar evolution, i.e., the life cycle of a star; and “The Return of Comet Halley” to commemorate the spring 1986 apparition of that periodic celestial visitor. The potential for programming was limited only by the time available for an operation that depended on a faculty member for which no faculty course-load credit equivalent was given for directing the Peterson Planetarium. Also, the development of these programs was dependent on other campus personnel, e.g., staff in media services for presentation equipment loans or media technicians to trouble-shoot audio-visual equipment. Occasionally, students with appropriate talents were utilized to assist with facets of program development.

### Personnel changes

While he was Chair of the Division of Physical Sciences (1971-1984), Charles Creager placed his aesthetic and architectural touch on a number of aspects of the Cram Science Hall. For example, the design of an entry façade to the planetarium chamber in large gold letters prominently displayed Peterson Planetarium above the entry. Also, the walnut-stained facade had one-inch wood stock verticals with a 24-by-24-inch grid system to attach specially built display panels to mount in a



Figure 2. Author poses with the audio and video systems added to the planetarium capability during the 1970s. Shown is the Spitz A-2 primary and auxiliary projectors that were situated on the control console in the center of the planetarium chamber.

variety of configurations. Some panels were completed to post items which could be changed in a bulletin board fashion, e.g., monthly sky calendars. Other displays were of an original artwork nature, e.g., a montage of screen prints of images of those scientists who were instrumental in the development of our understanding of space such as Ptolemy, Copernicus, Kepler, Newton, etc. Displays also featured current programs such as the “Constellations of the Zodiac ...,” or the “Taurus Incident.”

During summer 1983, work commenced to bring the Peterson Planetarium into compliance with the Americans for Disability Act (ADA), and to meet fire code access-egress guidelines (Backhus, 1984). A chair-lift elevator enabled ADA access, and a second stair and entry were provided to the ground floor hall to enable both compliance goals to be met. To accomplish these objectives, the dome, all seating, the console, and instruments had to be repositioned approximately five feet in the planetarium chamber.

I continued as Director of the Peterson Planetarium from 1972 through summer 1987, during which I also served as Interim Dean for the College of Liberal Arts and Sciences for the 1986-1987 academic year, which was followed by another administrative role. Consequently, I relinquished the planetarium responsibility. Gerald Witten (1988), Associate Professor in Physics/Physical Sciences Education, served as director from 1987 until his retirement in 1991. Witten was

succeeded by Ron Keith who was hired to teach similar courses to those that Witten taught, and who had astronomy course work during his graduate study at Cornell University. Keith and I had the rather ironic coincidence of having both studied under the influence of Carl Sagan, commonly considered one of the most effective and influential “popularizers” of the sciences, particularly space science, as well as the implications and negative consequences of the “darker” side of human activity, e.g., “nuclear winter,” or Venus as the prototype example of a runaway greenhouse effect. Keith maintained Peterson Planetarium programming in the context of the Spitz A-2 instrument limitations until a disastrous circumstance turned out to have a “silver lining” and provided the basis for yet another transition.

### Total transformation of Peterson Planetarium

The next significant episode in the history of Peterson Planetarium occurred in early December 1994. The rupture of a principal campus water line resulted in an accumulation of more than five feet of water in Peterson Planetarium, whose lower floor of the two-story elevation is a single-story subgrade to the ground-floor level of Cram Science Hall. The flooding resulted in irreparable damage to the Spitz A-2 instrument and its electrical and electronic systems, the bench seats, the six-foot long curtains draped from the base of the dome, stored materials and other aspects of the planetarium chamber. The salvaged remains of the A-2 instrument were made available to the Kansas Cosmosphere and Space Center in Hutchinson, Kansas, for display as a second-generation Spitz A-2 instrument to juxtapose with their original A-1 and A-3-P instrument displays.

Funds from the State of Kansas Educational Building Fund were, fortuitously, available, and a request for \$450,000 to install a new Spitz System 512 state-of-the-art projector, operator’s console, audio system, new uni-directional theater-style seating (possible because of a three-axis system which allowed a vertical axis to reorient horizon directions), and a perforated aluminum dome were granted. The funding approval and specification development for bidding by potential vendors required most of the 1995 calendar year. The new Spitz System 512 projector and associated chamber requirements were installed during 1996. Some utilization occurred for astronomy and space science classes in late 1996. Finally, full planetarium operations were resumed during the spring 1997 semester following a reopening and rededication ceremony January 30, 1997, using the Kansas state motto for the theme, “To the Stars Through Difficulty.” At that time, the Peterson Planetarium could be considered a state-of-the-art facility. When Spitz personnel installed those aspects for which they were responsible, they indicated that only about a dozen of these installations occur worldwide annually. This development helps one place in perspective the magnitude

and significance of the investment in this informal education and outreach facility.

The considered imperative to be educational, yet with an increasing entertainment quality, characterized programming during Ron Keith’s 15-year tenure as Director of the Peterson Planetarium from 1991 until he was incapacitated by cancer in late 2006 and early 2007. Keith provided the effort to acquire several automated programs, most of which had to be adapted to the Peterson Planetarium capability. Among those were programs such as “More Than Meets the Eye” and “Through the Eyes of Hubble.” Both programs featured “deep-sky” objects and the capability for high-resolution optical cameras such as those utilized by the Hubble Space Telescope, and also imagery in other spectral regions. Numerous public school children viewed these programs. A final program was in progress at the time of Keith’s untimely death in 2007 that was a program designed for lower-elementary grade students titled “Our Place in Space.”

Although I had chaired the Physical Sciences since 1989, I then resumed responsibilities as Interim Director of the Peterson Planetarium in 2007 and continued until my retirement in 2011 (Fig. 3). Planetarium programming was maintained with the assistance of undergraduate and/or graduate students with majors or course backgrounds in space science who received training for, in particular, the automated presentations.



Figure 3. Author demonstrates planetarium projection capabilities in the remodeled Peterson Planetarium to a space science class in 2009. The Spitz System 512 projectors and base unit are shown.

Now the future of Peterson Planetarium is positioned at a critical crossroads. A two-fold need exists: (a) an individual designated as director with the appropriate background and inclination to administer, sustain, and develop the programming in order to achieve the potential that exists within capabilities, and (b) an upgrade to an augmented or fully digital projection capability. In my 2007 annual report, I stated the following: “On behalf of students enrolled in a number of classes who benefit from the presence of Peterson Planetarium, and in the interest of informal science education and community outreach, I encourage continued support by the University and College to maintain and sustain the educational opportunities that Peterson Planetarium can provide. An affirmative response [to the needs cited] would ensure that” (pp. 2-3).

New university president, Michael Shonrock, recognized the need to maintain STEM infrastructure with his arrival in January 2012. A major exterior renovation of Cram Science Hall was undertaken almost immediately (Fig. 4). Also in spring 2012, Spitz personnel were on campus to demonstrate a digital projection system, which is now considered the state-of-the-art. Most who observed the demonstration were impressed. Approximately \$200,000 would ensure the acquisition of the needed digital system, and a designated faculty member to serve as director would fully realize future potential for Peterson Planetarium.

#### NOTABLE STUDENT ASSISTANTS

A number of students have had an exceptional past presence with the Peterson Planetarium operation. During George Downing’s tenure as Director, two students stood out and were cited. Ken Ohm was described by Downing as “exceptional.” Ohm completed baccalaureate and master’s degrees at KSTC, and a doctorate at the University of Wyoming. He had a career in academe teaching physics. Since retirement, he has authored reminiscences of “his early educational experiences in one-room rural schools, and his farm-life upbringing in the rural Flint Hills . . .” (*Welcome*, para. 1). Another notable student assistant was Bob Everoski, who worked as both an undergraduate and graduate student in mathematics, later had a stint with a planetarium in Texas, and now does some free-lance newspaper writing concerning current celestial events (Downing, pers. com. 2012).

During my first stint as Director, David Lindsley became a reliable and effective live-program presenter to visiting groups; spokes persons for the groups would often provide unsolicited accolades. David now resides in Tucson, Arizona, and has served as a docent at the Kitt Peak National Observatory complex. Lindsley’s tenure as a student was protracted—he would alternate with the family farming operation in western Kansas in the summer and fall, then return for course work in



Figure 4. Renovated Cram Science Hall in 2012. An entirely new exterior envelope provides a fresh appearance and the promise of improved energy efficiency.

the spring semesters when so many planetarium visits occurred. During my final service as Interim Director, Michael Newton quite capably assisted with the planetarium while he was a graduate student in physics and earth sciences. Newton was adept with the use of the ATM-3, and Spitz upgraded ATM-4 computer interface programming feature for show development. He completed the planetarium program, "Our Place in Space," and presented numerous automated show presentations from 2007 to 2011. Among the more recent multi-year planetarium student assistants was Lynn Lefebvre who is now employed by NASA at Johnson Space Center, and Chase McIver, who completed his undergraduate study in 2013 with a major in mathematics education.

Ron Keith would surely cite the assistance of Crystal (Wood) McParland, an ESU secondary education graduate licensed in chemistry and physics. Following completion of the MS degree at Missouri State University, she has taught in the Olathe, Kansas, school system. McParland assisted me with the introductory laboratory for space science, and she was also a summer intern at the Kansas Cosmosphere and Space Center.

#### UTILIZATION OF PETERSON PLANETARIUM

Attendance data are available for the annual reporting periods from 1972-1973 through 2010-2011. Attendance has been generally grouped by the following four principal categories with subdivisions in the actual annual records: (a) pre-college level students from Emporia area communities; (b) students from university classes who utilize the planetarium; (c) civic or special-interest groups from off-campus for whom presentations were made following a scheduled request; and (d) lectures presented in evenings to patrons from the general public which was suspended at times due to faculty load/staffing considerations. The following generalizations can be made from 36 years of data:

- On average more than 100 programs were presented annually to greater than 2800 attendees. The greatest number of programs (160) was offered during 1975-1976, and the greatest attendance was 5077 during the 1972-1973 fiscal year period.
- Through the years, the largest category of clientele served based on number of programs and attendance were enrolled university students, followed closely based on numbers of attendees by pre-college age school youngsters or groups of prospective students.
- Programming for the off-campus visiting groups has varied from 8 to 46 groups served in a given reporting period and with a cumulative attendance ranging from 71 to 984.
- Public lectures as evening events, and since the mid-1970s as events with a nominal charge, were offered with the greatest frequency in the 1970s. The peak of this programming was 1975-1976 when 36 programs were

presented to 1400 patrons. Within this number during that period were presentations arranged and developed by Joseph Ott, a music theorist and composer of electronically generated compositions in the Department of Music (*The Spotlight*, 1976).

#### A HUMOROUS NOTE ON PATRON BEHAVIOR

Allegedly a Wisconsin farmer spent a holiday in Los Angeles, and he made his first visit to a planetarium (perhaps Griffith Observatory and Planetarium). He regaled:

"First you see the sky," he told [an acquaintance] enthusiastically, "and all those little houses all around, like we were sittin' in a field in the center of the city lookin' up at the sky. And then it starts gettin' on to twilight so real it beats all get out. And then, by golly, that quarter moon shows, I tell you, I never saw the moon more real than that. Then it started gettin' darker and got to real dark, and the stars come out like I've seen 'em a thousand and one times. Well, I tell you!" He shook his head, overwhelmed, and fell silent. "Then what happened?" [the acquaintance] asked. He came out of his bemused wonder and replied, "What happened? Why, I went right to sleep." [Source unknown.]

All planetarians can share similar stories. I recall the following:

When we were serving groups characterized by some senior citizens, it was not uncommon to have them arrive early in the afternoon after lunch. During these live presentations, I would typically begin with the Sun in the morning sky, simulate daily motion, stop near noon when the Sun transits due south, project the meridian and coordinates, and point out seasonal Sun changes. Following a sunset with an appropriate reddening of the western sky, a darkening of the sky and a full display of stars, I might begin to hear the faint tremors of a snore. It would either cease with some chomping sounds, or escalate to the sounds of choking and snorting. All would then become quiet. I would simply say "The night sky can appear so real that people do what they do at night," then try to put the visitors at ease, and continue pointing out the planets, and prominent stars and constellations that would characterize the sky that they might see that evening.

**Note:** A substantial amount of the background information for the text was gleaned from annual reports tendered for Peterson Planetarium from 1973 through 2011, particularly the Thirty-Fifth Annual Report for the period from June 1, 2006 – June 30, 2007, and dated June, 2007, which contained a rather comprehensive historical summary.

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