Planetarium Dome as a Cultural Centerpiece: Innovative Approaches and Collaborations at a Planetarium in Japan

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ABSTRACT
Tsukuba Expo Center of TSUKUBA EXPO ’85 MEMORIAL FOUNDATION is engaged in innovative activities, centered on its planetarium dome. In order to maintain popularity and relevance in a city that is highly educated and increasingly diverse in both nationalities and age-groups, planetarium programs have been developed in collaboration with English-native volunteers from an international school and also experts from local universities. Additionally, evening music concerts have been organized to showcase local musical talents and simultaneously to provide a dual experience of music and science. These collaborations and events are helping to expand community involvement and also to attract a broader audience demography including International/English-speaking visitors.

INTRODUCTION
Tsukuba Expo Center, a hands-on, science museum located approximately 1 hour north of Tokyo by train, has a world-class (25.6m) diameter planetarium dome. The city of Tsukuba has a unique demography in Japan, home to a highly educated and international population, since it is the location of 32 national research facilities (including JAXA, the Japanese space agency, where multiple astronauts have worked) and multiple universities. Tsukuba Expo Center is operated by TSUKUBA EXPO ’85 MEMORIAL FOUNDATION, was originally established at the former site of the 1985 Technology World’s Fair (Tsukuba Expo ’85), which attracted more than 20 million visitors from around the world in that year. The Center strives to continue the legacy of that event by cultivating the spirit of wonder and curiosity through science and technology for people of all ages, nationalities, and backgrounds. In 2017, Expo Center attracted a total of 191,817 visitors, more than 60% of whom enjoyed planetarium programs. [Fig. 1]
The planetarium of Tsukuba Expo Center employs a hybrid, digital and optical projection system, featuring a Konica-Minolta Geministar-III optical planetarium to project up to 350,000 stars in the vicinity of the Milky Way galaxy and 12,900 other celestial objects, down to about 7.6 magnitude of brightness. The systems also employ a Konica-Minolta SKYMAX DSII-R2 (4K) digital system employing 6 harmonized Barco projects and the Digital Sky (DS) simulation software. The DS system includes a 3D universe simulator based on data from NASA and the New York Museum of Natural History. {Fig. 2, Fig. 3.}

Fig. 2 – Tsukuba Expo Center planetarium (interior)  
Fig. 3 – Tsukuba Expo Center planetarium (digital projection system)

I. PLANETARIUM PROGRAMMING

I.1 Original Program Productions

Uniquely in Japan, Expo Center produces its own original planetarium programs (pre-recorded/pre-programmed, hybrid programs) at a seasonal cadence. These programs may also be licensed for use at other planetariums, and some have enjoyed significant popularity at several other sites within Japan. Since 2006, a total of 47 programs have been produced, typically focusing on topics of: 1) unraveling the mysteries of the universe; 2) Learning about the planets and constellations; 3) Significance of stars and constellations from cultural or historical viewpoints

I.2 Options for a More Diverse Audience

Since 2014, in order to better serve the diverse community, we are offering an additional English language audio option, aimed at a non-Japanese speaking audience (or anyone interested in improving English listening skills). Moreover, Japanese subtitles and audio support for hearing impaired or elderly audience members have also been made available. The development and launch of these optional features benefited from inputs and consultation from experts at local companies, research organizations, and universities, including faculty from Tsukuba Gijutsu Daigaku, Japan’s only national university for education of students with hearing, visual, or other disabilities, who enabled optimization of the user experience for all viewers simultaneously.

To date, 12 programs have been produced with accompanying English audio, and to our knowledge this is a pioneering project, i.e. Expo Center is Japan’s only planetarium that continuously self-produces its own original feature programs and also provides options for English speakers and hearing-impaired visitors. Moreover, for recording the English language audio, we have invited the voluntary participation of popular and influential members of the English-speaking community in Tsukuba, including students and faculty from Tsukuba International School (TIS), an accredited International Baccalaureate School. {Fig. 4}
I.3 Recent Programs and Collaboration Example

In 2017, we have produced programs titled “Enchanting Planets” (a tour of the solar system, including latest scientific updates and images from various space probes); “Giant Meteor Impact into Earth” (a survey of asteroid/meteorite impacts and the prospects for protection from the risks of future impacts); “Star Tales of Old Japan” (explaining the practical value in old Japanese society of using stars for guiding the lives of the people including farmers & fishermen); and “Calling Jupiter” (on the mysteries of Jupiter from Galileo’s discovery of its moons to the latest data and images from the Juno space probe).

As a specific example of collaborations, the production of the program "Giant Meteor Impact into Earth", which featured several historic meteor events including the Yucatan peninsula (Chicxulub crater) impact of 66 million years ago and the Tunguska impact in Siberia about 100 years ago, benefited from many local experts and volunteers. Researchers and engineers from universities and corporations were consulted about the facts of these and other impacts including one that released fragments over Tsukuba City in 1996. As English voice actors, two volunteers were recruited from Tsukuba International School, which is an International Baccalaureate accredited school located in the city. Furthermore, an interactive exhibit was set up along the exit hall of the planetarium so that audience members could enjoy reviewing the learnings from the program and even provide their own ideas or opinions about how best to react to a future impact threat. The exhibit materials were prepared with bilingual explanations, also with help from Tsukuba International School students. [Fig. 5]

As for the current 2018 summer season, our original shows include our latest animated program, Einstein’s Homework” which explains the concepts and technologies of gravitational wave detection, also produced with volunteer voice actors from Tsukuba International School, and a digital program about the Van Gogh’s depiction of the stars in his art works, from both artistic and scientific viewpoints.

Fig. 4 – Recording scene of English language audio track

Fig. 5 – 2017 Summer Planetarium Program (“Giant Meteor Impact”)
II. INNOVATIVE COLLABORATIONS

II.1 MOU with an International School

Starting in October 2017, Tsukuba Expo Center is expanding the collaboration with Tsukuba International School. We signed a formal MOU and announced the joint initiative to local media outlets. Under the MOU, selected 11th year high school student volunteers from can participate from the early planning phase through to the production and post-production activities of planetarium programs, while simultaneously fulfilling their International Baccalaureate community service requirements, which are a condition for graduation under the school’s Diploma Program. Thus, both parties benefit from this unique collaboration, as the students gain valuable skills and experiences in project management, PR, and audio voice acting and recording, etc., while Expo Center reaps the benefits of the English language offering as well as helping to attract students, faculty, and friends of the volunteers.

II.2 Music Concerts under the Dome

In addition to the original seasonal production and other regular planetarium programs, as a new approach, Tsukuba Expo Center also utilizes the planetarium dome for special music concerts in evenings. The dome space offers a relaxing environment with comfortable seating and unique acoustics. The live music featuring local musicians is visually enhanced by optical and digital images and animation on the dome. Part of the concert is dedicated to a brief overview of the night sky with live explanation using the optical star ball, while the musicians provide musical accompaniment in the background. Featured musicians have included performers of classical, jazz, pops, as well as traditional Japanese instruments. One experimental collaboration featured a trio with piano, violin, and Japanese Shakuhachi (bamboo flute), under the planetarium night sky. Such events are thought to achieve a unique balance between arts and astronomy, and between entertainment and education.

Evening music concerts enable Tsukuba Expo Center to effectively appeal to a wider audience demography, including adults who are not available during the daytime hours, senior citizens, and residents who enjoy musical culture but may be less familiar with astronomy or science. This type of event can be an effective way to help a general audience become more familiar with astronomy and science. Furthermore, by featuring local musicians, some of whom are also research scientists or family members of scientists at universities and national laboratories in the area, we aim to further attract new visitors and also foster new collaborations with other science and education organizations through the planetarium operations. [Fig. 8]
II.3 Science Outreach Activities

Finally Expo Center is leading outreach activities, utilizing a large, mobile planetarium that was constructed by the staff. More than 100 visits per year are made to schools and local communities, primarily for children and people who may have difficulty to visit to Tsukuba Expo Center directly. Furthermore, outreach visits are planned at hospitals, especially for children who are seriously ill. We hope to instill the children with a sense of hope and perhaps dreams of future career in science or in space exploration.

II.4 Seeking Additional Collaborations

Based on the success of this model, Expo Center is also planning to initiate collaborations with other organizations, including a space science venture business.

III. CONCLUSION

Tsukuba Expo Center is endeavoring to forge new collaborations within the community for achieving the goals of
1) Expansion of the number and diversity of visitors;
2) Mutual benefits for both parties through our collaborative activities; and
3) Demonstrate new avenues for creative and educational expressions of science and astronomy, in order to inspire a new generation of scientists.

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