

Proposal for Supplementary Digital Dome System

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Section 1

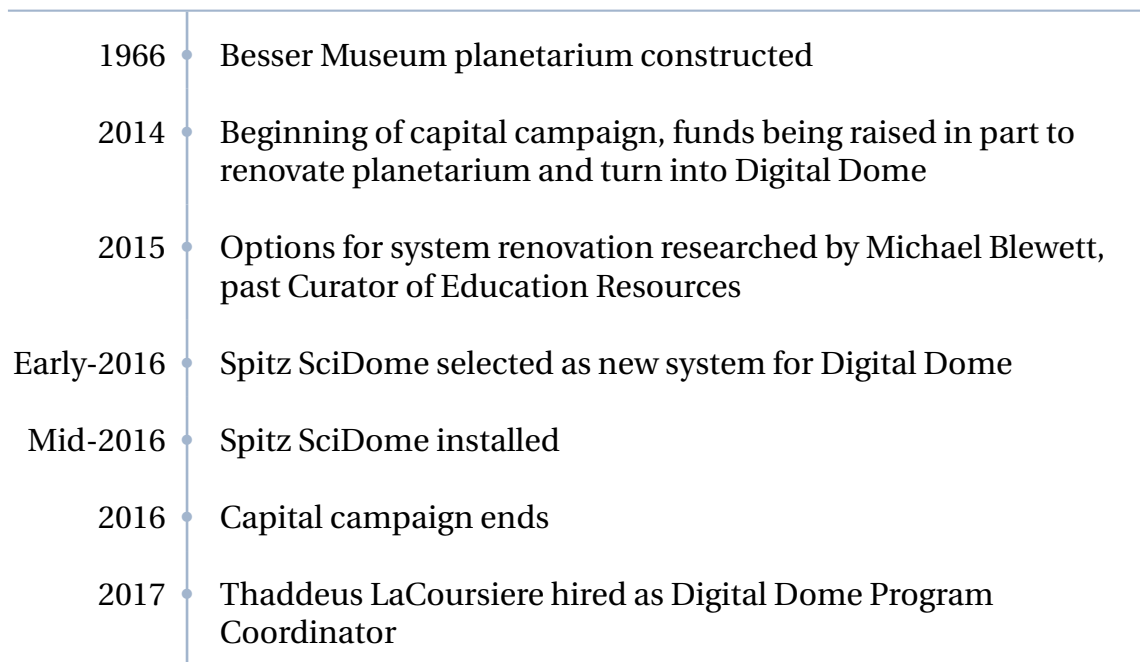
Executive Summary

1. Visitors to the Besser Museum Digital Dome Theater overwhelmingly go to live shows and want to interact with a live presenter;
2. The SciDome system currently installed does not meet the live show presentation and show production needs of the Besser Museum Digital Dome;
3. Specific parts of the Spitz SciDome provide great value, particularly the Earth science modules;
4. Dark Matter by Sky-Skan is proposed as an add-on Digital Dome system to make up for the gaps in SciDome;
5. Dark Matter will enrich show presentation through live, interactive experiences;
6. Dark Matter will enhance show production through ease of use, ability to use modern file formats, and consistent output;
7. Unique features such as the Video Capture System give the ability to connect to planetariums, institutions, and equipment around the world;
8. Dark Matter ships with curriculum designed for planetariums and a wealth of multidisciplinary content including biology, chemistry, and anatomy;
9. A final quote for Dark Matter is not yet available, but is estimated to be around \$30,000 - \$50,000;

Section 2

Digital Dome History

Timeline of Digital Dome Renovation



A vertical timeline with a central line and dots marking key events. The events are listed to the right of the line, with corresponding years to the left.

1966	Besser Museum planetarium constructed
2014	Beginning of capital campaign, funds being raised in part to renovate planetarium and turn into Digital Dome
2015	Options for system renovation researched by Michael Blewett, past Curator of Education Resources
Early-2016	Spitz SciDome selected as new system for Digital Dome
Mid-2016	Spitz SciDome installed
2016	Capital campaign ends
2017	Thaddeus LaCoursiere hired as Digital Dome Program Coordinator

In 2014 the Besser Museum started a capital campaign to raise funds for, among other things, a renovation of the existing Digital Dome planetarium. At the time, the only staff in the planetarium were part-time (John Heath) or responsible for it as a part of their other, more extensive, job duties (Michael Blewett, Curator of Education Resources).

New digital systems that were evaluated were judged based on three overarching concerns: cost, content, and connectivity. Spitz SciDome was chosen based on the belief that it was the best cost out of the systems previewed; there was extensive content available; and there was a way to connect to other planetariums. The Spitz SciDome was installed in mid-2016 and included an almost complete renovation of the existing analog system (Spitz A3P star ball and associated audiovisual equipment).

In mid-2017 Thaddeus LaCoursiere was hired into the position of Digital Dome Program Coordinator, taking on many responsibilities, including show creation and presentation using the SciDome system. John Heath remained on as Planetarium Instructor, presenting shows on a reduced and as-needed basis.

In the end, the SciDome system was purchased at a time when the capabilities of the Besser Museum Digital Dome were not yet clear and so only what had been shown in the past could guide the final purchasing decision. At the time of this report, with over eight months of continual shows and events, there is the chance to capitalize on what has been created and realize the full potential of the Digital Dome.

Section 3

Rationale for This Report

Over the last eight months it has become clear that the installed SciDome system does not fulfill the expectations of what is needed in the Digital Dome, namely presenting and creating live, interactive shows. In certain cases the SciDome system will present straightforward, linear shows that run without any deviation from a script. Based on visitor wants and needs this type of show cannot make up the majority of what is presented in the Digital Dome.

The software has severe, inherent limitations, including an overall poor user interface, inability to use multiple forms of media, clunky presentation, and software bugs. All of this profoundly limits the ability of a user to create or present shows that engage and inspire visitors, while also adhering to the best practices of the planetarium and education fields. Furthermore, the inherent limitations of the SciDome system extend to other aspects, including dome casting, working with other institutions, and even training volunteers.

The work that went into acquiring the new Digital Dome system cannot be understated. The SciDome system represents a significant investment for the Besser Museum, particularly given how funds were raised and the trust placed in the Besser Museum by the community members who donated monies.

The additional time spent hiring the Digital Dome Program Coordinator and the subsequent salary requirements also represent a noteworthy investment by the Besser Museum. Both investments were made to enhance the Besser Museum and fully utilize the incredible resource that is the Digital Dome. This report advocates for an additional system, Dark Matter, that will enhance the programming capabilities of the Digital Dome. The call for the addition of Dark Matter reflects the deepest desire of the writer to maintain the highest quality possible in the Digital Dome and larger museum.

Section 4

Intended Usage of This Report

This report is intended to be used in three ways:

1. To better understand visitors wants and needs;
2. To briefly explain the ways in which the SciDome system has not lived up to the needs of museum visitors or staff;
3. To propose and ask for the purchase of supplementary planetarium hardware and software system to enhance and extend the current installation.

4.1 Research Into Digital Systems and Audiences

Reflected in this proposal is information gained through multiple channels, including

1. The Digital Dome Program Coordinator's first-hand experience with various digital systems and with visitors, which includes
 - (a) 8 months of intensive work with the current SciDome system through in-person and online training, show creation, hundreds of shows presented to thousands of visitors, and
 - (b) 5 years experience presenting thousands of shows using DigitalSky2 by Sky-Skan, and
 - (c) Hands-on demo experience with E&S's Digistar, SCISS's UniView, and other planetarium systems, and
 - (d) Conversations with some of the thousands of visitors from hundreds of shows presented in just the last 8 months
2. In-person, phone, and email conversations with Spitz technicians and sales representatives;
3. Conversations with other planetarium professionals who use Dark Matter, SciDome, and other manufacturers to understand inherent and constructed limitations of the various systems;
 - (a) Additional focused talks with those professionals who have used multiple systems or have switched between systems

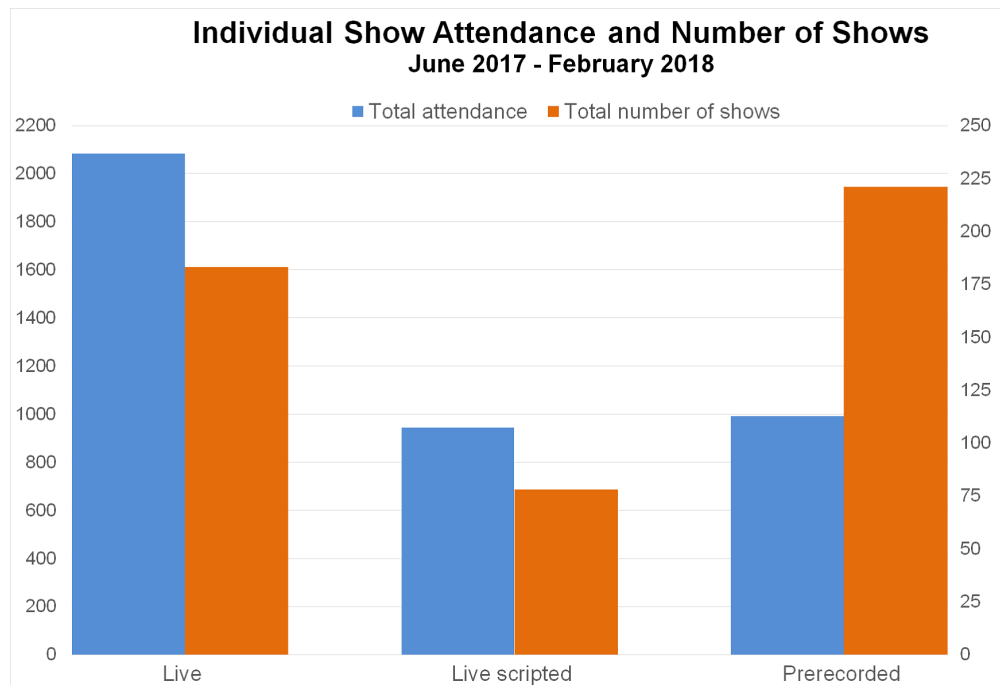
4. Research into planetariums and Digital Dome best practices, current and future activities, and visitor expectations;
5. Multiple in-person and email conversations with Beth Moger of Sky-Skan which has garnered quotes, documentation, training videos, and supplementary material about Dark Matter.

Section 5

Digital Dome Show Attendance and Revenue

Since June of 2017, the Digital Dome has seen over 4000 visitors of every age and background, from pre-K to senior citizen, and from “ never looked at the sky before” to literally discovered a comet. The shows these visitors have seen have also varied, from pre-recorded movies to completely live, off-the-cuff explorations of the universe to a combination of both pre-recorded and live presentation.

5.1 Attendance



- 52% of attendance has been at live shows, yet only 38% the shows presented have been live,
- 23% of attendance has been at “live scripted” shows, and 16% of the shows presented have been “live scripted”,

- 25% of attendance has been at pre-recorded movies while 46% of the shows presented have been pre-recorded movies.

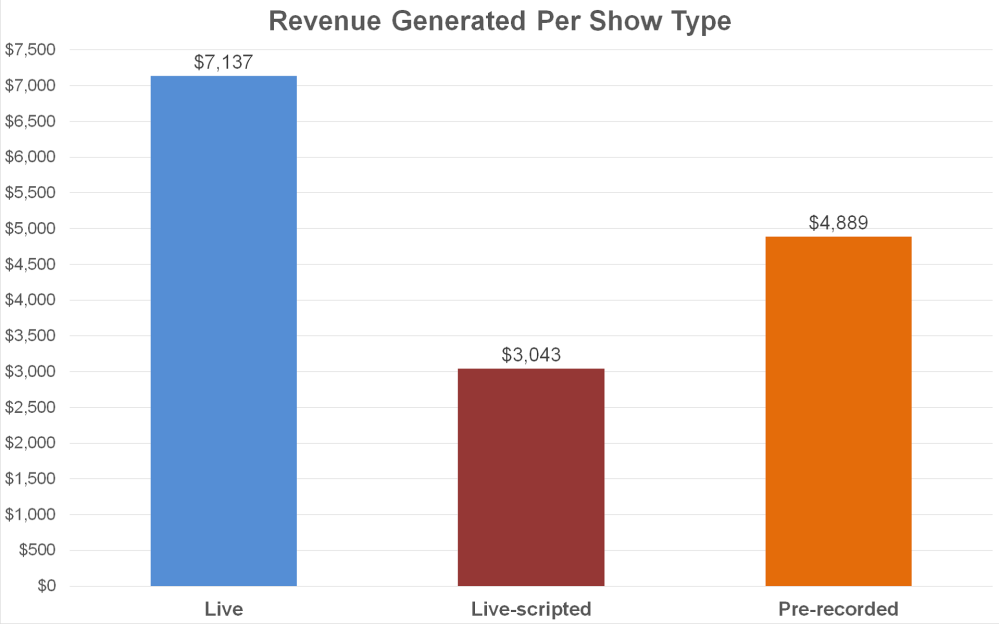
The shows visitors choose to attend speak to what people want and expect from the Digital Dome and also to the strengths of the Digital Dome. Live shows, despite being available in only a few time slots and making up only a third of shows presented, account for over half of the Digital Dome attendance. Multiple pre-recorded movies have been available in multiple time slots over the past eight months, and have made up almost half of shows presented and have attracted only a quarter of the total number of visitors. Visitors want live shows and the live shows allow the Digital Dome technology to be used to its fullest extent.

Live-scripted shows live somewhere in between truly live and pre-recorded movies. Live-scripted shows require a live presenter and system images and videos. These shows run along a more linear path but they also allow for visitors to interact with the presenter, ask questions, and gain more relevant information. Live-scripted is the category of show that Digital Domes can now make in-house using only staff time and system resources.

Overwhelmingly, from the attendance at live and “live scripted” shows, we can see that visitors expect and enjoy being able to interact with a “real” person, ask their own questions, and engage with the amazing dome experience. Visitors enjoy being able to pause, talk with the presenter, and better understand and explore what they’re seeing. These aspects create a dynamic and personal environment for visitors, fostering an exciting, comfortable learning environment. This interpretation tracks well with other Digital Domes where some pre-recorded movies are shown, but the bread and butter of show presentation is done in-house and includes a live presenter.

5.2 Revenue

Digital dome shows are also a source of revenue for the Besser Museum and shows that attract visitors bring in money.



Live shows have brought in 1.5x as much revenue as pre-recorded shows. This represents not just a significant source of revenue from the Digital Dome but also highlights the unique draw *of* the Digital Dome. Visitors enjoy and will pay for the experience of conversing with a speaker about fascinating topics in a one-of-a-kind setting.

Section 6

SciDome

6.1 Uses for Spitz SciDome

The SciDome system is not going to be thrown away, it represents a significant investment of time and money, and has aspects that stand out and should be utilized. The Starry Night software was originally meant to be used in the classroom or by amateur astronomers setting up their observing sessions. Starry Night can still be utilized this way, which, with the initiation of an astronomy club would give an invaluable way to introduce beginners to the night sky. This would place the Besser Museum at the center of any night sky activity being planned, drawing in a new audience of visitors.

Additionally, The Layered Earth software has a set of lesson plans about Earth sciences. Due to the demands of the other parts of the SciDome system, not enough time has been spent with these plans. With more time to focus on The Layered Earth, shows reaching into different disciplines can be produced to extend the appeal of the Digital Dome to more audiences. More connections to other parts of the Besser Museum can be made, making a more cohesive and satisfying experience for visitors and driving repeat business.

Finally, pre-recorded movies are able to be played as funds and time become available to purchase them. Although pre-recorded movies are an useful break, for example, when presenting five shows in a row, they can not replace a live presentation. Furthermore, even excellent pre-recorded movies such as “Habitat Earth” can not be shown every day for multiple years as people will rapidly tire of the same content. Purchasing pre-recorded movies is expensive and although they add useful content to what is available, they are not a substitute for live presentations.

There are places and situations where the SciDome will provide useful and compelling content. However, the SciDome system has inherent limitations and issues that need to be addressed. For the purposes of this proposal, the focus is on two specific areas: presentation and production.

6.2 Restricted Presentations

The SciDome system is not meant to be used for live presentations. The Starry Night 7 (SN7) software is designed to set up “scenes” that are saved and run through the ATM-4 software. Whether used by on their own or together, these scenes are meant to be set up and played straight through, without stopping or pausing. Trying to change tracks or shows in the middle results in errors or crashes, ranging from the lights suddenly turning on to the wrong show starting to the system crashing. Adapting shows to fit with audiences’ questions or interests is either impossible or virtually so. Audiences who want answers must be directed to resources outside the museum, bringing into question why they visited the Digital Dome or the museum in the first place.

This also means that SN7 is not user friendly, e.g. information is not immediately accessible, and individual options and selections are hidden among dozens or hundreds of other options. This restricts what a presenter can bring up during a live show to a small handful of actions. More time is spent trying to find or set up a scene than is spent conversing and engaging with audience members. Additionally, even when a scene works, nothing is truly hands-off, and the system must be continually monitored, resulting in increasingly small amounts of real audience interaction.

Although a range of content has been put together, the limitations on what can be shown are rapidly approaching or already past. Attempts to extend content to better engage with the current visitors and to bring back repeat visitors have been obstructed or completely stopped by built in restrictions of the SciDome system. When visitors come to a “live” show with the SciDome system, they are, more likely than not, going to see the same thing they saw a short while previously. This situation does not drive repeat business and makes the Digital Dome, and by extension, the Besser Museum, a boring and uninviting place to visit.

6.3 Limited Show Production

The SciDome system is meant to produce linear shows and achieves this to some extent. Using simple images and remaining mostly on the Earth, a show can be constructed to illustrate some simple astronomical principles, e.g. an analemma. Any attempt to move beyond the Earth or to include videos, animations, 3D objects, movement, or custom creations, or even to use built in features will fail. Shows that are created cannot include the basics of what makes planetariums and domes such incredible places to visit: unique content, a sense of immersion, and a deeper look into the universe.

Attempts to add new content, e.g. aurora simulations, or waiting for Spitz to supply new content, e.g. NOAA’s Science on a Sphere, have rarely been successful, with these attempts either failing due to lack of basic system abilities or repeated lack of supplied

content. Conversations with Spitz have revealed the glacial pace of their software development and apathy towards addressing issues that arise.

The SciDome system is also not compatible with modern video and image standards. More time has been spent trying to convert media to play on the SciDome than has been spent playing the media. This includes download time, time spent moving and copying files, rendering time, and time spent restarting the SciDome system after it crashes when trying to use common media formats. It is always necessary to work with media to ensure that it looks good and displays properly on the dome, however all of the additional time necessary with the SciDome system is time not spent working on other job duties and assisting in other areas of the museum.

Taken altogether, show production with the SciDome system is unproductive, with simple tasks becoming time consuming and infuriating. Consequently, creating new shows, especially non-astronomy shows and ones devoted to Northeast Michigan's unique culture, are an exercise in frustration. This limits the ability to present live shows and to create the live-scripted shows that allow for less-experienced presenters to take part in the Digital Dome.

6.4 Lack of SciDome Connectivity to Other Institutions

“Dome casting” is an emerging ability that is currently gaining traction in the planetarium world as it represents a way to connect to diverse audiences that used to be completely segregated. Dome casting has particular importance for institutions such as the Besser Museum which are more geographically isolated and need to seek out new and innovative ways to connect to outside groups such as universities and businesses.

The SciDome system was originally selected with the understanding that it included the ability to connect to other SciDome systems around the world through dome casting. However, the SciDome system does not have any dome casting features and there are no plans to include any by the manufacturer, Spitz.

Section 7

Dark Matter

To overcome the shortcomings of the SciDome system, the purchase of a supplementary planetarium hardware and software system is proposed. The system proposed to be purchased is “Dark Matter” by Sky-Skan, an extraordinarily capable package that will enhance the offerings already available and further extend the capabilities and reach of the Besser Museum’s Digital Dome. There are multiple areas in which Dark Matter will supplement the existing system.

7.1 Enriching Live Presentation

Dark Matter is made to be controlled in multiple ways, one of which is completely live. This means that with minimal set up a presenter can easily find, go to, or talk about anything that an audience member has asked about. The presenter is free to engage directly with the audience and help make the experience in the dome the audience’s own, all without anyone having to worry about what the system might do or what could go wrong.

A second way to control content in Dark Matter is by using pre-built “buttons” that carry out a set of actions. Buttons allows presenters to provide deep and meaningful content to audiences even when the presenter does not have a great deal of experience presenting. As well, presenters who have strong background knowledge in the subject being discussed but do not have strong computer skills can focus on their strengths and leave the system to handle movements, images, or anything that needs to be shown. These buttons can also seamlessly include updated content from partners like NASA, JPL, Goddard, and others.

For example, it would be easy to create a button that, with one single click, would fly to Jupiter, orbit around it for 30 seconds, then fly to one of its moons and after arriving there display the latest images from the Juno spacecraft, before flying back to the Earth. The movement and transitions during this would be steady and smooth, without the jarring spins that happen now, and the audience and the presenter would be free to focus on what should be talked about, not on system glitches.

Live presentations give visitors the chance to ask questions, get answers, and in general, drive the show forward at their own learning pace and in their own learning style. This control over their own experience takes the Digital Dome from “just a room with the stars and planets,” and turns it into a unique, one-of-a-kind place for patrons

to visit, over and over. Dark Matter allows for these customizable, interactive shows which are what our visitors want. Enhancing the capabilities of the Digital Dome with Dark Matter will increase visitor attendance, make shows look and “feel” better, and continue to show the Besser Museum in the best light possible.

7.2 Efficient Show Production

Dark Matter allows for immediate control over the placement and editing of objects and scenes in the system. Show production through Dark Matter can be accomplished several ways; one is through a timeline interface where elements are dragged and dropped and quickly positioned. This works well as a “rough cut” of a show and is teachable and usable to anyone within minutes. Although entire shows can be set up and played that way, more advanced show creation and editing can also be accomplished through a script editor. This allows for the automation of otherwise complex tasks and for the strict control necessary for creating flight paths, multiple image overlays, working with 3D objects, or other multi-part scripts.

Show production is enhanced by the ability to immediately use any image or video needed, regardless of file format. Formats like GIF, MP4, MKV, blend, speck, and KML are supported in Dark Matter and give the capacity to extend what can be shown on the dome in ways that are impossible to do with only the current system. With the ability to take in any image or video and change it in real time on the dome, there is no down time between an amazing new scientific discovery and sharing it with visitors. This will continue to make the Besser Museum “the place to go” to learn about the latest findings.

Dark Matter also ships with an enhanced set of 3D models, including a moveable model of the Mars Science Laboratory “Curiosity.” Incorporating models like this would give an added sense of realism to shows and allow for expanded offerings. Visitors who are used to high production values would enjoy a show with comparable quality. Every day things like taking a tour of the International Space Station or special events like the deployment of the James Webb Space Telescope could also become a part of routine shows.

With Dark Matter it would also be possible to move beyond the walls of the Besser Museum and have partners like NOAA show their videos or other content on the Digital Dome. This could be accomplished without additional preparation like warping or rendering. As a result, museum staff would be able to spend more time on other projects (as well as making the Digital Dome more than just a place to see the stars!). After a show is produced, created scenes could be rendered out and distributed or sold to other partners or institutions. With these capabilities, Digital Dome shows can be made and shown without fear of them looking wrong or not working at all. This saves time and effort and makes presenting shows stress-free.

Creating a show in Dark Matter is always straightforward and simple; it can also be deep and complex if needed. This makes show production fast, allowing for more

shows to be created in the same amount of time. This gives more reasons for visitors to attend the Digital Dome, enhancing their experience and keeping them engaged and connected to the Besser Museum. Unique shows that could be produced with Dark Matter would also increase the standing and reputation of the Besser Museum in all of Northeast Michigan.

7.3 Dome Casting through Video Capture System

The Dark Matter system also ships with a Video Capture System (VCS) that takes an external source and feeds it directly into Dark Matter to be shown on the dome. For example, it would be possible to take a DVD feed, or a laptop showing a feed from another institution and display it directly on the dome. This is the equivalent of the dome casting feature that was promised by Spitz but that does not exist for the SciDome system and will not exist for the foreseeable future. In many ways this is preferable to a dedicated dome casting system. For example, those systems will only connect to other systems by the same manufacturer.

With Dark Matter's VCS, the Besser Museum would have the ability to take in any video stream that is connected. For example, the Kavli Fulldome Lecture Series is streamed live by the Adler Planetarium in Chicago through SCISS UniView and also over YouTube. With Dark Matter's VCS, we could take the YouTube feed and participate without having to buy a SCISS system. The Besser Museum could access any institution that is live streaming over YouTube or a similar program, or work with institutions to set up personalized streams.

This single piece of Dark Matter extends the capabilities of the planetarium and truly turns it into a Digital Dome where anything that can be put through a computer can be shown in an immersive, awe-inspiring way. For example, a wedding party in the dome where a stream from relatives who could not attend is visible on the dome while the wedding is also streamed to their relatives. On a more direct level, a video output from a microscope could be streamed into the dome, allowing everyone in the Digital Dome to observe a cell or meteorite sample or the inside of a real human eye, all in real time. This would give the Besser Museum the ability to showcase new and exciting discoveries in every discipline—art, history, science, and more—and make personal connections to existing and new audiences.

7.4 Enhancing Other Disciplines

Earth science, chemistry, biology

Dark Matter comes with anatomical models of the human body and its subsystems and a catalogue of molecular models. Dark Matter also includes the ability to fly into an

animated animal cell model in real-time and includes data visualizations of cross sections of different kinds of cells ranging from brain neurons to cancer cells. In conjunction with the Zygote Body software, this would allow for an unprecedented look into the human body, bringing in multiple disciplines and reaching out to an incredibly wide audience.

7.4.1 Science on a Sphere

Dark Matter also has the entirety of NOAA's Science on a Sphere (SOS) and can be updated to include the latest releases from NOAA. SOS has been available at the Thunder Bay National Marine Sanctuary's Great Lakes Maritime Heritage Center, however they are limited to what they have predetermined to show. With the complete SOS database, the Besser Museum has the opportunity to help fill in the gaps at the Heritage Center both by showing additional content as a regular show and also by bringing up content as requested by visitors. This would make the Besser Museum the most up-to-date and responsive institution in northeast Michigan.

7.5 Dark Matter Cost

Conversations with Beth Moger of Sky-Skan regarding a final quote for Dark Matter are ongoing. A final quote in the range of \$30,000 - \$50,000 is expected. Several lists of questions—including about Dark Matter, its capabilities, and how it would work with the current system—have been submitted and Ms. Moger is working the answering the most recent ones. So far she has supplied information about the Video Capture System, and given assurances that Dark Matter would smoothly integrate with the Spitz equipment. She has also provide copies of three webinars that Sky-Skan produced for current Dark Matter users which have given most insight into the many capabilities and potential uses of Dark Matter. These webinars are available for viewing as and when needed.