DISCUSS Colloquium Evaluation: Full Report

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Prepared for:

White Oak Institute and the DISCUSS Colloquium

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Understanding, fostering and promoting lifelong learning

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Executive Summary

Project Background

The National Science Foundation has provided funding through NSF-ISE# 0946691 to support the DISCUSS Colloquium, a seed initiative to nurture a shared Digital Immersive Giant Screen Specifications (DIGSS) for STEM learning film production at a scale and quality that is sustainable in the informal science education (ISE) community. It is anticipated that when such specifications are adopted and published, equipment manufacturers and show producers will be better able to raise capital based on the scale of the network and their need for replacement equipment and new films.

Researchers from ILI conducted three studies to inform and evaluate the DISCUSS colloquium held in Marblehead, MA June 14th – 16th 2010 and the expanding community collaboration that flowed from those efforts. Prior to the meeting, semi-structured phone interviews were conducted with colloquium participants to determine areas of convergence and divergence, prior to holding the colloquium. Onsite observation and informal interviews to determine the level of engagement and motivation of participants took place during the colloquium, and an analysis of the interaction between participants through the online forum following the meeting assessed the representativeness of opinions, points of concordance and discord within the community, and the ability of this group to reach consensus on behalf of the industry. These studies were conducted to inform the facilitators and participants of DISCUSS as they move towards the creation of Digital Immersive Giant Screen Standards (DIGSS) that represents the needs and unique expectations of the ISE community that has committed to this format.

Results

A number of issues or themes emerged from the three studies in aggregate. Participants agreed that attending a GS film at a science center is a unique learning experience and inherently different from attending a movie in a traditional "industry" theater. They believed that the value of this experience needs to be highlighted and capitalized by future business models and marketing, and, importantly here, that the unique attributes of the existing analog format needs to be captured in any DIGSS initiative. They agreed that there continues to be demand for quality new science, technology, engineering and math (STEM) programming for the giant screen theaters in museums, although they also recognized the need for a better understanding of how GS films uniquely contribute to STEM learning.

It was agreed that compliance with the current Digital Cinema Initiative (DCI) standards for standard "Hollywood" films would be a baseline on which to build. The group also arrived at consensus on definitions, technical issues, and important questions related to the specifications but did not always achieve agreement on specific details. These issues include

- how to reconcile the differences between the needs of GS flat and dome theaters,
- how to acknowledge both the limitations of current technical capabilities (e.g., limits of digital projectors) and the need to move the technology forward;
- the need for higher standards on the "film capture" side of production,
- the need for greater development of audio specifications in DIGSS, and
- how to ensure that operators are appropriately informed about the specifications.

Finally, the group made clear that decisions made by the independent IMAX Corporation, a brand of GS theater that is linked in the public mind to perceptions of the format, will have impact on any adoption

of specifications. Some members of the group raised concerns that some current technical advancements being pursued by IMAX might impact DIGSS and the success of the venture.

Examination of the process revealed that most decisions made through this collaboration took place onsite at the colloquium, with refinements advanced in subsequent phone discussions between one or two participants. In most cases during the colloquium, individual goals were given fair discussion by those with opposing views, and changes were made to accommodate these concerns, with the group moving quickly towards consensus. These behaviors reflected a highly functional process and coherent group working as a community. In reviewing online communication (Study 3), there is little to suggest that a collaborative conversation took place after the meeting or that the specification document was created as an iterative process, as was a goal of the process. Rather, it appears that the initial work developed by the project's Principal Investigator and the technical team received tacit approval from the collaborators, were refined by one or two experts with knowledge about that section during the online process, and re-distributed for editing by the group and the team of technical and economic experts. However, examination of the online forum revealed that no comments by participants on the shape and direction of the document were recorded. This result suggests that the small community that contributed to the specification were likely to agree with the substance and form of the specification in its current form, perhaps reflecting the groups confidence in the abilities of each expert in their individual area of expertise.

An online forum may still be valuable for continuing the conversation with the larger GS industry; however, based on these results and the level of participation by leaders in the GS community in the first phase, a second larger public comment phase may not receive much participation, or may result in some proprietary debates about equipment or facility specifications based on existing conditions falling below the aspirations of these authors rather than any detailed discussion of the primary specification categories and content goals.

A separate study (Fraser and Yocco 2010) of the information and education campaign undertaken at the 2010 GSCA annual meeting in Chattanooga, TN, found that the efforts of the DISCUSS team at educating GS professionals on the process and benefits of DIGSS resulted in significant increases in awareness and in positive attitudes of GS professionals towards the need and the creation of DIGSS. This would suggest the GS field as a whole is relatively receptive to the process of creating and testing DIGSS, being carried out through the grant given to conduct DISCUSS, and that trust in the process and its outcomes has been placed by the field in those who are engaged in the process. Additionally, the GSCA Board has discussed DIGSS and has recently assigned their Technical Committee to carry out screen testing to look at the provisional specs. The first round of this happened at a meeting in Galveston, TX with over 100 GS professionals attending comparison screenings of various sorts. Wider collaboration of this type will ensure large scale buy-in of the DIGSS process and outcomes throughout the GS industry.

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Introduction

The National Science Foundation has provided funding through NSF-ISE# 0946691 to support the DISCUSS Colloquium, a seed initiative to nurture a shared Digital Immersive Giant Screen Specifications (DIGSS) for STEM learning film production at a scale and quality that is sustainable in the informal science education (ISE) community. Concurrently, planetarium/fulldome technology has been advancing rapidly alongside the emergence of a Hollywood entertainment industry specification dubbed the Digital Cinema Initiative (DCI) that ensures copyright protection and distribution security of new digital films. The DISCUSS initiative focuses on developing a set of shared, open specifications for brightness, resolution, aspect ratio, digital file transfers and other factors (DIGSS) that will facilitate a plan for the institutional segment of the GS field to "go digital." The intention of this initiative is to develop an initial set of specifications that will enable the GS industry to speak as a single voice for education outcomes and that may broker a convergence of the GS and fulldome fields to create a new global network. It is anticipated that when such specifications are adopted and published, equipment manufacturers and show producers will be better able to raise capital based on the scale of the network and their need for replacement equipment and new films.

A Colloquium held June 14th – 16th 2010 engaged 14 experts in the initial development of a proposed technical specification that was then presented to an expanded group of GS professionals through an Online Forum with the goal of achieving consensus on a final recommended DIGSS (Draft 0). Immediately following the colloquium, the fourteen experts collaborated on editing the specifications (Draft 1a), followed by a GS Open Forum: a one-month open session with a wider invitation to at least 100 more GS participants to review and make recommendations for the future for all GS professionals on the Online Forum. Institute for Learning Innovation (ILI) is serving as the evaluator for this collaboration.

This report represents findings from three studies: A pre-conference survey of the experts scheduled to attend Digital Immersive Screen Colloquium for Unified Specification Standards (DISCUSS); researcher observations of the onsite proceedings of DISCUSS; and an evaluation of the activity and project development through the online forum following the symposium.

Evaluation Purpose and Questions

The three process evaluation studies were undertaken to ensure the efficiency and effectiveness of the planning efforts achieve their desired outcomes, including the surfacing of discordant views and the achievement of consensus among all parties involved. To undertake this work, process evaluation employs a suite of evaluation techniques including surveys, interviews, informal discussion, observation of participation and analysis of correspondence and written discussion to track and monitor the efforts used to achieve the outcomes.

- Study 1: Assessment of colloquium members' expectations for the collaboration and desired outcomes for the project, and areas where participants agreed or disagreed on specification-related topics.
- Study 2: Assessment of participation and engagement during the colloquium
- Study 3: Assessment of the effectiveness of online discussion and informal "off-line" correspondence that resulted in a recommended specification for use in the GS film industry.

Study 1: Pre-colloquium Telephone Survey

Introduction

The purpose of conducting the pre-colloquium survey for DISCUSS was to identify participant's goals and objectives for the project, and uncover areas of agreement or disagreement regarding the proposed DIGSS among the professionals who planned to attend the colloquium. The results reported here were also shared with participants at the opening of the colloquium to surface areas of concern for discussion and to clarify tacit agreement in order to expedite the process.

Methods

Semi-structured telephone interviews were conducted with 12 of the 14 participants scheduled to attend the DISCUSS colloquium in Marblehead, MA from June 14th – 16th 2010. Two participants were unable to participate due to international travel and other obligations prior to the conference. The same ILI staff member conducted all interviews. Each interview lasted approximately 30 minutes. All interviews were recorded with the approval of participants. Responses to the open-ended questions were transcribed and responses grouped according to the themes that emerged naturally during the discussions. Where four or more people expressed similar opinions on a theme, and in the absence of disagreement by other participants, it was concluded that there was general consensus on a topic by experts with that specialist knowledge. Where differing opinions emerged, these were noted in the findings. Where a topic emerged in only one conversation, it was considered a point of information that will contribute to the colloquium and noted for reference.

Results

The interviews focused on five issues: The challenges facing adoption of universal specifications, the requirements the DIGSS need to meet, the impact of Hollywood 3D on the GS field, financial concerns, and participants expectations for the process. Analysis of the data revealed a number of common themes across all five issues, with some participants offering more detail on a theme based on their own disciplinary expertise.

Theme 1: Challenges facing adoption of universal specifications by institutional GS theaters

Participant responses to this issue showed clearly identifiable and distinct themes, although some of the following are challenges faced by the GS industry as a whole, not specific to development of the DIGSS. However, all of these issues potentially impact the discussion and development of specifications, particularly in their interactions. These issues ranged from a perceived inadequate supply of quality films, the levels of administrative support across the GS film industry, and the political climate surrounding film production given the dominance of IMAX Corporation's products and licensing of theaters in comparison to the other producers and distributors in the marketplace.

Many participants felt that there was an **inadequate supply of quality STEM learning digital films** available for institutions necessary to meet a growing demand from visitors to informal science learning environments. They commented on audience expectations for "high quality story" with "educational value" as necessary for ensuring continued support by museum audiences. Some participants felt the supply of 40-minute films fell below the industry needs, while others felt the scale of the industry might not support the production of more films.

Another topic to emerge was the concern related to technical challenges related to **converting existing theater systems**. These participants felt the new digital equipment did not provide the resolutions or lamp strength required to fill the screens without using more than one projector, while others held out hope that new equipment might emerge in the near future that might meet these needs.

> When does the technology catch up so we know when digital format will be available that gives us the current resolution, image quality and brightness of 1570 with 15kW lamps. If you knew when this system would be available it will affect how you plan.

Others were concerned that museum **administrators with existing theaters might not support conversion to DIGSS** due to the cost and apparent lack of inventory for new films. These participants felt that the lack of support may come from the costliness of the conversion while others thought that others might proceed based on limited local opinion rather than working as an industry for the benefit of all members seeking to share the inventory of films.

Another concern that emerged in a number of conversations was the political influence of IMAX Corporation and their willingness to work with and accept consensus specifications developed by the stakeholders working through the Giant Screen Cinema Association. On the other hand, one participant noted that NSF is a political ally to institutional giant screen theaters and the development of a shared specification. They suggested that it will be necessary for NSF to provide informal learning institutions with support to ensure a healthy future for educational giant screen films.

All participants claimed that institutional GS theaters offer a different experience and different content than conventional theaters, and that institutional theaters need take advantage of these differences as a **branding strategy**. They felt that the giant screen created a unique visitor experience that is integrally linked to an educational mission as essential brand equities. While they recognized that DIGSS would be separate from both a branding issue and any specific requirement for education content as essential to the GS brand, they still focused on education content as central to the brand. This was often described as a "type of film" that is suitable for GS screens rather than the format specifications themselves. Some felt this distinguished the entire format, even though they supported the use of these theaters as sites for traditional Hollywood films as well.

There was no consensus on scale required to ensure adoption of DIGSS. A few participants expressed the opinion that as few as a dozen theaters might sustain a shared specification that would lead others to follow, while others felt that the number of supporting theaters might need to be as large as 200. Most felt that a primary consensus outcome for the colloquium might be the size of the network required to ensure that those pursuing film production would recoup their costs.

> *"You need to have enough theaters to make producing the films economically profitable to the producers."*

Most participants acknowledged that **full dome theaters require different technical specifications** than their flat screen counterparts due to their existing geometries and some emerging trends from advances in planetarium content production. The majority of participants also felt that DIGSS should be created to ensure that GS films can be produced for both dome theaters and flat screen formats with relative ease. This convergence, however, was seen as a contentious topic that will require further discussion since dome theaters are seen as having a brand distinction that may be unique, while others thought that DIGSS could support production that was cross-platform while another participant felt that domes

have the capability to play films that giant flat screens are not able to play. Although the majority of participants felt that it would be unwise to split institutional theaters into even small groups of domes and giants screens one participant raised the point that domes have already started to create a sub-network to address the unique issues they face.

Theme 2: Unique Requirements for DIGSS

A number of the topics emerged regarding the nature of the GS experience, engaging viewers in visually compelling, immersive content stories. Participants stressed that the DIGSS must fully support what is unique and valuable about GS technology. Secondary themes addressed more practical concerns, such as the flexibility of the specifications to respond to evolving technologies and uses.

1) Immersion

Participants tended to agree that the specifications need to ensure that the immersion experience be retained as an essential component for DIGSS. Some participants felt that immersion uniquely contributes to the learning process by developing spatial understanding, while others felt the impact was more affective and motivational. In either case, it was agreed that the loss of peripheral views of the room reduced the experience below an acceptable level.

2) Image quality

Most participants described the need for DIGSS to benchmark against the current film image quality in institutional giant screen theaters—e.g., resolution, aspect ratio, brightness, and contrast—as the basis for future films. One participant mentioned that, for dome theaters, having a seamless screen is as important as these features. Participants variously described issues of image quality based resolution, pixels, aspect ratio, frame-rate and brightness.

3) Flexibility

Most participants felt that the specifications should ensure flexibility including the opportunity for GS theaters to present DMR branded films. More than one participant also mentioned the importance of alternative content in helping to make institutional giant screen theaters profitable. Specifically participants mention being able to manipulate data in real time (e.g. Science on a Sphere) or flexibility to support other uses beyond feature presentations in a digital cinema.

4) DCI Compliance

All participants felt that DCI compliance was a basic tenet of DIGSS, but noted that DCI did not address the image quality issues that are central to DIGSS, even though they broach the topic in smaller screen formats. Most justified this adherence to DCI as a strategy for ensuring incremental revenue to support GS theaters through presentation of standard Hollywood fare. A few participants noted that there will be some technical specifications in DCI that will not meet the needs of the GS professional community.

> The DCI specs are all about content, production, projection they are not about theater space or aspect ratio. They mention it but the main concern is security. Theater geometry specs are dependent on some of the technical specs.

5) Accommodation of dome theaters

Two participants specifically mentioned dome theaters as having unique qualities that may challenge the principles of DIGSS, specifically that screen size cannot be treated in the same manner when comparing half-dome theaters, flat screens and true full-dome projection surfaces.

> I would like to see an embracing of the scalable nature of domes. Domes are just as immersive if they are smaller as they are if large.

6) Film production specifications

Lastly, it was noted that DIGSS would need to address standards for the equipment used by filmmakers, that is content capture as well as rendering and production of the final film. There was concern that current digital equipment may not support the "scale up" requirements to support DIGSS unless the film is shot specifically for the new resolutions and projection equipment.

Theme 3: Profit and Loss

There were a number of concerns related to the financial costs of operating a giant screen theater, including attendance, costs of conversion, and developing new business models. Some participants commented on what they perceived as an issue of dwindling attendance reducing the potential revenue that supported GS film production to date. Some attributed declining attendance to the lack of perceived uniqueness to the format, while others thought that the brand has been diluted due to the increased role of large screen branded theaters that are appearing in traditional "multiplex" commercial theaters. Most felt this reduced income stream was having a direct impact on the potential to support DIGSS because it reduced the likelihood of administrative support for underwriting the cost of conversion. One participant noted that the IMAX Corporation's policy decisions were directly implicated in this challenge.

> Regardless of what institutions feel 3D movies such as Avatar have created a demand that audiences want to see.

> It's mainly a question of who will be providing content and under what terms. IMAX had said they would convert films to digital then they reversed that policy and now say they will create a library that is converted free of charge. IMAX is setting itself up to be a middleman between theaters and producers. Theaters need to consider if they want IMAX in the middle of every transaction or if they want to go directly to producers to get what they want.

Participants' suggested that the current business model for institutional GS theaters needs to be updated to reflect the current state of the field. They noted that emulating the Hollywood model of shorter runs and more frequently changing films was not an avenue to financial success because the industry does not have the number of available seats to support the Hollywood economic model. Some felt the long history of the format has also contributed to reduced funding for promotion and unrealistic expectations for profit.

Theme 4: Risk Factors Unrelated to DIGSS

A number of participants felt that the GS industry relied on "quality storytelling" to ensure the experience is greater than that offered by Hollywood movie theaters, but did not outline how to specify

quality. On the other hand, a few participants stated that they did not feel the need for DIGSS to address learning outcomes. In considering these comments, it was important to note that the effort to develop a shared specification cannot determine quality of a film, nor who might police such a standard given the wide range of interests that may be found in audiences and museums who commission specialized film content.

A second topic emerged based on the recent spate of new Hollywood 3D movies. These comments indicated both pro and con impacts on the potential for supporting interest in the format, if not necessarily impacting the actual development of a specification. From a positive perspective, new Hollywood 3D films were considered valuable for supporting consumer awareness. On the other hand, Hollywood 3D was perceived as having a negative impact on giant screen theaters in institutions because it might increase cost, competition, and blur the lines of entertainment and education.

> People don't view 3D as educational; they only think it's entertainment.

Theme 5: Participant Expectations

All participants felt the process outlined for the colloquium was well-conceived and useful. Most did not believe that they would arrive at consensus quickly, feeling there may be more discordance in views than emerged in the interviews. Most participants were familiar with one another, expressed respect for the technical skills that would be present at the meeting, and were quite willing to participate. Most concerns related to the program were more focused on the industry's ability to work collaboratively rather than any process issue that might limit their ability to develop a common recommendation for the field.

Study 2: Onsite Colloquium Evaluation

Introduction

The purpose of observational study of the DISCUSS colloquium was to assess the degree to which each professional engaged in the development of the specifications, in order to ensure all voices were heard, and to monitor the efficiency and effectiveness of the planning efforts to achieve desired outcomes outlined in the original proposal. As a participant observer, ILI offered background information to the team, explained the evaluation process for the entire project to all participants, and offered information to the colloquium leaders throughout the program in order to ensure that all participants' opinions were given hearing and incorporated in the deliberations. In a few instances, the observer also acted as an expert advisor on empirical research methods and best practices to ensure transparency in any research projects proposed by the participants as part of their work product.

Method

Throughout the colloquium, the evaluator acted as an observer/participant, asking questions of individuals to elicit how they were deliberating and what they individually thought of the results, but carefully avoiding any interruption in the integrity of the program. The evaluator also actively engaged participants in how they might best self-evaluate their own process, raising questions of validity or

evidence in order to assess whether the participants were representing their own personal views or if they were basing their recommendations on data that was common to the field.

The observer recorded interactions and live conversation, reviewed documentation from the event, and made note of individual interactions and behaviors as they reflected engagement in the colloquium. The approach emphasized a "three-dimensional inquiry space" which encompasses the temporal, spatial, and personal-social aspects of the experience and how those dimensions have a relationship to the knowledge gained, attitude changes, and motivations embedded in the designed curriculum. Additionally, the participant/researcher approach sought to uncover the information while revealing and minimizing the researcher's influence on the narrative.

The nature of this discussion of professional technical standards does not constitute participants as human subjects in research and therefore no Institutional Review Board review was required.

Results

Colloquium Observations and Conversations

Theme 1: Community of Practice

The participants demonstrated a collegial knowledge of one another, arriving in a timely fashion, quickly engaging in professional and personal discussions. Although the participants came from all areas of the field, their behaviors suggested that they entered the project with a great many shared goals and objectives, with few concerned about their individual professional or corporate concerns. This low level of individual goal seeking led to a highly cooperative program throughout the two days.

In a few instances, specification items were challenged by one or two participants based on their individual corporate goals. These challenges were offered honestly with the potential conflict of interest disclosed, and quite often represented as a concern that may emerge from someone not present at the colloquium. In most cases, these individual goals were given fair discussion by those with opposing views, changes were made to accommodate these concerns and the group moved quickly toward consensus. These behaviors reflected a highly functional process and coherent group working as a community.

All participants remained engaged throughout the entire program. One participant was required to leave at the end of the first day to attend to a family emergency, but this did not impact the overall tone, although everyone expressed their condolences and reflected a great compassion for one of their members.

It is important to note that the social aspects of the program contributed significantly to building trust and reciprocity. The jovial nature of the conversations increased throughout the program without impact to the earnestness with which all participants engaged in deliberating on the topics presented in the time allocated. Of particular note was the affirmations offered to those who presented new recommendations for standards and anecdotal support for the recommendations based on personal experience in other venues.

The researchers concluded that the participants in the colloquium reflected both the concerns of a larger community, and a professional community that depends on one another to achieve shared goals and objectives. The trust held within the group resulted in a great deal of consensus on the main topics

within the time allocated for the colloquium and suggested that the process was both efficient and effective.

Theme 2: Organization of the Colloquium

The program structure (Appendix A) was well articulated, with adequate time allowed for most discussions. The breakout groups during the second day appeared rushed which created a number of challenges for participants. Although the collegial nature led participants to negotiate assumptions on which to build a tentative model, most participants expressed some discomfort with the overall results during the weekend, in part, due to the perceived speed with which decisions were made. Many noted that the results had some degree of face validity, but without empirical results from further study, these models merely reflected the current state of the field and strongly held beliefs that were common across the majority of the participants. In order to address these concerns the team has identified those specifications in need of further empirical evidence as "provisional" in the specifications.

Presentations were notably fast-paced and appeared to reflect a high level of knowledge about each technical aspect offered for discussion. However, the active participation by many members of the group during the presentation, clarifications requested and deference shown to the presenters' professional opinions indicated that there was deep understanding and consensus about the topics covered. The observers noted that participants were very attentive throughout the presentation, with only an occasional lapse in attention by one or two members at any time. Given the aggressive schedule and number of presentations, the engagement indicated a high level of concern for the topics in general.

Participants in the colloquium appeared to understand the wiki as an organizational tool, as well as the process outlined for engaging with the wiki following the colloquium. However, given the low level of subsequent online participation, it appears that the wiki could have received both more attention during the colloquium (not all participants had access during the meetings) and greater emphasis as an important process and evaluation tool for the project as a whole.

Theme 3: Content Decisions, Agreements and Discord

Aspect ratio and resolution were generally understood by everyone present to be the core specification issue that needed to be addressed at the colloquium. Participants felt that the history of change, variation across facilities throughout the world, and number of theaters required to ensure adoption of DIGSS might impose limits rather than resolving these issues from a purely technical viewpoint. The topics that generated the most debate seemed to focus more on what the upper limits were for resolution based on projectors, and the reconciliation of that resolution with the existing screen shapes present in the GS community. Some concern was raised about how setting those limits might preclude participation by some current members in the designation GS, and that this specification might undermine the business case. Some participants commented that the degree to which these limits were considered or perceived to be arbitrary may represent a risk facing the implementation of the specifications with a larger community.

During discussion, a few points were raised that may have impact on the overall adoption of DIGSS and may be more related to political discussions than any specific "technical" issue related to the development of a common standard that can be used to describe a quality standard. These include:

- Use of specific Motion Picture Association of America film-rating designations for films considered to meet GS specifications. One participant suggested that G or PG would be the assumed rating for a qualified DIGSS compliant film. This topic was not debated;
- IMERSA vs GSCA as the sponsoring organization for DIGSS. While this topic received only minor focus, with GSCA recognized as a grant recipient, the project leadership left open the possibility of developing a strategy for integrating with the IMERSA leadership;
- Incorporation flexibility to allow "plug and play" films or incorporation of live dataset feeds that can be customized for the performance, or integration of live programming with digital assets that can be manipulated to coincide with a live performer, or programs designed to be reorganized for custom presentations as is current practice in some dome theater technologies.
- The colloquium made an assumption that the current 35 – 40 minute learning film is the a priori standard, without discussion of how dome theater scripting or use of live programming can be addressed within the GS format;
- There was also agreement among the attendees that the current narrative film standard using current production budgets are the basis for all economic considerations and specification goals, especially as it relates to scale required for viable business case to support a unique specification and industry standard. This assumption may not necessarily be necessary and these assumptions should be addressed in any report.

In general, there was consensus on many of the technical details for production and copyright protection through delivery of digital assets. Of greater concern was the emerging question about whether this group was hampering itself by thinking of current technical limits of digital projectors, as 4K and how an "interim fix" might help move digital media forward as new projectors with high resolution emerge.

At one point in the discussion, a participant representing theater operators noted that some of the DCI and DIGSS specifications were so technical that they exceeded operator's comprehension. It was noted with concern that this lack of knowledge may require some remedial explanation to ensure that the reason for the specification was clear to industry members, and why current technologies may not produce the desired results for these theater operators. This concern may require additional strategies to help operators with an overview or purpose description for the main concepts in order to ensure they understand the principle and concept in lay-terms.

Lastly, a conversation surfaced around whether fulldome theaters would be considered as part of the program. This challenge was not fully addressed nor was consensus reached. It was generally considered that the fulldome experience would benefit from the specifications, but the equipment and performance, module based scripted programs would not necessarily conform. Based on the lack of consensus, the group concluded that a sub-committee should be formed to address integration in order to avoid further separation for these two types of giant screen experiences that have traditionally focused on different science learning topics, although some evidence did confirm that participants were aware of programs being created for projection in GS and Fulldome formats.

Study 3: Email and Online Forum Evaluation

Introduction

To elicit the most information surrounding the post-colloquium discussion, an ILI evaluator read all postings on the project wiki, noting both who was participating and the nature of the discussion.

Unfortunately, there was little participation on the wiki, even when participants were prompted through challenges introduced by the research team. This may be due, in part, to the discretionary nature of participation, travel and work schedules by the participants, and participants' caution in challenging online claims without support. Additional post-colloquium data were provided in the form of email communication between the project PIs and participant in the DISCUSS proceedings and forum.

Data Analysis

The email exchanges between subset participants were provided to the evaluation team by the project leadership. These emails, along with the Wiki discussion, were considered the data concourse for analysis. These discussions were assessed for content, tone and degree of engagement. The coding scheme was based on the rubric that emerged in Study 1.

Results

Email topics

The emails comprised a total of 41 unique strands between the project team at White Oak Institute and various participants of DISCUSS after the colloquium. A review of themes found in the emails suggests that over 60 percent (64%) of the email correspondence taking place between the PIs and those involved in DISCUSS or the development of DIGSS were on topics related to logistics, editing, or dissemination of DIGSS. Twelve percent of the emails reviewed were directly related to the development of the specifications to be included in DIGSS. This would suggest that a majority of correspondence related to the development of DIGSS took place either in person or over the phone, or that the specifications were developed by the individual experts in each area with little discussion amongst the group on the content of the specifications.

The emails were grouped into seven topics:

Topic 1: Process and logistics

Thirteen (32%) email strands were categorized as being topics related to process and logistics. This included emails from the PIs to others on the topic of a pre-colloquium study that was conducted, emails from the PIs to colloquium participants reminding them of the tasks necessary to be completed prior to participants receiving payment, updates to NSF program officers on the process, and reminders from the PIs to participants to utilize the wiki for discussion. Responses, where included, were cordial and addressed the topic of the initial email.

Topic 2: Future GS business model

Three (7%) email strands were started by one of the PIs and directed to others working on DISCUSS/DIGSS, asking for assistance with developing the future GS business model. This included requests for editing the business model chapter included in the proceedings, as well as requests for more information. Each of these emails was responded to cordially, and with detailed information that had been requested. This topic included some discussion and analysis between the PI and DICSUSS participants about data acquired from the pre-colloquium study conducted by PIs.

Topic 3: Editing proceedings drafts and specifications

Seven (17%) email strands were requests from the PIs to the DISCUSS participants to review and edit the colloquium proceedings and the specifications emerging from the proceedings. This included general edits from all participants as well as specific requests for participants to review the areas they had helped develop the specifications for. Addressees were also informed they would be able to find more information available on the wiki. The final email on this topic included the most recent draft of the proceedings, and requested feedback for inclusion in the final document by December 7, 2010. There were no reply emails from any participants.

Topic 4: Clarifications

Four (10%) email strands were categorized as being clarifications or requests for clarifications on DISCUSS/DIGSS related topics. The project PI sent an email to DISCUSS participants clarifying what DIGSS is and is not attempting to do. The impetus for this email, as stated by the PI in the email, was expressed confusion by some in the industry over the purpose of DIGSS and if its purpose was to limit who could belong to the GSCA by requiring all GSCA members to be DIGSS compliant. The PI stated this is not a goal of DIGSS; rather the hope is for GSCA will support DIGSS and encourage compliance. Another strand was from the PIs to the editor of the LF Examiner disputing an article in the journal that stated the GSCA had concluded what specifications were required of theaters to be considered GS. The editor replied that the article was in reference to an upcoming advertising campaign and that the GSCA had set forth specifications theaters would have to meet to utilize the "Bigger/Bolder/Better" advertising campaign.

A separate strand initiated by a colloquium participant asked for clarification on what was being referred to as the "reference seat" in the proceedings. Another DISCUSS participant responded with citations from the literature supporting the definition and location of the reference seat. The final email strand categorized under clarifications was initiated by a supplier who had received requests from potential clients as to the possibility of creating a DIGSS compliant system. The supplier stated they believed they were able to produce DIGSS compliant systems and inquired as to the reason WOI was spearheading the effort. The PI responded, including reasons for undertaking the effort to develop DIGSS, and asked the supplier to participate in the wiki discussion.

Topic 5: Research and evaluation

Three (7%) email strands were categorized as falling under research and evaluation. Two of these strands were attempts to coordinate screen and resolution tests to inform DIGSS. These emails informed DISCUSS participants of the need for research on specification and that ILI would be submitting for funding of a series of studies that would inform knowledge of the learning that takes place from GS films. The third strand involved communication between ILI and WOI on the creation of the instrument used to measure the impact of the DIGSS information campaign at the annual GSCA conference.

Topic 6: Dissemination

Six (15%) email strands were between the PI and various DISCUSS participants on the topic of disseminating the plan to develop DIGSS. These emails reflected attempts to spread the word about DIGSS to the GSCA community through their conference, through press releases to be distributed through IPS and IMERSA. It was unclear if the PI had received feedback from IPS on their willingness to distribute DIGSS related information over their listserv based on the communications provided for the

study, however the PI reports that IPS posted this information on their website and disseminated it to members more broadly. One DISCUSS participant who was attending the IPS conference did agree to present and distribute information on DIGSS at the conference in Egypt. Administrators at ASTC were contacted and agreed to distribute information on DIGSS to science center professionals. GSCA related dissemination included formal and informal discussions planned around DIGSS, as well as having information available for those attending the conference.

Topic 7: Specifications

Five (12%) email strands were about the development of the specifications. In one strand, an outside vendor contacted one of the PIs to note that the current draft of the specifications contained audio specifications unsupported by SMPTE. The vendor offered assistance in the development of the audio specifications. The PI replied that the audio specifications were, at that point, relatively underdeveloped and that more information would be shared as it emerged. A separate email was a diagram mapping out image quality against seat position in flat giant-screen theaters. A third strand of emails were in response to an inquiry sent by the lead researcher from ILI asking DISCUSS participants to verify the assertion that no empirical evidence exists in the literature documenting a relationship between theater geometry and learning outcomes in giant-screen theaters. The response did not refute this assertion.

Wiki Discussion Threads

Posts on the wiki were downloaded and distributed to the researchers as of December 17, 2010. The wiki posts reflected 16 unique strands of conversation (not including an introduction strand), six (38%) of which consisted of an initial post by a participant with no follow up responses.

Overall the wiki posts seem to have served as a more substantive forum for commentary than the email strands. However it is notable that there was very little interaction on the wiki: only 16 unique strands were started, six of which consisted only of an initial post with no replies. Additionally, there were themes that had originally started over email but were moved to the wiki, as well as topics that were posted to the wiki but had been addressed via email.

Examining the communication that took place over both email and the wiki suggests that most of the discussion of the development of the specifications took place either over the phone, in person at the colloquium, or independently among experts in each field.

Topic 1: Specifications

Ten (63%) discussion threads on the wiki were categorized under the broad topic of specifications. Three (33%) of these threads consisted only of the original post, with no follow up replies from participants.

The thread with the greatest response from participants started with a post questioning the logic of tying DIGSS to the DCI specifications. The initial post suggested DCI does not meet the needs of GS theaters, would be a "maintenance nightmare," and are mainly focused on security issues. Responses from three participants, including one of the PIs, suggested that DCI makes sense because some suppliers will want that level of security, and that DCI had time and finances to test their specifications that DIGSS does not have. Additionally, it was noted that DCI can be modified or amended to meet the needs of the GS community. The thread unfolded respectfully, with all parties stating their opinion and attempting to sway the original poster to see the logic underlying the use of DCI as a model for DIGSS.

One thread focused on the horizon parameter in dome theaters, with a response stating that the acceptable range of dome tilt angles would define this. A separate thread questioned the benefits of the surface variance specification when considering cost. Replies to this thread suggested this specification was based on IMAX current standards and questioned where the information on cost was being generated. Another thread began with a suggestion that system providers be required to guarantee the "up-time" or reliability of a system, suggesting this be at 99.5%. The reply to this post was from another participant who stated this would be a good idea.

A separate thread under this topic was a suggestion to lower the minimum time for GS films to 15 minutes. The original poster suggested many shorter films are being released at this time. A PI replied that this is a good idea as well as extending the maximum time to 60 minutes, as there are many longer films being released as well. A separate thread suggested the need for DIGSS to be as inclusive rather than exclusive of institutional theaters. The initial post suggested including theaters that may not technically qualify as GS would be a good policy. A PI replied that DIGSS should strive to set the bar as high as possible for theaters who are capable of meeting the demanding specification, while also having sub-sets of standards that would apply to situations in which theaters were unable to meet the most demanding specifications. The PI reiterated that the purpose of DIGSS is to be inclusive.

A separate participant on the wiki posted the topic of audio specifications, which had been echoed in an email exchange between an outside participant and the PI. The participant noted they were unable to find audio standards in the specifications. A PI replied that audio specifications were still open and that to that point DIGSS had focused on optical specifications. The PI noted that while playback audio and distribution encoding were being developed for DIGSS, they were purposely avoiding the creation of recording specifications that might constrain producers.

Topic 2: Research

Five (31%) discussion threads on the wiki were categorized under the broad topic of specifications. Two (40%) of these threads consisted only of the original post, with no follow up replies from participants.

The most popular post under this topic, with three replies (including one from the original poster) was a list of the deficiencies in research on learning from GS film, as well as suggestions for studies to remedy these. The replies suggested that there might be some literature informing a few of the deficiencies, as well as some data collected from the DCI project that might inform the technical aspects.

The second most popular post under this topic, with two replies was the need for research using different specifications across a broad audience. The initial post suggested the study population and sample size needed. The two replies agreed with the need for this type of study to inform DIGSS, as well as the suggestion to test frame rate along with color and resolution.

A separate thread under this topic suggested that aspect ratio be tested by differing the aspect ratio for one minute of a six minute film. A PI replied to this suggestion stating that testing is desirable, the aspect ratio had been "voted" by the experts and that Domes would require at least a 4:3.

Topic 3: Outsiders observation

One wiki participant, who was not a participant in the DISCUSS meeting, commented on their perceptions of the process of developing DIGSS. This participant stated they did not see enough effort to address audience outcomes and impacts of films in the DISCUSS process and how to differentiate museum films from conventional films. There was no reply to this post.

Conclusions

The GS industry is at a crossroads, faced with the opportunity to establish specifications that will enable the industry to grow based on the unique value and impact of the technology. The DISCUSS colloquium and surrounding evaluation were designed to identify and elaborate on the key issues and challenges this opportunity poses. The colloquium represents the start of the conversation, the first draft of the DIGSS the beginning of what is hoped to be an iterative process engaging the larger institutional GS field. Some of the understandings gained to date are promising; others point to the need for more targeted work and discussion, and better systems for engaging the field.

There appears to be a great deal of consensus regarding both challenges and opportunities. Immersion is seen as key to the learning outcomes of giant screen films (although it was agreed that learning outcomes, too, need to be specified) and participants in this phase of the project agree that additional focus must be given to branding institutional STEM-learning films as value-added.

The greatest challenge threatening the future of institutional giant screen theaters is a "chicken and egg" issue: the need for a large enough library of quality films to support conversion to digital to offset the cost of conversion and the lack of administrative support for the cost required to maintain institutional GS theaters. All participants agree that GS profit is declining and a new business model is required to meet the needs of the field. IMAX Corporation's closed formats may also represent a critical challenge to the development of a sustainable network of institutional STEM learning GS theaters at a scale that is cost effective.

In general, there was consensus on many of the technical details for production and copyright protection through delivery of digital assets. Some areas of disagreement among stakeholders include how to address the different requirements of domes and flat screen theaters to move forward in unison and the need for standards on the "film capture" production formats. The dome experience would, it is generally believed, benefit from the specifications, but certain format features and requirements would not necessarily conform. Given the lack of consensus, it will be important to specifically address integration in order to avoid further separation for these two types of giant screen experiences that have traditionally focused on different science learning topics.

In terms of process, there was little evidence of larger conversation or discussion taking place over email or on the wiki. The majority of email exchanges related to the logistics and process of developing DIGSS rather than the content of the specifications, and there is little to suggest that the specification document was created as an iterative process as planned. Instead, the process was linear, providing participants with the opportunity to comment rather than invest in a collaborative process. The use of an online platform has great potential to broaden and engage the field in the conversation; the system for doing so should be evaluated and revised going forward.

Appendix A: Colloquium Agenda

Agenda: DISCUSS Colloquium

NSF-ISE # 0946691, John Jacobsen, PI

Note: The furthest distance between meeting venues is a seven minute walk, though allow ten minutes or more for conversations en route. Car transportation is available during inclement weather or on request in advance.

Monday, June 14, 2010

Start	Duration			
1:00 pm		Check-in available at the Harbor Light Inn (#2) and the Boston Yacht Club (#4)		
4:00		Welcome and Registration Packets	All	1a. Marblehead Historical Society
	5 min.	Welcome and Opening Remarks	Welch	
	10 min	Introductions and Acknowledgements	Stahl	
	5 min	GSCA Role; Marketing Recommendations	Mensforth	
4:30		Briefings:		
	20 min	1a: Colloquium Purpose and Prior Knowledge Review	Jacobsen	
	10 min	1b: Evaluation Process and Front-end Findings	Fraser	
	20 min	1c: Digital Cinema Initiative: A Case Study	Ordway	
5:30	50 min	Questions and Group Response and Interaction	All	
6:20	5 min	Marblehead Map and Logistics	Robison	

Monday, June 14, 2010 (cont.)

Start	Duration			
6:30 pm		Break (Hotel check-in if not done earlier)	All	1b. Lee Mansion open for special tours
7:00		Meet for cocktails and beverages(Cash Bar)	Optional	2. Harbor Light Inn
7:45		Walk to The Landing Restaurant		
8:00		Group Dinner (Cash bar, dessert or coffee)	All	3. The Landing Restaurant

Tuesday, June 15, 2010

		B & B Breakfast		At your Inn/Club
8:45 am		Room Opens (coffee)		4a. Boston Yacht Club: Main Lounge
9:00		Briefings:		
	12 min	2a: Research on Learning in Immersive Environments	Fraser	
	7 min	2b: Theater Geometry	Becker	
	16 min	2c: Digital Recording (Capture) Technologies and Analog Library Conversions	Reyna	
9:45	45 min	Questions and Group Response and Interaction	All	
10:30	15 min	Blackberry Break – Coffee and biscotti		
10:45		Briefings:		
	12 min	3a: Digital Distribution Technologies and Security Recommendations	Oran	
	15 min	3b: Digital Playback (Projection and Audio) Technologies; Fulldome and Dome Master	Lantz	
11:15	45 min	Questions and Group Response and Interaction	All	

Tuesday, June 15, 2010 (cont.)

Start	Duration			
12:00		Briefings:		
	9 min	5a: Data & Trends: GS and Fulldome Inventories	Hyder	
	16 min	5b: Current and Potential Future Business Models	Stahl / Peterson	
12:30	45 min	Questions and Group Response and Interaction	All	
1:15		Lunch Break and Walk to Marblehead Arts Association		4b. Buffet at BYC Downstairs Lounge
2:00	3-90 min sessions	Break-out Teams per assignment: Edit proposed standards and frame Phase 2 trial tests – 1st half		5. Marblehead Arts Association
		1. Theater geometry/Playback (JK, JF, JWJ, DC)	Becker/Lantz	
		2. Recording/Distribution (DD, GM, WO, VK)	Reyna/Oran	
		3. Business model (JH, DK, TM, SW, MK)	Stahl/Peterson	
3:30		Break		
3:45		Break-outs – 2nd half – switch to your choice		
5:15 +/-		Adjourn		
6:30		Garden Reception (complimentary open bar and hearty appetizers, significant others welcome)	All	6. JWJ/JS's Residence, Hanover Court entrance
Later		Open Dinner if you wish	On your own	See list of restaurants

Wednesday, June 15, 2010

		B & B Breakfast		
8:45		Room opens (coffee)		4. Boston Yacht Club: Main Lounge
9:00	10 min	Business Model Team Recommendations	Team Captains	
9:10	50 min	Questions and Group Response and Interaction	All	
10:00	10 min	Recording/Distribution Team Recommendations	Team Captains	
10:10	50 min	Questions and Group Response and Interaction	All	
11:00	15 min	Break – coffee and biscotti	All	
11:15	10 min	Theater Geometry/Playback Team Recommendations	Team Captains	
11:25	50 min	Questions and Group Response and Interaction	All	
12:30	75 min	Revise the standards and questions using Online Forum	All	
1:00	15 min	Working lunch served– sandwich boxes	All	
1:15	45 min	Revise the standards and questions using Online Forum	All	
2:00	40 min	Summarize next steps, research agenda and process	All	
2:40	10 min	Evaluation Process	Fraser	
2:50	5 min	Conclusions and Thanks	Jacobsen/Stahl	
2:55	5 min	Closing Remarks	Welch	
3:00	5 min	**Adjourn formal sessions**		
3:30		Afternoon tea in the garden, for those remaining	All	6. JWJ/JS Residence, Hanover Court entrance

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