

1. Statement of Need.

Tens of millions of people rely wholly or in-part on libraries to provide access to the internet (FCC, 2016), (Horrigan & Duggan, 2015), (Inklebarger, 2015). In two-thirds of communities, libraries are the only source of no-fee internet access but one must travel to the library building to take advantage of this essential service (Hong, 2016). Expanding the reach of the library's internet signal outside of the library building (and beyond library hours) to public spaces (e.g. subsidized housing, schools, clinics, parks, shelters, senior centers, and museums) would vastly expand the benefits the library brings to the community. This project, led by Dr. Kristen Rebmann of San Jose State University's School of Information (SJSU-iSchool) and with key collaborators Don Means of Gigabit Libraries Network (GLN), John Windhausen of the School, Health, & Libraries Broadband Coalition (SHLBC), Angela Siefer of the National Digital Inclusion Alliance (NDIA), and Joe Hillis of the Information Technology Disaster Resource Center (ITDRC), requests \$249,998 to explore dramatically expanding digital access/inclusion and disaster preparedness by using TV Whitespace (TVWS), an emerging, low-cost wireless technology. We have two primary audiences: underserved populations and library practitioners. Our project's primary goal is to address challenges in access and inclusion by raising awareness of TVWS networking in the library community and supporting practitioners' abilities to use TVWS to expand internet access to underserved populations. Our secondary goal is to create a context where libraries may lead in community disaster planning and response using TVWS as a resilient information infrastructure during times of crisis. In response to IMLS reviewer feedback, access and inclusion are our highest priority.

TVWS is an extremely valuable license-exempt radio spectrum located in the bands for traditional TV broadcast (Knapp, 2011). The Federal Communications Commission (FCC) recently made a portion of these TVWS bands of spectrum available for open, shared public use, similar to WiFi. Access to TVWS is and shall remain free. Yet, unlike WiFi, with a reach measured in 10s of meters, the range of TVWS is measured in 100s or even 1000s of meters (Chavez et al, 2015), improving the coverage and inclusion of patrons in accessing library programs, services and the broader internet. TVWS in conjunction with WiFi allows libraries to extend their networks of internet access strategically across their communities. An equally important benefit of using TVWS (yet virtually unexplored) is the potential for improved disaster response as TVWS hotspots can provide essential digital access in times of crisis. With these developments in mind, our project serves both practitioners (to raise awareness and professional competency in new networking technologies) and the public through the potential of TVWS networks to improve access and inclusion for all community members.

This project will build upon the efforts of a 2015 grant to Gigabit Libraries Network (GLN, <http://www.gigilibraries.net/>) and the Chief Officers of State Library Agencies (COSLA) from the Knight Foundation (<http://knightfoundation.org/grants/201450242/>). The goal of this grant was to create basic orientation and analysis tools to help libraries and their partners understand and evaluate TVWS capabilities as a potential new library communications tool. The Knight grant resulted in libraries beginning to experiment with TVWS technology to enable the placement of new remote library access points in public spaces like parks, playgrounds, shelters, and community centers. This project adds professional development, refinement in TVWS implementation, and the dimension of crisis planning to the previously (Knight) funded efforts.

2. Impact.

Analyses of a recent digital inclusion surveys suggest that technology upgrades can have significant impact on the ability of libraries to expand programs and services (Koerber, 2016). Our project will expand and improve access to digital content and services through the adoption of new networking technologies and infrastructure

(TVWS frequencies) recently released by the Federal Communications Commission (FCC). We hope to articulate a national model that may be applied to users across the United States. **Our primary goal is to improve access and inclusion** by leveraging networking technologies in the public domain that would expand internet access to underserved populations. The FCC defines Community Anchor Institutions (CAIs) “as schools, libraries, hospitals and other medical providers, public safety entities, institutions of higher education, and community support organizations that facilitate greater use of broadband by vulnerable populations, including low-income, the unemployed, and the aged.” There are several potential benefits of library-led collaborations to deploy TVWS networks in Community Anchor Institutions (CAIs) and other public spaces. K-12 schools can close the “homework gap” by using TVWS to provide wireless internet service directly to access points (APs) in student homes that are otherwise lacking connections. Health providers can create direct connections to the homes of patients for remote patient monitoring. Finally, the portability of access points allows libraries to extend their reach by providing wireless connections to cultural or civic events like fairs, markets or concerts. Supporting documents 3 and 6-9 link to and describe several implementations.

Our secondary goal is to create a context where libraries may introduce a new resource into community disaster planning and response. Libraries can demonstrate innovation and leadership by partnering with other community organizations to enhance resilience in access. TVWS-enabled remote access points in daily use around communities are ideally situated for rapid redeployment to damaged areas as pop-up hotspots to provide essential communication and information resources in times of crisis.

IMLS reviewer feedback requested we elaborate on how a TVWS network operates (see Figure 1 and

Supporting Doc. #10 for a larger version).

Libraries first identify their current fiber-based connection to the internet and several community spaces where internet access is needed. Next, the library works with a TVWS equipment supplier to install a TVWS base station that is integrated with their wired connection to the internet. Through this step, the library gains access to public TVWS frequencies by which they can broadcast and receive

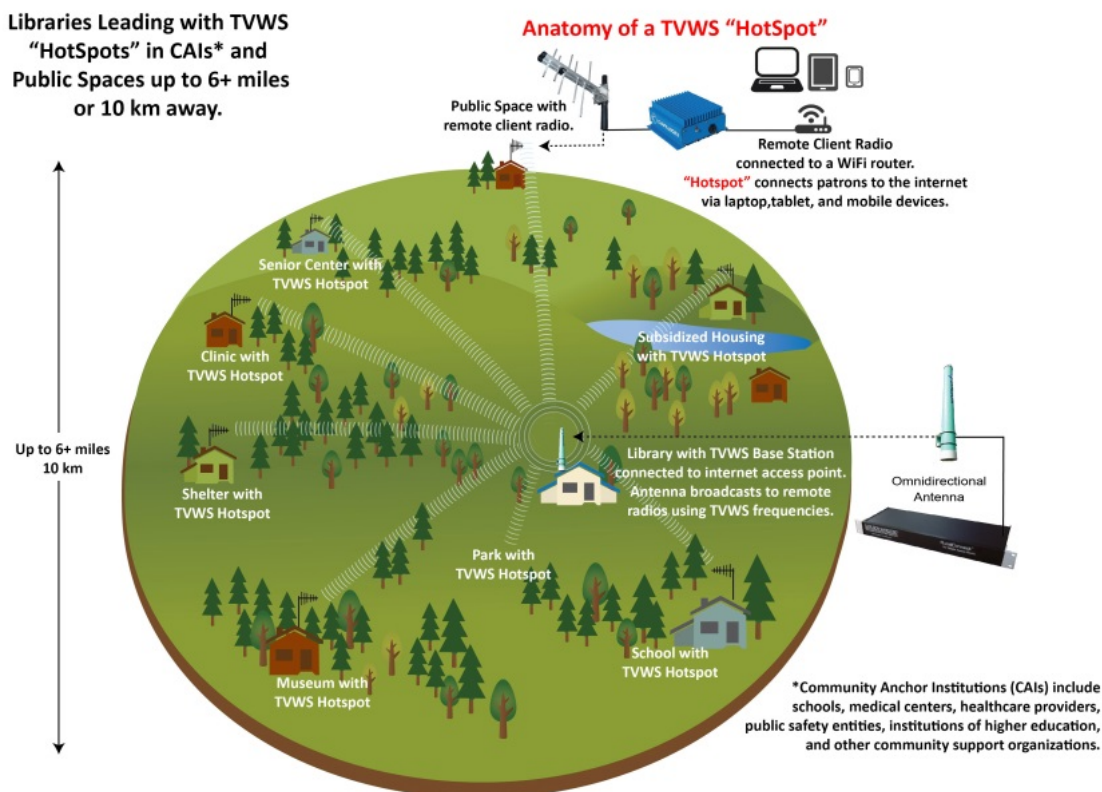


Figure 1. Libraries Leading with TVWS. Modified Infographic from TVWS Equipment Manufacturer and Collaborator Carlson Wireless Technologies

internet connections from paired TVWS-enabled remote hotspots. Finally, the library places TVWS-enabled remote hotspots in (previously identified) community-based spaces where internet access is needed by

underserved populations. The TVWS-enabled remote hotspots now provide WiFi connections to patrons in community spaces previously out of the library's WiFi-enabled reach.

IMLS reviewer feedback also requested a discussion of the benefits of TVWS vs. other networking technologies. Access to TVWS frequencies is **free and requires no subscription fees** other than the initial equipment investment (Chavez et al, 2015). This model is in marked contrast to mobile or cell-based services for internet access that require not only equipment investment but monthly subscription access as well. TVWS networking has great interoperability in that it **integrates seamlessly** with existing library internet connections and WiFi implementations. It leverages WiFi in such a way that libraries can now install **hotspots up to 6+ miles (10km)** away. Whereas WiFi networks can only reach patrons in the immediate vicinity of the library, TVWS implementations can support library hotspots in places like: **subsidized housing (as noted by IMLS reviewers), schools, clinics, parks, shelters, senior centers, and museums.** Furthermore, unlike technologies that require line-of-sight between units, **TVWS signals possess unique non-line-of-sight characteristics** enabling them to travel through obstructions like buildings, trees, and even over small hills. TVWS remote **hotspots also can be easily (and strategically) moved** to support occasional community needs or in response to crisis situations. TVWS installations have proven to be **very stable** at previously funded pilot sites in Mississippi, Colorado, Kansas, and Delaware. *"The technology was easy to set up; works extremely well and requires little support. It just runs day in and day out."* -John Gavan of Delta County, CO Public Library

As mentioned previously, this project builds upon previous efforts (funded by the Knight Foundation). In that project, measures of patron internet usage were found to increase via a TVWS implementation (~20%). We would like to spur similar improvements in community access. Our target for increases in library network usage is (therefore) +20%. This measure will indicate that meaningful increases in access and information use are occurring.

Each phase has its own Key Performance Indicators (KPIs) and associated deliverables. Our project provides tangible value to the field of library & information science by contributing to the core mission of access/inclusion and by sharing knowledge of TVWS with the field via professional development and (what will be) first publications on the topic. Among our deliverables, tangible products include meaningful increases in digital usage among underserved populations and the creation of multimodal curricular materials, vignettes/case studies, and models for TVWS adoption nationally. Please see the project design and activities for details below. Artifacts will be made available in perpetuity through the archiving of course materials, publication of print materials, and communication of findings at conferences. We intend to use this project to further develop our agenda of increasing access and inclusion based upon early and evidence-based adoption of new networking technologies like TVWS. The project benefits greatly from previous efforts in implementing TVWS networks and plans to take what we learn from this project to create more refined models for implementation in contexts of basic and crisis-contingent access.

3. Project Design.

The project activities play out across 4 phases over 2 years. All activity phases will benefit from the content created from the efforts of a 2015 grant to Gigabit Libraries Network (GLN, <http://www.giglibraries.net/>) and the Chief Officers of State Library Agencies (COSLA) from the Knight Foundation (<http://knightfoundation.org/grants/201450242/>). Through this funding, GLN produced several TVWS-specific informational resources including (1) a 2-minute TVWS Project Overview Video (<https://www.youtube.com/watch?v=SofOEsh3BNU>), (2) an interactive Prospective Coverage Map

(<http://wsgmaps.droppages.com/>) using 17,000 library coordinates from an IMLS database to indicate where remote library access points might be installed, (3) seven archived webinars designed to introduce TVWS technology, (4) presentations at three conferences, and (4) cases (see supporting documents #6-9 for details regarding each case) and findings from experiments in which TVWS technology was placed in new remote library access points such as parks, playgrounds, shelters, and community centers. These resources will serve to inform new curricula for a new online, open course to be built by the iSchool at San Jose State University (Phase 1). Practices and scenarios for TVWS implementation will inform strategies for technology investment and implementation (Phase 2). Phases 3 and 4 will benefit from what was learned through the Knight Grant by enhancing the team's ability to collect relevant information from subaward participants and evaluate their plans and forms of collaboration. The following sections describe management details requested in IMLS reviewer feedback.

Strategic Direction and Activities for Phase 1: Professional Development. Phase 1 involves Kristen Rebmann (SJSU-iSchool), Don Means (GLN), John Windhausen (SHLB), Angela Siefer (NDIA), and Joe Hillis (ITDRC) working together to develop curricular content for professional development by creating an open, online course (hosted by SJSU-iSchool) for public librarians that increases the level of awareness of TVWS technology and scenarios for its application and collaboration with other community information/support centers. **This initial phase of the project responds to the IMLS National Digital Platform's call for continuous learning and cultivating a digital library workforce.**

"Advances in technology are requiring continuous archives, libraries, and museums training in digital competencies and skills for archives, libraries, and museum professionals." (IMLS National Digital Platform, 2015)

Phase 1 Roles and Commitments. All project partners are key players in this phase of the grant. The iSchool is committed to leading the design, implementation, and delivery of the course. Kristen Rebmann will work as the TVWS course designer, content author and instructor during grant year 1 and on course maintenance during year 2. Don Means will work as course content author/instructor and support the development of multimodal course materials during year 1 and on course maintenance during year 2. John Windhausen, Angela Siefer, and Joe Hillis will serve as TVWS course content advisors, guest instructors, and peer evaluators during grant year 1. All collaborators will participate in publicizing the course widely.

Phase 1 Key Performance Indicators (KPIs)

- 1.1. TVWS curricula that prepare librarians to understand scenarios for library implementation of TVWS and the potential for library collaboration with community anchor institutions to advance crisis planning.
- 1.2. Online, open course designed and implemented.
- 1.3. List of public library systems who may apply for TVWS investment and implementation subawards (for focused outreach).

Strategic Direction and Activities for Phase 2: Technology Investment and Implementation. Phase 2 initiates TVWS investment and implementation via (5) public library system subawards during grant year 1. These subawards will support equipment purchases and library-led TVWS implementations in places like: subsidized housing, schools, clinics, parks, shelters, senior centers, and museums. TVWS-enabled check-out hotspots are another example of an emerging technology that subaward recipients might explore. In response to IMLS reviewer feedback please find new details regarding subaward selection criteria discussed below.

Phase 2 Roles and Commitments. Kristen Rebmann (SJSU-iSchool), Don Means (GLN), John Windhausen (SHLB), Angela Siefer (NDIA), and Joe Hillis (ITDRC) will jointly author program guidelines and develop specific criteria for subaward pilot site selection. These partners will likewise conduct outreach to raise awareness of the program (which will infuse 5 libraries with \$15,000 in funds to support TVWS implementations) and evaluate all resulting proposals. **General criteria for (subaward) pilot site selection:** The project collaborative will seek to fund libraries who propose comprehensive plans for TVWS/WiFi implementations that (1) have the greatest potential to improve access/inclusion and (2) include multi-organizational collaboration as a component of community crisis/disaster preparation. All project partners will jointly author subaward program guidelines and selection criteria, engage in applicant recruitment/outreach, and review subaward proposals. Kristen Rebmann and Don Means will distribute subaward funds and coordinate implementation efforts with subaward recipients. Baseline usage data will also be collected from sites prior to installations.

Phase 2 Key Performance Indicators (KPIs)

- 2.1. Subaward program guidelines authored.
- 2.2. Subaward application selection criteria authored. **Criteria for selection to privilege: applicant plans for TVWS that improve digital access and inclusion, applicants with competencies relating to TVWS (gained through participation in phase 1 – professional development), applicant plans that place libraries as leaders in crisis planning, and applicant plans for publicizing the TVWS hotspots to community members.**
- 2.3. Pool of subaward program applicants identified.
- 2.4. Five public library systems selected for subawards.
- 2.5. Baseline data for library network usage at subaward sites.
- 2.6. Subaward funds distributed.
- 2.7. Five TVWS-enabled networks implemented.

Strategic Direction and Activities Phase 3: Reporting. Phase 3 collects information from subaward recipients in the form of usage statistics, reports, planning documents, and surveys. In meeting grant reporting guidelines, each recipient will develop mission specific uses for the TVWS equipment while also collaborating to develop a common backup communications plan where libraries and other community anchor institutions may act in coordination as responders to various crisis/disaster scenarios.

Phase 3 Roles and Commitments. Phase 3 collects information from subaward recipients in the form of quantitative data (usage statistics before & after TVWS installations) and qualitative data (reports, planning documents, and surveys). **Please see our digital stewardship form for more details on data management.** Kristen Rebmann (iSchool) and Don Means (GLN) will work collaboratively to author guidelines libraries must follow in reporting on the process of implementing their subawards. Guidelines will outline the inclusion of planning documents for each subaward site that address mission-specific and disaster response uses of the technology. Survey and data collection protocols will be designed with the goal of capturing processes of implementation, CAI organization of collaboration, and impact of TVWS implementations. Kristen Rebmann and Don Means will travel to/observe TVWS implementation sites, survey subaward recipients, and collect subaward recipient reporting documents during Grant year 2. Surveys will be conducted electronically using Qualtrics software.

Phase 3 Key Performance Indicators (KPIs)

- 3.1. Measurable increases in library network usage at subaward sites (target: +20%).
- 3.2. Guidelines for reporting documents authored and sent to subaward recipients.

- 3.3. Survey and data collection protocols sent to SJSU Institutional Review Board (IRB) for approval.
- 3.4. (5) Visits to subaward sites.
- 3.5. Surveys distributed to subaward recipients.
- 3.6. Planning documents for each subaward site (for access/inclusion-specific uses).
- 3.7. Planning documents for each subaward site (for disaster response).
- 3.8. Reporting documents for each subaward site.

Strategic Direction and Activities Phase 4: Evaluation Research. Phase 4 evaluates the process and impact of the selected TVWS (subaward) implementations. Led by Kristen Rebmann (SJSU-iSchool) and Don Means from GLN, analyses of datasets collected in Phase 3 will explore the issue of TVWS/WiFi to improve internet access/inclusion, models for crisis response collaboration among CAIs, and the role TVWS might play as a sustainable, resilient wireless infrastructure.

Phase 4 Roles and Commitments. Kristen Rebmann (iSchool) and Don Means (GLN) will work collaboratively in grant year 2 to analyze TVWS-enabled network usage statistics and other subaward datasets in support of the creation of several deliverables. These artifacts include five vignettes/case studies, a model for using TVWS technology to increase digital access and inclusion, a model for using TVWS technology as a component of library-lead disaster planning, and a how-to document to assist libraries initiating TVWS implementations on their own. These deliverables will explore the barriers and opportunities for community collaborations that emerged across the different subaward sites.

.Phase 4 Key Performance Indicators (KPIs)

- 4.1. Surveys and reports charting library services and CAI collaborations emerging from award.
- 4.2. Five vignettes or case studies written to describe subaward configurations.
- 4.3. A model for TVWS implementation to serve mission-specific (access & inclusion) goals.
- 4.4. A model for TVWS implementation for public libraries to serve community disaster-readiness goals.
- 4.5. A how-to document for libraries who would like to initiate new TVWS implementations on their own.

4. Diversity Plan.

The IMLS 2015 National Digital Platform Document poses a key question: ***“How can we ensure that the national digital platform serves all Americans?”*** This project addresses issues of economic diversity and the goal of ensuring all Americans are served by the national digital platform through its focus on digital access and inclusion. Through the provision of library-led, expanded, broadband access and new structures for community-collaborative disaster planning we hope to empower diverse communities. **In short, our library-led TVWS networks can eventually reach every community and especially impact the underserved while also enabling structures to support information access in times of crisis.** Our team recognizes that issues of digital access are idiosyncratic to individual communities as are the impacts to underserved populations. Professional Development Phase 1 of the projects engages with library communities not only to raise awareness of TVWS technology but to create a conversation about the needs of diverse communities and how they might benefit most from new forms of broadband access. Our Phase 2 implements TVWS networks to reach underserved populations. Phase 3 increases dialog between our communities via reporting, surveys, and in-person observations so that our team can learn from their experiences, technology configurations, and plans for disaster preparedness. Phase 4 makes our communities’ voices heard even more via the authoring of vignettes to describe their implementations and analyses of participants’ feedback. It is our intention that

the voices and strategies of our subaward recipients will inform and guide future implementations of TVWS technology.

5. Project Resources.

The grant will fund release time, summer pay, and fringe benefits for Kristen Rebmann (Phases 1-4) and contracting fees for Don Means (Phases 1-4), John Windhausen (Phases 1 and 2), Angela Siefer (Phases 1 and 2), and Joe Hillis (Phases 1 and 2). Subawards for TVWS equipment and support (Phase 2), travel to TVWS implementation (subaward) sites, and attendance at conferences (Phases 3 and 4) are also funded by the grant. San Jose State University facility and administrative indirect costs are represented in the budget as well. See Figure 2 for a timeline of project activities.

Grant Year 1	Oct. 2016	Nov. 2016	Dec. 2016	Jan. 2017	Feb. 2017	Mar. 2017	Apr. 2017	May 2017	Jun. 2017	Jul. 2017	Aug. 2017	Sep. 2017
Design TVWS Course				D								
Write Subaward Applicant Guidelines				M								
Presentation Planning (conferences)												
TVWS Course Runs					M	M	M					
TVWS Subaward Outreach												
Write/Share Reporting Guidelines									M			
Select Subaward Recipients									M			
Collect Baseline Usage Data								M	M	M		
Subawards Distributed \$\$\$									M	M		
TVWS Subawards Go Live									D	D	D	D
Grant Year 2	Oct. 2017	Nov. 2017	Dec. 2017	Jan. 2018	Feb. 2018	Mar. 2018	Apr. 2018	May 2018	Jun. 2018	Jul. 2018	Aug. 2018	Sep. 2018
Author Surveys and Interviews					M							
Gain SJSU IRB approval for data collection.					M							
Publications Planning & Writing												
TVWS Subawards Site Visits						M	M	M	M			
Data Collection: Planning Documents, Reports, Usage Statistics, Surveys						M	M	M	M			
Analyze Datasets												
Author Vignettes/Case Studies (5)										D		
Develop Model for TVWS Implementation											D	
Develop Model for TVWS Crisis Planning												D
Grant Year 2 Cont.	Oct. 2018	Nov. 2018	Dec. 2018									
Publications Planning & Writing cont.												
Analyze Datasets cont.												
Develop TVWS How-To Document			D									

Figure 2. Timeline

Project Director, Kristen Rebmann, PhD, MLIS, is an Associate Professor at San Jose State University’s (SJSU) School of Information (iSchool). Kristen has 10+ years of experience implementing and evaluating technology integration at the community level and 9+ years’ experience as a distance educator. Her research background includes community-based research, distance education, and programs/services design for diverse populations. She is a published author contributing to research in the fields of technology integration, learning design, and distance education/librarianship. She teaches courses in services for diverse users, learning design for new literacies, ethnographic research methods, and information retrieval. Kristen is a recognized leader with experience chairing several SJSU committees: the iSchool Retention, Tenure, & Promotion Committee, the iSchool Diversity Committee, and the SJSU Institutional Review Board (IRB). She received the School of Information’s Outstanding Professor Award in 2013 and the iSchool’s Faculty Distinguished Service Award in 2012.

Co-director Don Means represents the Gigabit Libraries Network (GLN), founded by Means in 2013 as an open ad-hoc global collaboration of tech-savvy, innovation libraries. He has devoted 3 years to exploring TVWS/WiFi capabilities in support of library missions. With over 25 years of experience in ICT (in 2012) Means launched the “Libraries WhiteSpace Project” to advocate for library community leadership in utilizing new long range license free spectrum to dramatically expand access to library WiFi in communities everywhere. Means is also director and founding chairman of the Schools, Health and Libraries Broadband Coalition and Trustee for the Sausalito Public Library. In 2007, Means initiated the “Fiber to the Library” campaign to assure gigabit fiber connections all US libraries to deliver “next generation” broadband into every community. In 1996, he created the Community TeleStructure Initiative, a national consortium advocating local community responsibility for telecom/broadband infrastructure planning. In 1992-93, as a member of the Atrium Group, Means served as an advisor to the Librarian of Congress on digitization strategy.

John Windhausen, Jr. J.D. is the Executive Director of the Schools, Libraries Broadband (SHLB) Coalition based in Washington, DC. The SHLBC is a non-profit, advocacy organization with 59 members, including community anchor institutions, broadband companies, research and education networks, foundations, state broadband officials, broadband consultants, and public interest groups. The SHLBC promotes open, affordable, high-capacity broadband services for anchor institutions and their communities. Prior to co-founding the SHLB Coalition, Mr. Windhausen served for five years as President of the Association for Local Telecommunications Services (ALTS), a trade association representing competitive local exchange carriers. From 1987 to 1996, he served as Counsel and Senior Counsel to the U.S. Senate Commerce Committee, where he helped draft the Telecommunications Act of 1996. He began his career at the FCC as a staff attorney in 1984. Mr. Windhausen graduated from Yale University and the UCLA School of Law.

Angela Siefer, MS is a member of the National Digital Inclusion Alliance (NDIA) where she is a national leader working collaboratively to craft, identify, and disseminate financial and operational resources for digital inclusion programs while serving as a bridge to policymakers and the general public. Angela has been working on digital inclusion issues since 1996. Beginning with a University of Toledo sociology graduate school assistantship coordinating a regional community technology network, Angela then moved onto serving as the Executive Director of the Ohio Community Computing Network distributing funds to and supporting community technology centers. Angela has been involved with the Broadband Technology Opportunity Program of the National Telecommunications Information Administration (NTIA) through participating in creation of two successful Sustainable Broadband Adoption (SBA) grants, implementation work on One Community’s SBA grant, coordination of three broadband conferences and serving as an NTIA consultant researching and writing best practices for the NTIA Broadband Adoption Toolkit. Angela worked on two Institute of Museum and Library Services (IMLS) funded projects. For OCLC, Angela led a project supporting communities piloting Building Digital Communities: A Framework to Action. For the University of Illinois Center for Digital Inclusion Angela conducted research for the project Inclusive Gigabit Libraries. She is now the Director of the National Digital Inclusion Alliance, a unified national voice for local technology training, home broadband access and public broadband access programs.

Joe Hillis is the founder of the Information Technology Disaster Resource Center (ITDRC). The ITDRC is a non-profit of IT and technology professionals that help communities in disaster. Joe has 20+ years of experience in the fields of emergency services and information technology. He was a systems engineer who spent most of his life working IT in public safety before retiring in 2004. He then went to work for himself as an IT consultant for small businesses. After 9/11, the concept of a national technology guard of volunteers was introduced to

Congress. In 2008, he co-founded the ITDRC, Information Technology Disaster Resource Center. Joe was honored as a 150 Top Influencers in 2013 and 2012 by SMB Nation and received the 2013 Humanity Road Da Vinci Award.

Our key players in terms of the management of the project's financial management include: the **SJSU Research Foundation (SJSU-RF), Kristen Rebmann, and Don Means**. SJSU-RF, a 501(c)3 organization incorporated in 1932 and an auxiliary organization of San José State University, serves to advance the welfare of San José State University and assist it in fulfilling its goals. The Research Foundation provides the entrepreneurial framework that supports faculty in developing compliant proposals and managing sponsored programs and demonstrates a consistent high standard of financial management as evidenced by unqualified audit opinions, a reasonable level of cash reserves, management free letters accompanied by audited financial statements relatively free of internal control comments. The administrative Central Office staff of about 50 professionals operates under three main divisions: the Office of Sponsored Programs offers specialized pre- and post-award services, Finance and Accounting processes and tracks project payments, and Human Resources assists in hiring, managing and compensating the over 900 Research Foundation employees engaged in sponsored programs and Central Office administration. Kristen Rebmann has experience working with grant-funded research since 2001 and small business finance since 2012. Don Means' educational and work experience in grant-based and non-profit finance dates back to 1984.

It's important to note that GLN, SHLBC, NDIA, and ITDRC all have identified work in the project's topic area as a critical part of their respective missions. Involvement in this project will support these organizational missions. The project will contribute to the goals of SJSU's School of Information through its creation of professional development activities that support learning for new and established information professionals. The project will help Kristen Rebmann expand her research in technology integration at the community level, the provision of services to underrepresented populations, and the design of rich learning experiences.

6. Communications Plan.

The project integrates different forms of communication at each phase with each of its intended audiences. We have two primary audiences: underserved populations and library practitioners. We plan to reach underserved populations via a new networking/communications technology: TVWS. Our goal is to use Phase 1 (our professional development course on TVWS) to engage in outreach to library practitioners. We intend to reach the library community further by attending conferences such as the *Association for Rural & Small Libraries Annual Conference*, the *Public Library Association's Annual Conference*, the *National Association of Telecommunications Officers and Advisors Annual Conference*, the *Schools, Health and Libraries Broadband Coalition's Annual Conference*, the *Dynamic Spectrum Alliance Global Summit*, and the *Broadband Communities Annual Summit*. These professional conferences will allow us to spread the message about TVWS implementations and disseminate findings as part of our process of authoring more formal articles for publication.

Phase 1 is designed to reach library practitioners through the provision of an open, online course for public librarians that will increase the level of awareness of TVWS technology and scenarios for its application and collaboration with other community information/support centers. The TVWS subaward program will cultivate research-library-community collaborations and technology adoption. All project staff will participate in outreach and promotion of phase 1 and phase 2 activities. Phase 2 engages in outreach via the course developed in phase 1, professional networks, and at conferences to develop a pool of subaward program

applicants. **From Phase 2 onward, our key audience (the public) will be reached by increased digital access and inclusion mediated by the TVWS implementations. Subaward recipients will also publicize the new TVWS hotspots to community members.** Don Means and Kristen Rebmann will take the lead on qualitative and quantitative data collection and dissemination activities phases 3 and 4.

Phase 3 communicates with subaward recipients (via guidelines) regarding reporting on the process of implementing their subawards. Subaward recipients will share usage statistics before and after TVWS implementations and planning documents for each TVWS implementation for mission-specific (access) uses and for disaster response. Phase 3 will also survey recipients about their implementations. Phase 4 will communicate with IMLS and the broader library community via professional publications, presentations at conferences, and resources designed to communicate the findings of datasets collected in phase 3. We anticipate disseminating (technology oriented) project results in journals that use open publishing models. *Journal of Library Innovation* and *Information Technology and Libraries* are just two open access venues (of many) that we might consider for article submissions. Findings relating to diversity, access, and inclusion might benefit in publication through journals such as *Public Libraries Magazine*. Phase 4 also communicates with the library & information science community through its deliverables (case studies, survey results, models, and a how-to document).

7. Sustainability.

Our team's activities relating to advocacy and grant-funded pilot implementations have placed us in ongoing communication with early adopters of TVWS technology. These forms of communication informed this proposal, represent key components of future (sustainable) implementations, and will continue as part of this project's legacy. The Colorado, Kansas, Delaware, and Mississippi installations that were funded by the Knight Foundation in 2015 continue to operate. *"Our Whitespace WiFi significantly increased public usage of our wireless network and is now a conduit for outreach programming at the Douglass Community Center. We plan to extend that outreach to the City Park in the coming month."* -May 2016 letter from Kerry Ingersoll, *Manhattan Public Library (KS)*. The success in Kansas (and at other sites) suggests that the adoption of TVWS (along similar lines to WiFi's adoption path), can become self-perpetuating for this project's subaward recipients and the library community at large. Our deliverables (usage statistics, learning materials, models, and how-to document) will benefit from continued collection and revision beyond the grant period to support the project's benefits long-term. Our vision is for these resources to be updated continually in support of a national model for the adoption of TVWS technology across the United States.

DIGITAL STEWARDSHIP SUPPLEMENTARY INFORMATION FORM

Introduction

The Institute of Museum and Library Services (IMLS) is committed to expanding public access to federally funded research, data, software, and other digital products. The assets you create with IMLS funding require careful stewardship to protect and enhance their value, and they should be freely and readily available for use and re-use by libraries, archives, museums, and the public. However, applying these principles to the development and management of digital products is not always straightforward. Because technology is dynamic and because we do not want to inhibit innovation, we do not want to prescribe set standards and best practices that could become quickly outdated. Instead, we ask that you answer a series of questions that address specific aspects of creating and managing digital assets. Your answers will be used by IMLS staff and by expert peer reviewers to evaluate your application, and they will be important in determining whether your project will be funded.

Instructions

If you propose to create any type of digital product as part of your project, complete this form. We define digital products very broadly. If you are developing anything through the use of information technology (e.g., digital collections, web resources, metadata, software, or data), you should complete this form.

Please indicate which of the following digital products you will create or collect during your project
(Check all that apply):

	Every proposal creating a digital product should complete ...	Part I
	If your project will create or collect ...	Then you should complete ...
<input type="checkbox"/>	Digital content	Part II
<input type="checkbox"/>	Software (systems, tools, apps, etc.)	Part III
<input type="checkbox"/>	Dataset	Part IV

PART I.

A. Intellectual Property Rights and Permissions

We expect applicants to make federally funded work products widely available and usable through strategies such as publishing in open-access journals, depositing works in institutional or discipline-based repositories, and using non-restrictive licenses such as a Creative Commons license.

A.1 What will be the intellectual property status of the content, software, or datasets you intend to create? Who will hold the copyright? Will you assign a Creative Commons license (<http://us.creativecommons.org>) to the content? If so, which license will it be? If it is software, what open source license will you use (e.g., BSD, GNU, MIT)? Explain and justify your licensing selections.

Phase 1 of the project will result in the creation of an online, open course relating to TVWS technology. Phases 2 and 3 will create datasets. Phase four will create models, reports, a how-to document, 5 case studies, and publications. We intend to make project materials freely available and attribute all work to our project staff. Attribution will be given to IMLS for their support. We support open access and intend to share datasets created via the project though we have not identified a repository or a license for these materials.

A.2 What ownership rights will your organization assert over the new digital content, software, or datasets and what conditions will you impose on access and use? Explain any terms of access and conditions of use, why they are justifiable, and how you will notify potential users about relevant terms or conditions.

According to the SJSU Research Foundation, SJSU does not assert copyright if investigators intend to make digital content or datasets open access. We don't anticipate any barriers to the provision of our open course materials and datasets as a freely available resource.

A.3 Will you create any content or products which may involve privacy concerns, require obtaining permissions or rights, or raise any cultural sensitivities? If so, please describe the issues and how you plan to address them.

No. Reporting processes and data collection will be covered, however, via human subjects approval of our quantitative and qualitative research methods. SJSU's Institutional Review Board will review our project protocol for human subjects compliance.

Part II: Projects Creating or Collecting Digital Content

A. Creating New Digital Content

A.1 Describe the digital content you will create and/or collect, the quantities of each type, and format you will use.

Phase 1 of the project will result in the creation of an online, open course relating to TVWS technology. Digital content will be produced in the form of instructional videos, webcasts, and course content in audio and text/print formats.

A.2 List the equipment, software, and supplies that you will use to create the content or the name of the service provider who will perform the work.

Our project will select a web-base content management platform for our online open course during the first months of year 1. Our plan is to use WordPress to create a course site that links participants to learning materials in multiple modalities. Among those materials will be live webinars in Blackboard Collaborate. Recordings of these webinars will be converted (via Collaborate Publish!) to MP4 and optimized for mobile use (640 x 480). We chose this (relatively low) resolution in anticipation that viewers will access recorded materials on many different types of devices (desktops, phones, tablets, etc.). We also intend to convert (via Collaborate Publish!) webinar recordings to audio only MP3 files (64 kpbs). Course content in text formats may appear in Microsoft Word and Adobe Acrobat files.

A.3 List all the digital file formats (e.g., XML, TIFF, MPEG) you plan to create, along with the relevant information on the appropriate quality standards (e.g., resolution, sampling rate, or pixel dimensions).

Course content and learning resources will appear in video, audio, and print formats. Live recordings will be available for access via Blackboard Collaborate. Recordings of course webinars will be available in MP4 (640 x 480) and MP3 (64 kpbs) formats.

B. Digital Workflow and Asset Maintenance/Preservation

B.1 Describe your quality control plan (i.e., how you will monitor and evaluate your workflow and products).

We will follow the workflow as outlined in our Schedule of Completion for the creation of our online open course. Our timeline for meeting planned milestones and deliverables will help us monitor and evaluate our progress.

B.2 Describe your plan for preserving and maintaining digital assets during and after the award period of performance (e.g., storage systems, shared repositories, technical documentation, migration planning, commitment of organizational funding for these purposes). Please note: You may charge the Federal award before closeout for the costs of publication or sharing of research results if the costs are not incurred during the period of performance of the Federal award. (See 2 CFR 200.461).

We support open access and intend to share digital assets created via the project though we have not identified a repository or a license for these materials. We intend to maintain open access to the course in WordPress during and after the award period.

C. Metadata

C.1 Describe how you will produce metadata (e.g., technical, descriptive, administrative, or preservation). Specify which standards you will use for the metadata structure (e.g., MARC, Dublin Core, Encoded Archival Description, PBCore, or PREMIS) and metadata content (e.g., thesauri).

N/A.

C.2 Explain your strategy for preserving and maintaining metadata created and/or collected during and after the award period of performance.

N/A.

C.3 Explain what metadata sharing and/or other strategies you will use to facilitate widespread discovery and use of digital content created during your project (e.g., an API (Application Programming Interface), contributions to the Digital Public Library of America (DPLA) or other digital platform, or other support to allow batch queries and retrieval of metadata).

N/A.

D. Access and Use

D.1 Describe how you will make the digital content available to the public. Include details such as the delivery strategy (e.g., openly available online, available to specified audiences) and underlying hardware/software platforms and infrastructure (e.g., specific digital repository software or leased services, accessibility via standard web browsers, requirements for special software tools in order to use the content).

N/A.

D.2 Provide the name and URL(s) (Uniform Resource Locator) for any examples of previous digital collections or content your organization has created.

N/A.

Part III. Projects Creating Software (systems, tools, apps, etc.)

A. General Information

A.1 Describe the software you intend to create, including a summary of the major functions it will perform and the intended primary audience(s) this software will serve.

N/A.

A.2 List other existing software that wholly or partially perform the same functions, and explain how the tool or system you will create is different.

N/A.

B. Technical Information

B.1 List the programming languages, platforms, software, or other applications you will use to create your software (systems, tools, apps, etc.) and explain why you chose them.

N/A.

B.2 Describe how the intended software will extend or interoperate with other existing software.

N/A.

B.3 Describe any underlying additional software or system dependencies necessary to run the new software you will create.

N/A.

B.4 Describe the processes you will use for development documentation and for maintaining and updating technical documentation for users of the software.

N/A.

B.5 Provide the name and URL(s) for examples of any previous software tools or systems your organization has created.

N/A.

C. Access and Use

C.1 We expect applicants seeking federal funds for software to develop and release these products under an open-source license to maximize access and promote reuse. What ownership rights will your organization assert over the software created, and what conditions will you impose on the access and use of this product? Identify and explain the license under which you will release source code for the software you develop (e.g., BSD, GNU, or MIT software licenses). Explain any prohibitive terms or conditions of use or access, explain why these terms or conditions are justifiable, and explain how you will notify potential users of the software or system.

N/A.

C.2 Describe how you will make the software and source code available to the public and/or its intended users.

N/A.

C.3 Identify where you will be publicly depositing source code for the software developed:

N/A.

Name of publicly accessible source code repository:

URL:

Part IV. Projects Creating a Dataset

1. Summarize the intended purpose of this data, the type of data to be collected or generated, the method for collection or generation, the approximate dates or frequency when the data will be generated or collected, and the intended use of the data collected.

Phase 3 collects information from subaward recipients in the form of quantitative data (usage statistics before & after TVWS installations) and qualitative data (reports, planning documents, and surveys). In meeting grant reporting guidelines, each library will develop mission specific uses for the TVWS equipment while also collaborating to develop a common backup communications plan where community anchor institutions may act in coordination as responders to various crisis/disaster scenarios. Kristen Rebmann and Don Means will travel to/observe TVWS implementation sites, record usage statistics, survey subaward recipients, and collect subaward recipient reporting documents during grant year 2. Surveys will be conducted electronically using Qualtrics software.

2. Does the proposed data collection or research activity require approval by any internal review panel or institutional review board (IRB)? If so, has the proposed research activity been approved? If not, what is your plan for securing approval?

We will seek human subjects approval of our quantitative and qualitative research methods. SJSU's Institutional Review Board will review our project for human subjects compliance during the early part of phase 3 of grant year 2.

3. Will you collect any personally identifiable information (PII), confidential information (e.g., trade secrets), or proprietary information? If so, detail the specific steps you will take to protect such information while you prepare the data files for public release (e.g., data anonymization, data suppression PII, or synthetic data).

No collection of personally identifiable information is planned. Surveys will collect information that is associated with subaward site locations.

4. If you will collect additional documentation such as consent agreements along with the data, describe plans for preserving the documentation and ensuring that its relationship to the collected data is maintained.

Consent agreements will be saved electronically in Qualtrics for survey data collection and consents will be included with other (in print) datasets.

5. What will you use to collect or generate the data? Provide details about any technical requirements or dependencies that would be necessary for understanding, retrieving, displaying, or processing the dataset(s).

Survey data will be collected using Qualtrics. Survey data will be archived/shared in a delimited text file or excel spreadsheet. Analyses of survey data will be done using Qualtrics and Excel. Written reports from subaward recipients will be in .doc/.docx or .pdf format. Qualtrics datasets will be maintained in a password-protected account associated with project director, Kristen Rebmann.

6. What documentation (e.g., data documentation, codebooks, etc.) will you capture or create along with the dataset(s)? Where will the documentation be stored, and in what format(s)? How will you permanently associate and manage the documentation with the dataset(s) it describes?

Survey questions and planning/reporting documents will be saved as .doc/.docx and .pdf files. Survey data will be shared in a delimited text file or excel spreadsheet. Multiple datasets will be associated with each other based upon site locations.

7. What is the plan for archiving, managing, and disseminating data after the completion of the award-funded project?

We will use a portion of phase 4 in year two of the grant to develop a plan with additional details for archiving/managing datasets. Phase 4 will communicate with IMLS and the broader library community via professional publications, presentations at conferences, and resources designed to share the findings of datasets collected in phase 3. Please see our narrative for more details regarding plans for dissemination.

8. Identify where you will be publicly depositing dataset(s): To be determined.

Name of repository: TBD
URL:

9. When and how frequently will you review this data management plan? How will the implementation be monitored?

We will review this data management plan during April, May, and June of grant year 1 and October, November, December, January, and February of grant year 2. We chose this time frame as it corresponds with grant activities (in the Schedule of Completion) associated with writing sharing applicant guidelines (year 1) and obtaining Institutional Review Board approval (year 2).

Libraries Leading in Digital Inclusion and Disaster Response via TV WhiteSpace Wireless Connections

IMLS Proposal Overview

Tens of millions of people rely wholly or in-part on libraries to provide access to the internet. In two-thirds of communities, libraries are the only source of no-fee internet access but one must travel to the library building to take advantage of this essential service. Expanding the reach of the library's internet signal outside of the library building to surrounding homes and businesses would vastly expand the benefits that the library brings to the community. **This project, involving San Jose State University's School of Information (SJSU-iSchool), Gigabit Libraries Network (GLN), the School, Health, & Libraries Broadband Coalition (SHLB), and the National Digital Inclusion Alliance (NDIA) will encourage libraries to explore dramatically expanding patron internet access and disaster preparedness by using TVWhiteSpace (TVWS), an emerging, low-cost wireless technology.**

TVWS is an extremely valuable license-exempt radio spectrum, located in the bands for traditional television service. The Federal Communications Commission (FCC) recently made these TVWS bands of spectrum available for open, shared public use. Yet, unlike Wi-Fi, TVWS has a much longer range. For example, TVWS signals travel several miles, potentially improving the coverage and inclusion of patrons in accessing library programs, services and the broader internet. An equally important benefit of using TVWS is the potential for improved disaster response and public safety. The portability of TVWS equipment enables rapid disaster response-based redeployment to damaged areas. These "pop-up hotspots" (or access points) go live within the critical first hours after an event has occurred.

"The reality is that after a catastrophic event, the public communications infrastructure WILL be down for 2 – 10 days on average, and the community will need temporary connectivity until the public utilities are restored... TVWS technology can help bridge that gap by overcoming the distance limitations of (Wi-Fi)..." -- Joe Hillis | Operations Director, Information Technology Disaster Resource Center (<http://itdrc.org/>)

"Public access to information was the most important service the library provided in the aftermath of Hurricane Katrina." -- UM / FL State U findings.

The FCC defines Community Anchor Institutions (CAIs) "as schools, libraries, hospitals and other medical providers, public safety entities, institutions of higher education, and community support organizations that facilitate greater use of broadband by vulnerable populations, including low-income, the unemployed, and the aged." Libraries have the potential to use TVWS/Wi-Fi in collaboration with other CAIs to create a redundant intra-facility communications resource that may increase community resiliency against large scale events like floods, fires, hurricanes, and earthquakes. These efforts can also serve as an inexpensive complement to the federal 2016 FirstNet initiative (<http://www.firstnet.gov/>).

There are several other potential benefits of library-led collaborations to deploy TVWS networks. K-12 schools can close the "homework gap" by using TVWS to provide wireless internet service directly to access points (APs) in student homes that are otherwise lacking connections. Health providers can create direct connections to the homes of patients for remote patient monitoring. Finally, the portability of access points allows libraries to extend their reach by providing wireless connections to cultural or civic events like fairs, markets or concerts.

National and Professional Impact: Project Goals

This project will extend the efforts of a 2015 grant to Gigabit Libraries Network (GLN, <http://www.gigilibraries.net/>) and the Chief Officers of State Library Agencies (COSLA) from the Knight Foundation (<http://knightfoundation.org/grants/201450242/>). The goal of this grant was to create basic orientation and analysis tools to help libraries and their partners understand and evaluate TVWS capabilities as a potential new library communications tool. Through this funding, GLN produced (1) a 2 minute Overview Video (<https://www.youtube.com/watch?v=SofOEsh3BNU>); (2) an interactive Prospective Coverage Map (<http://wsgmaps.droppages.com/>) that uses 17,000 library coordinates from an IMLS database to indicate where remote library access points might be installed; (3) seven archived webinars; (4) presentations at three conferences; and (5) two site visits. The Knight grant resulted in libraries beginning to experiment with TVWS technology to enable

Libraries Leading in Digital Inclusion and Disaster Response via TV WhiteSpace Wireless Connections

the placement of new remote library access points in public spaces like parks, playgrounds, shelters, and community centers.

The project requests a \$248,844 grant to widen the scope and depth of prior TVWS explorations through a three-part work plan involving professional development, technology implementation via a subaward program, and evaluation research. Project Goals include: (1) to educate public librarians on TVWS technology and its applications through an online, open-access course, (2) to determine the usability and usefulness of TVWS to expand availability of library Wi-Fi for 10s of millions of patrons, (3) to realize the potential of establishing direct facility-to-facility links among libraries, schools, clinics and other CAIs where each may act as responders to various crisis/disaster scenarios, and (4) to create a context for libraries to lead as early adopters, test beds, and demo sites for emerging information & communication technologies (ICTs).

Proposed Work Plan

Guided by the San Jose State University's School of Information (SJSU-iSchool), Gigabit Libraries Network (GLN), the Schools, Health & Libraries Broadband Coalition (SHLB), the National Digital Inclusion Alliance (NDIA), and with input from several project advisors, grant funds will support activities in three main areas: professional development, technology investment and implementation, and evaluation research.

Professional Development: Phase 1

Phase 1 involves the SJSU-iSchool, GLN, SHLB, and NDIA working together to develop curricular content for professional development by creating an open, online course (hosted by SJSU-iSchool) for public librarians that increases the level of awareness of TVWS technology and scenarios for its application and collaboration with other community information/support centers. This initial phase of the project responds to the IMLS National Digital Platform's call for continuous learning and cultivating a digital library workforce.

"Advances in technology are requiring continuous archives, libraries, and museum and training in digital competencies and skills for archives, libraries, and museum professionals." (IMLS National Digital Platform, 2015)

Technology Investment and Implementation: Phase 2 and Phase 3

Phase 2 initiates TVWS investment and implementation via (5) public library system subawards. These subawards will support library-led formation of local/regional collaborations among schools, health clinics and other community anchor institutions (CAIs). SJSU-iSchool, GLN, SHLB, and NDIA will jointly author program guidelines and develop specific criteria for subaward pilot site selection. These groups will likewise conduct outreach to raise awareness of the program which will infuse libraries with \$15,000 in funds to support 5 TVWS implementations and evaluate all resulting proposals. **General criteria for (subaward) pilot site selection:** The project collaborative will seek to fund libraries who propose the most interesting and potentially effective plans for TVWS/Wi-Fi implementations that (1) improve access/inclusion and (2) develop structures for multi-organizational collaboration as a component of community crisis/disaster preparation. **Phase 3** collects information from grantees in the form of reports, planning documents, surveys, and interviews. In meeting grant reporting guidelines, each CAI will develop mission specific uses for the TVWS equipment while also collaborating to develop a common backup communications plan where CAIs may act in coordination as responders to various crisis/disaster scenarios.

Evaluation Research: Phase 4

Phase 4 evaluates the process and impact of the selected TVWS (subaward) implementations. Led by SJSU's School of Information and experts from Gigabit Libraries Network, analyses of datasets collected in Phase 3 will explore the issue of TVWS/Wi-Fi to improve internet access/inclusion, models for crisis response collaboration among CAIs, and the role TVWS might play as a sustainable, resilient wireless infrastructure. **Each of the four phases associated with this project will address IMLS' National Leadership Grants for Libraries National Digital Platform project category by positioning TV WhiteSpace technology as a communications technology that is supportive of libraries' role as leaders striving for information access/inclusion and community anchors in times of crisis.**