Next Gen TV Considerations

for Public Media

Planning for the Rollout of ATSC 3.0 in Local Markets

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Public TV Broadcasting Considerations for Implementing ATSC 3.0

This report highlights important considerations for public television stations that are deciding whether, when or how to transition to ATSC 3.0, the new, voluntary broadcast transmission standard approved by the Federal Communications Commission (FCC) in November 2017.[1]

Drawing on primary and secondary sources, including interviews with executives currently involved with this transition, this paper seeks to identify and analyze opportunities and challenges resulting from a voluntary ATSC 3.0 (also referred to as Next Gen TV[2]) transition. Included is a recap of current ATSC 3.0 initiatives, research on regulatory and economic matters, issues public television stations will face in the next few years, as well as a closer look at potential new business models that ATSC 3.0 offers. Following each section is a series of questions that public media leaders should consider as they develop their own plans regarding Next Gen TV. We hope that public television general managers together with their respective engineers and finance personnel find this information useful.

It is expected that many, but not all, public media operations will be a part of this transition. The timing and involvement of individual organizations that do elect to transition to ATSC 3.0 will vary by their willingness and readiness to participate as well as by what local commercial television stations and group owners are planning for their own respective transitions.

In the context of the ATSC 3.0 transition, public media entities should now be considering how their strategic mission of service to their local communities would be affected by new opportunities and challenges associated with this new transmission platform.

The first and most fundamental issue -- should they transition to 3.0 at all? While transitioning to ATSC 3.0 will be very challenging and involve significant financial and other resources, stations not undertaking the transition may risk an uncertain future in a competitive and fast evolving marketplace. Second, if stations decide to transition to ATSC 3.0, when would be the most appropriate time for that transition? Do they become early movers? Do they take a deliberate

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1 As with any attempt to capture a rapidly changing industry in a static White Paper, information provided herein could become obsolete as policies, plans and projects evolve. A good resource for the latest information on ATSC 3.0 is the ATSC organization's website: https://www.atsc.org/.

2 ATSC 3.0 is also referred to "Next Gen TV," "NextGen TV," and "Next Generation TV." These terms are interchangeable and refer to the underlying technical standards, as well as the ATSC 3.0 enabled tools, devices, platforms, and related products and services being developed. It is still unclear which branding will prevail in the consumer market as adoption progresses.

"wait and see" approach and learn from others? Regardless of how transitioning stations address the timing issue, it is imperative they start gathering information, considering options and developing strategic plans.

While the initial legal and technical aspects of ATSC 3.0 have been publicly identified and well discussed, these aspects remain dynamic, and changes are to be expected. ATSC 3.0 tests and demonstration projects underway are providing the entire television industry with important information about the technical capabilities of the new transmission system, the ability to develop productive business relationships, as well as insights into facility upgrades, equipment purchases, and staff training needed to ensure compatibility with the new opportunities afforded by ATSC 3.0. Public media companies will need to keep abreast of these projects as they develop, review and revise their own ATSC 3.0 strategies. At the same time, they will also need to think broadly about the potential for enhanced and new services they could provide through Next Gen TV and the revenue streams that could be generated to support their overall mission.

A characteristic of the ATSC 3.0 transition that public media also needs to be aware of is the widespread support of major commercial television industry entities for the transition – and that their embrace is more rapid than for the analog to digital transition in 2009, despite similar concerns. This is due in part to knowledge gained from the first digital rollout, and significant advances in the underlying technologies, such as the ability to provide mobile service.

Major station-ownership groups plan to transition enough of their stations to provide a critical mass of coverage area in the U.S. to motivate consumers to buy ATSC 3.0 sets when they appear in the market by 2020.[3] The transition will be challenging, but the enthusiasm of the entire broadcast community is important for success, as it encourages the receiver, smartphone, and other device manufacturers to begin production of ATSC 3.0 capable components. In similar fashion, the commercial television broadcast community is testing and examining many different business plans for enhanced and new services, many of which public media could also implement.

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[3] In early April, a broad coalition of broadcast station groups, including both commercial network owned-and-operated stations and affiliates announced plans to deploy Next Gen TV in the 40 largest U.S. TV markets by the end of 2020. The coalition said that a first wave of over-the-air Next Gen TV service will begin with several markets slated for launch this year, with dozens more planned through 2020. The first transitioning stations were said to have been identified in 19 of the 40 largest markets, with efforts under way to identify first-movers in 21 other top-40 markets and 21 additional, smaller markets.

Public media entities contemplating the transition to ATSC 3.0 should consider the following observations and recommendations:

1. **Strategy and Business Models:** The ATSC 3.0 platform supports new capabilities and revenue-generating opportunities that can be incorporated into noncommercial public media's strategic plans, and business models consistent with mission goals and objectives, and local market needs and opportunities.

2. **Personnel:** Existing personnel and new hires should commit to being informed about ATSC 3.0 implementation and opportunities, paying particular attention to implications for the interplay between station operational areas. This includes keeping abreast of the developments in current and emerging pilot programs around the country.

3. **Industry:** Relationship-building with local commercial operators and participation in industry technical groups and committees (e.g., SMPTE, IEEE, ATSC), as well as state and national broadcast associations will help to increase the information acquisition and a deeper understanding of challenges and opportunities.

4. **Governing Body:** The more informed and prepared a station's governing body is, the more productive the planning and strategy development processes can be. Webinars, position papers, briefings and discussions made available to these groups will be invaluable in ensuring an effective and timely transition.

5. **Financial/Operational:** Begin planning now for changes to the transmission chain. Ensure the remainder of the physical plant is ready for an IP-based infrastructure. Consider whether the migration also suggests a change in operating model, organization structure, et cetera.

6. **Communications:** Develop a communications strategy and messaging. A station's communications strategy for informing its local communities should anticipate possible audience confusion and resistance.

7. **Legal:** Collaboration with the production community, commercial stations, non-broadcast data agreements, and cooperative agreements with other stakeholders will require skilled legal representation.

8. **Content and Applications:** It is unlikely that just one "killer ATSC 3.0 app" will emerge. Rather, each station should focus on benefits that most closely match its strategy, market, skill set, and organizational plan. Given the lengthy funding cycles and ramp-up time necessary for high quality production, early planning is essential to ensure enough content is available to take advantage of the opportunities offered by ATSC 3.0.

1.0 INTRODUCTION

Changes in technology, audience behaviors, and business strategies are challenging the ways local public and commercial TV broadcasters have operated for decades. Even with the 2009 cutover from analog to digital TV, the basic business model of delivering fixed schedules of programming to television sets in fixed locations was unchanged.

The current ATSC 1.0 digital TV standard mandated for use by the FCC was based on technology that provided substantial improvements in both the quality and capacity of TV broadcasting but does not support mobile reception. The current standard does support broadcasters' ability to provide a mix of Standard Definition and High Definition program streams along with datacast services, and this mix of services has found a market. However, in the decade since the rollout of ATSC 1.0 was completed, consumers began showing a strong preference for a mix of services based on their growing use of mobile and Internet technologies to access television programs whenever and wherever viewers choose. Unfortunately, ATSC 1.0 is neither mobile-friendly, nor Internet capable.

In November 2017 the Federal Communications Commission (FCC) approved a voluntary new digital TV standard deemed ATSC 3.0 that provided a solution to the mobile and Internet challenges of ATSC 1.0. ATSC 3.0 is based on the Internet Protocol (IP) suite of standards and uses a transmission technology that is robust enough for mobile reception. These two features, along with other enhancements such as vastly improved video (e.g., 4K, HDR) and audio (e.g., Dolby, multichannel sound) combine to create exciting new possibilities for what TV broadcasters can do with their signals, and what business models they can bring to market.

The launch of ATSC 3.0, also known as "Next Gen TV" is like ATSC 1.0 in that it is not backwards compatible with the previous standard. Just as ATSC 1.0 does not work on analog sets, ATSC 3.0 will not work on ATSC 1.0 digital television sets. However, unlike the transition to ATSC 1.0 that had a specific FCC-mandated cutover deadline, the FCC determined the industry could adopt Next Gen TV on a station-by-station, market-by-market basis without a fixed deadline. As a bridge, the FCC requires those broadcasters launching ATSC 3.0 services also to provide their main program service to viewers in an ATSC 1.0 format for five years from the FCC's approval of the new standard, that is, until November 2022.

The question now facing public and commercial media alike is, "what will you do about Next Gen TV?"

In this report we 1) summarize the state of knowledge about ATSC 3.0; 2) highlight current work by broadcasters and others to explore what possible business models seem to make the most sense; 3) speak to the regulatory and technical practicalities of starting up ATSC 3.0 operations; and 4) provide guidance on key questions that public media entities will face as they consider their own approaches to Next Gen TV in 2019.

2.0 DAWN OF THE NEXT GEN TV ERA

2.1 A New Dynamic Standard

Next Gen TV began in earnest in November 2017 when the FCC authorized the ATSC 3.0 standard for use by TV broadcasters, with deployment underway since 2018. ATSC 3.0 essentially refashions local TV stations into broadband wireless platforms that are "Internet-friendly." As such, there are two basic things that public media executives can factor into their Next Gen TV strategies.

- First, since Next Gen TV uses the suite of standardized Internet Protocols (IP) it can connect to and interoperate with other IP devices and applications. Local TV stations can provide one-way broadcast connectivity to ATSC 3.0-compatible devices ranging from large-screen smart TVs, desktops, and the "Internet of Things"[4] in fixed locations in the home, to laptops, tablets, smartphones, wearables and the "Internet of Things" on the go. This broadcast capability can even extend, for example, to activating the "last-yard" public safety alerting capabilities of consumer devices or to feeding the devices that large numbers of "first responders" would use to access large common data sets such as maps, floor plans or the output of key surveillance cameras in a crisis situation. TV broadcasters can also potentially integrate the content they broadcast with all manner of traffic on other bi-directional communications networks, including both social media and the networks likely to be used in autonomous or connected vehicles, telemedicine, or many features of "smart city" operations. This opens the door to expansive new possibilities highlighted in this report.

- Second, as an IP-capable platform, many of the assumptions and practices that apply to operating a local TV station under the ATSC 1.0 standards will need to be reexamined closely. It is important to remember that ATSC 3.0 is not a backwards-compatible technology and will not work with ATSC 1.0 devices. Therefore, during the transition period, the FCC requires ATSC 3.0 broadcasters to also provide a substantially similar 1.0 service. Electronics manufacturers will likely sell add-on devices like 'converter' boxes or tuner dongles to bring the new signals to older devices.

The complete set of ATSC 3.0 standards on the new transmission and related layers of operations has been released by the FCC. By design, however, these standards will be evolutionary and adaptive to changing demands.

While these standards are quite complex and will continue to evolve, in simplest form, all television stations would need new transmission facilities and ancillary support equipment in order to make a

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[4] IoT or the "Internet of Things" refers to the millions of new devices that will be attached to wireless networks, ranging from cars to refrigerators, and that will exceed the capacity of 4G wireless networks and deeper entry into media and related services including over-the-top (OTT), mobile apps and mobile web.

transition to Next Gen TV. Costs and operational impacts will vary by each station's situation, including capital and operating budgets.

With tests and initial deployments underway, major parts of the television industry are committed to a launch at scale in 2020.

2.2 Evolving Audience Expectations

Even as some parts of the local TV industry are still adjusting to the now decade-old transition from analog to digital, change is relentless. The video industry has taken giant leaps forward since 2009. We are living in an age of Netflix, Facebook, fast and large-screen 4G smartphones, near-ubiquitous, always-on Internet connectivity, and eager consumer adoption of new devices, platforms, and services provided by an increasing array of digital media companies, not to mention a stunning proliferation of "Internet of Things" applications in households, businesses and governments.

Consumers adopted mobile devices and over-the-top (OTT) video services faster than many observers expected. Whereas the first transition of local TV technology was from analog to digital, the current transition is more about getting broadcast TV's platform capabilities in tune with today's media and technology marketplace. That means being able to serve a broadly mobile and Internet-connected audience with enhanced experiences ranging from 4K and High Dynamic Range (HDR) video to greatly improved audio (e.g., Dolby) and a rich variety of program and non-program related services and features appealing to both current and new types of user groups. The overall goal for the move to ATSC 3.0 is to modernize the efficiency, capacity and competitiveness of terrestrial TV.

Consumers expect to access a wide range of video and other related services in the most appropriate formats with high-quality user experiences regardless of what devices they use. Watching a PBS documentary on a 65-inch smart TV creates one level of expectations in audiences, likely a linear "lean-back" experience. Accessing the same content on a smartphone or laptop may raise expectations of being able to share content or clips on social networks, interact with the content, dig deeper to learn more about the program and its topics, etc.

Over the past decade, a new generation of IP-centric companies developed compelling solutions leading and encouraging these changing audience preferences, attitudes and behaviors. As the first generation of digital standards for local TV, ATSC 1.0 certainly gave broadcasting a big step forward. However, now one decade on, many in the local TV industry see the need to develop new capabilities to serve the existing and future needs of their audiences with different kinds of business models to sustain operations.

While local public TV stations certainly focus on the needs and interests of their respective communities in developing their services mix, a core part of this strategy is offering access to nationally distributed services. PBS itself has responded to market forces by innovating and providing a mix of new and familiar services that are more tuned to the Internet age. PBS Passport, for example, is aimed at the new digital and mobile audience. PBS Passport could become of even greater value to public media audiences when it is accessible

via Next Gen TV by providing updates to familiar content streams such as LearningMedia, PBS Kids, and other services via the newer, enhanced technology.

2.3 A Different Transition

The market-led, voluntary approach approved by the FCC, rather than a government mandate on a uniform schedule, makes for a less orderly market transition as different parts of the broadcast ecosystem come to grips with deciding whether, when, and how to approach a transition to Next Gen TV. Commercial and public media sectors are developing real world experience via a set of demonstration projects, beta tests, and trials to inform a range of business, technical and regulatory decisions they will need to make about transitioning to Next Gen TV.

ATSC 3.0 permits local TV stations to become extremely agile, capable, and adaptive to different use cases and business models. There may not be an obvious path to success in every market, but there is plenty of opportunity. There is no master plan for how Next Gen TV will roll-out either in local markets or nationwide, so it is up to each public media entity to study the options and make informed decisions. Some public media entities may decide to sit out the early days of the race to Next Gen TV to see how things unfold. Others may decide to begin by leasing out to other entities significant portions of their new transmission capabilities with ATSC 3.0 in order to generate revenue before building up their more costly local production capabilities.

It will take planning, budgeting, and a different type of infrastructure, staffing and operations for public media to make the jump into ATSC 3.0. The operating and capital budgets along with technical practices in three core areas - *transmission*, *production* and various *back-office* functions - will change markedly. Budgetary impact is difficult to predict, but the Next Gen TV transition costs per station can range from $100,000 to $1 million depending on individual circumstances.

For example, stations currently involved in the spectrum auction repack may be upgrading the transmission chain to accommodate ATSC 3.0 standards. This forward-looking budgetary approach will soften the blow if and when a full transition is contemplated. Likewise, purchases of computer-based production and editing equipment should be made with IP-based distribution in mind. While the sign-on with a new ATSC 3.0 signal will be the most obvious and expensive event, numerous smaller and less expensive changes can be made now that will better prepare a station for the transition. Again, foresight in planning is the key.

3.0 NEXT GEN TV CAN TRANSFORM PUBLIC MEDIA'S ROLE

3.1 Public Media's Unique Service

Public media entities target services to a wide variety of traditional audiences and user groups, including pre-school and school age children, schools and universities, local community organizations, local and state government, general TV audiences, and special needs groups. Public media entities inventively served these various communities by broadcasting programming to TV sets and increasingly by using consumers' Internet connections to deliver digital assets such as websites, streaming video, and interactive applications to PCs, laptops, tablets and other smart and mobile devices.

The role of public media stations in the age of digital media and technology has already changed by adding to the basic capabilities of TV all that Internet and mobile technology can offer. What is different as we enter the Next Gen TV era is that for the first time, many of the services and capabilities can now be offered directly via TV signals using the new ATSC 3.0 standard. (Most services dependent on bidirectional transmission and interactivity will continue to require capabilities beyond those enabled by ATSC 3.0, although fuller integration of broadcast services with other, bidirectional networks and platforms may make those limitations much less visible to users.)

With public media's mandate to reach and serve all Americans, Next Gen TV could be a great equalizer for enhanced content experiences and services. Whether or not those served by public media have fast Internet connections, the latest smartphones with expensive data plans, or costly subscriptions to cable, telco and satellite TV providers (now referred to collectively as "multichannel video program distributors" or "MVPDs"), Next Gen TV can reach these groups once they have adopted some type of compatible device. Free, over-the-air broadcasting can now offer services that audiences once had to pay MVPDs and internet service providers (ISPs) to provide. Next Gen TV will look like any other app and can offer user-friendly formats, a mix of educational and entertainment content, and both linear and interactive experiences.

Public media outlets that bring Next Gen TV to their markets can transform their roles by adding the power and flexibility of the Internet and mobility to their traditional TV broadcast services. This new transmission standard will allow all the current services to be provided in new and enhanced ways. Next Gen TV will also allow public media to develop entirely new services to address unmet or underserved needs within their communities.

3.2 Exploring New and Enhanced Services

The broadcast television industry's goal for Next Gen TV is to provide a set of services more attractive and engaging to present day audiences, and thereby to stimulate more viewing and participation in new program-related content by aligning the broadcast and online parts of their programming.

Many local television stations and groups judge ATSC 3.0 to be an enabler of critical new capabilities that may secure the future success of this medium. These new capabilities can provide not only the current range of

public media services, but also significant enhancements while launching entirely new services not possible with the current TV standard.

Public media entities including UNC TV in North Carolina, WKAR in East Lansing, Michigan, KAET/Arizona PBS in Phoenix, and others are evaluating and pursuing a variety of initiatives through which Next Gen TV could transform their service to their communities. These entities are exploring new business models, experimental broadcast operations, new service models for distance education, supporting emergency alerting and public safety first responders, and a variety of other uses enabled by ATSC 3.0 operations.

The Pearl TV group, representing the interests of its commercial TV members, is pursuing a vision of ATSC 3.0 as the vehicle for enhancing the basic audience experience with higher technical quality for programming. This includes enhancements such as 4K UHD, HDR, Dolby processing and multichannel audio, more program choices, extending content and interactivity experiences across multiple devices and platforms.

Once a cutover is made to Next Gen TV, ATSC 1.0 devices will not be able to receive and process the over-the-air signal without some sort of adapter, dongle, or media gateway interface, and may not be able to present to audiences the full enhanced viewer experience, even with adaptive gear. These are familiar and accepted solutions in the marketplace that served the industry during the analog-to-digital transition some ten years ago. This provides public media decision makers some flexibility over how and when to approach Next Gen TV adoption.

Entities such as Spectrum Co (led by Sinclair, Nexstar and other commercial broadcasters) and the Public Media Venture Group (led by public media entities) are working on business models that seek to monetize ATSC 3.0 capabilities in non-core markets. Essentially, this means serving market segments in business, government, and education by providing spectrum capacity or other services beyond free-to-air typical public TV broadcasting. The market for ATSC 3.0 non-core broadcasting spectrum services, while potentially lucrative, is unproven and requires experimentation, market testing and clear proof points before any kind of success at scale is expected.

As with most new technology roll outs, market penetration takes time. At first, few consumers will be able to receive the new signal. As new sets are made available, adoption will increase over time, as anticipated in the figure below prepared by the Pearl TV group. Manufacturers are currently planning to make ATSC 3.0 TV sets and other equipment available to consumers starting in the fourth quarter of 2020. It will take several more years for the consumer market to ramp up its adoption of ATSC 3.0.

Figure 1. Next Gen TV to be Commercially Launched by 2020
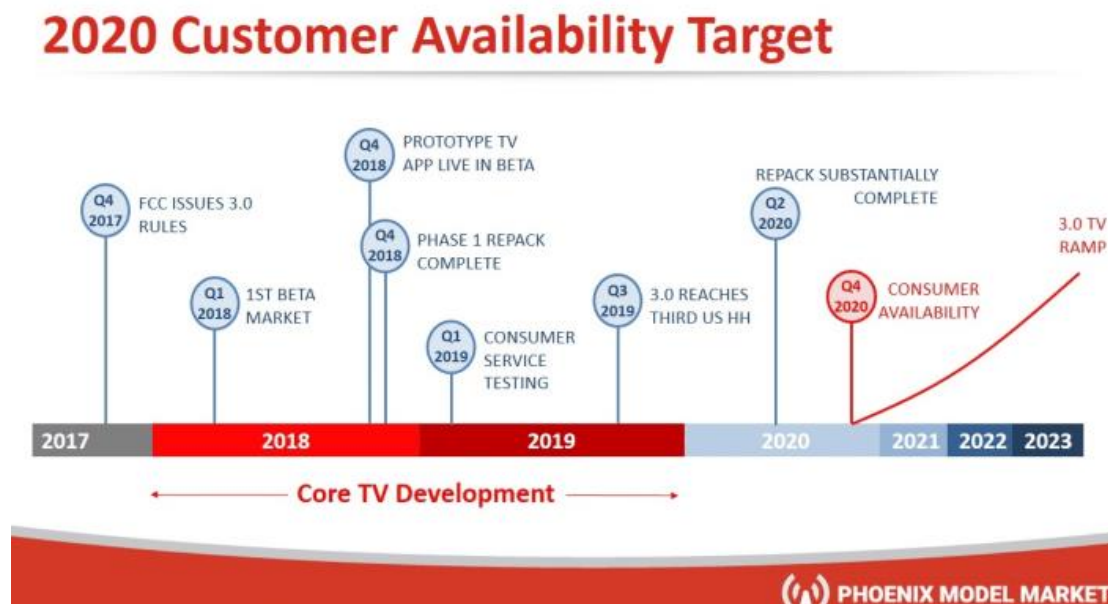
Source: Pearl TV, 2018

3.3 Viability of Terrestrial Television Services

Whether or not public and commercial media adopt ATSC 3.0, there is a question as to whether the over-the-air television medium can remain relevant into the future. Some argue that as OTT players including Netflix, Amazon, Hulu, and MVPDs including Charter, Comcast, Verizon, and AT&T make the move to 4K addressability and attribution, local TV broadcasters may not be able to remain competitive. In this case, it takes innovation and investment just to keep pace let alone expect growth in audience and financial support. Local TV broadcasters will be far more challenged to be competitive in the evolving marketplace if they remain with ATSC 1.0 operations. However, maintaining the status quo may still make sense for some broadcasters. For others seeking paths to growth and improved services, the road to ATSC 3.0 is part of the plan.

The Next Gen TV transition comes at a time when many different forces are affecting the local television market for both commercial and noncommercial television stations. According to Nielsen, the over-the-air audience is about 15 percent of the total TV audience.[5] According to these data, most households' access and viewing occurs on platforms other than terrestrial TV over-the-air distribution.

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[5] Butts, Tom, "Nielsen Sees 'Resurgence' In OTA Households: Number of Households Labeled OTA Has Nearly Doubled in the Past Eight Years," *TV Technology*, January 15, 2019. https://www.tvtechnology.com/news/nielsen-sees-resurgence-in-ota-households.

Current marketplace conditions call into question the future viability of terrestrial TV as a significant distribution platform for TV services. How will public media address the challenge? The Next Gen TV over-the-air platform needs to be closely scrutinized. Specifically, it is important to identify unique or additive benefits Next Gen TV brings over and above what ATSC 1.0 currently supports. Leaders and governing bodies of local public media stations will need to engage in in-depth study, discussion, and evaluation of cost/benefit analyses as they develop and implement their strategies.

Alternatives to broadcast TV are very successful in attracting new subscribers and audiences. However, local TV stations will remain as an important part of the video programming distribution ecosystem. Broadcast TV still provides the programming that attracts the largest audiences and provides some cost and marginal efficiencies not matched by other programming service platforms.

Local television stations attract sizeable audiences and, for commercial broadcasters, generate substantial advertising revenue with attractive margins by delivering these audiences. Younger audiences certainly have different, more digitally oriented video consumption habits, but overall the basic model of local TV is robust and well positioned to be competitive with its mix of programming, promotion, and distribution strategies for the foreseeable future. Beyond that window, Next Gen TV is designed to provide compelling new features and services that may make local TV even more competitive in the future and perhaps create movement back into growth mode.

3.4 Transitioning Public Media

In this context of dramatic change in the local video ecosystem and the introduction of this new transmission system, public media organizations need to think first about their position in their individual markets before committing to transitioning to ATSC 3.0. We are coming to an inflection point where it makes sense for stations to revisit or reaffirm strategic plans and consider how ATSC 3.0 fits into those plans to better serve their communities. ATSC 3.0 supports new business models, though it will take a committed process for individual public television stations to plan for and implement this transition. It may be that some local public television stations will opt for a "wait and see" approach to transitioning to ATSC 3.0 while they continue to fulfill their missions in their local communities. However, a key part of this approach should be to figure out exactly what they are "waiting to see."

ATSC 3.0 can support new business models but what works for individual public TV stations will depend upon their strategic plans and other local conditions. This includes considerations such as what the other local television stations, MVPDs, vMVPDs (virtual MVPDs, including the major cable, telco and satellite system operators' 'over-the-top' services) and wireless carriers are planning for their own generational transitions.

For those television stations involved in the repacking process, much of the equipment being purchased (and reimbursed by the FCC) will at least be minimally compatible with this new standard, lowering the costs of the transition for some. The transmission, production and back-office functions can continue to support legacy operations.

But with Next Gen TV, the promise is to provide new services such as 4K video, HDR, Dolby Audio, enhanced data services and other broadcast related improvements, as well as the potential for entirely new, possibly non-broadcast services. So, in addition to upgrading the transmission chain to 3.0, depending on the business model, the process may require additional capital and operating funds for enhanced audio and video production, post-production, sets, interactive application designers and tools, more cloud-based storage, licensing more Software-as-a-Service (SaaS) packages, etc.

3.5 Section Summary

- In the Next Gen TV era, many services can now be offered directly via TV signals.

- Both noncommercial and commercial entities are actively exploring Next-Gen's potential.

- Current marketplace conditions call into question the future viability of terrestrial TV as a significant distribution platform for TV services, making Next Gen TV a platform that needs to be closely scrutinized.

- It is important to identify the unique or added benefits Next Gen TV brings over and above what the current terrestrial TV platform offers.

- Public television broadcasters will be especially challenged as the Next Gen TV transition unfolds. Funding assistance in the repack process, viewer and underwriting campaigns and other targeted initiatives should be considered to help ease the transition.

3.6 Station Considerations

Mapping Potential Costs and Benefits of a Next Gen TV Transition
1. What is the strategic vision of our local public television station in our local market?   2. What potential opportunities from the introduction of ATSC 3.0 fit into that strategic vision?   3. What are the announced Next Gen TV transition plans of other local commercial and public television stations? Will those plans affect our station? Will a "wait and see" plan work in our local market and not negatively affect our station?   4. How can the benefits of ATSC 3.0 allow us to compete with or more fully utilize OTT?   5. What are the financial resources available for a possible ATSC 3.0 transition?

4.0 A LOOK AT MVPD, vMVPD AND WIRELESS CARRIER INNOVATION

In addition to broadcast TV, consumers in most of the country (including institutional consumers such as schools, businesses and libraries) are served by three other video-capable platforms, each undergoing their own transitions. These are the MVPDs (multichannel video program distributors), vMVPDs (virtual MPVDs) and wireless carriers.

4.1 A Crowded Field

MVPDs include the major cable, telco and satellite multi-system operators (MSOs): Charter, Comcast, Verizon, DISH, and DirectTV. In the vMVPD model—a new type of video platform that provides what is commonly called "skinny TV bundles" —OTT (over-the-top) Internet video services are aggregated and curated to provide a service similar to what MVPDs offer, but less expensive and with only the most popular local TV stations, cable networks and other services.

What makes vMVPDs different is that they offer services like MVPDs but do not provide these services over their own distribution platforms. Instead vMVPDs distribute their services "over the top" of existing network platforms like MVPDs and wireless carriers that provision broadcasters' Internet capacity. vMVPDs include popular brands like Roku, Hulu Live, YouTube TV, Amazon Prime Video, Pluto TV, etc. The major wireless carriers providing both fixed and mobile wireless services include Verizon Wireless, AT&T, T-Mobile and Sprint.

In addition to providing their own video, data and communication services, MVPDs and wireless carriers also provide the data capacity and network connectivity that support the rise of the OTT marketplace. As MVPDs and wireless carriers improve and increase their range of network platform capabilities, it will be both the platform operators themselves as well as OTT service providers and platform aggregators on top of these network platforms that will continue to redefine the video and data ecosystem.

For public media entities, Next Gen TV can provide the marketplace with significant stand-alone video and data capacity independent of MVPD and wireless carrier platforms. And public media entities can also expand their range of services by developing their own deployment models that complement and interoperate with MVPDs and wireless carriers in hybrid platform solutions. In effect, these hybrid solutions can provide the best of both worlds – Next Gen TV plus what the other platforms can add over and above what Next Gen TV can do by itself.

As we will explore below, these platforms are in their own early stages of generational upgrades just as major portions of the broadcast TV industry are transitioning to Next Gen TV. In each case, as with Next Gen TV, these upgrades will increase data capacity, and reduce latency. For wireless carriers, their "ATSC 3.0" is the transition from 4G to 5G wireless networks. For MVPDs, it is the transition from the current 1G-EPON (1 Gbps over Ethernet Passive Optical Networks) to 10G-PON (10 Gbps PONs). These platform transitions will support

development and roll-outs of improved and new services and business models based on Internet Protocols, making each platform essentially part of the Internet.

As public media executives contemplate the potential adoption and rollout of Next Gen TV, it is relevant to consider not just what other broadcasters are doing in their local markets but also what other major platform providers are doing in terms of adopting and deploying new innovations. Terrestrial TV executives are not alone in wrestling with the opportunities and challenges of a generational change in platform architecture. MVPDs and wireless carriers' platform upgrades might compete, or complement, how public media entities move forward (or not) with Next Gen TV.

4.2 Upgrades for Wireless Carriers

The major wireless carriers are each pursuing network upgrades to 5G, their next generation platform that will initially complement and eventually perhaps succeed the current 4G LTE network technology.

- The wireless industry is motivated to upgrade their 4G LTE networks serving fixed and mobile wireless consumers by the increased demand they foresee for data capacity (in both speed and latency), and the rise of the Internet of Things.
- The new 5G networks comprise a variety of technologies, capabilities and spectrum locations depending on the carrier.
- Next generation fixed and mobile wireless networks using 5G will roll out in three different spectrum bands that determine its peak performance characteristics.
- While performance varies based on specific implementations, expected peak data rates range from 100 Mbps for 5G low-band spectrum (below 1 GHz) to 1 Gbps for mid-band and up to 10 Gbps for high-band spectrum networks.[6]
- At the NAB Show in April, Sinclair Broadcast Group, Inc. and its subsidiary ONE Media 3.0 strongly promoted exploration of the potential for convergence of ATSC 3.0 and 5G technologies, particularly in OTT/over-the-air applications.

4.3 Changes for MVPDs

MVPDs in the U.S. currently serve 80 percent of their market with 1G service, up from just 5 percent in 2016.[7] Their new upgrade program formally announced in 2019 is to move from 1G to 10G networks.

- The large MSOs were prompted into considering the necessary infrastructure investments by examining market trends and considering their own strategic futures. This motivated them to redesign their networks for higher bandwidth capacity and improved performance.

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[6] Winkelman, Steven, "What is 5G? Here's Everything You Need to Know," *Digital Trends*, January 29, 2019. https://www.digitaltrends.com/mobile/what-is-5g/.
[7] "Introducing 10G: The Next Great Leap for Broadband," CableLabs, January 7, 2019. https://www.cablelabs.com/news/10g-next-great-leap-broadband.

- The market forces the MVPDs deem most actionable include the proliferation of connected devices (e.g., TV, smart phones, tablets), competitors building out gigabit fiber networks, the rapid growth of OTT services, and the evolution to higher quality 4K video. [8]

- CableLabs, the MVPDs' innovation center, unveiled the cable industry's new vision for 10G at the 2019 Consumer Electronics Show. The vision focuses on how 10G "will transform consumer experiences in homes, businesses and wherever people connect" and "creates new possibilities for smart cities, healthcare, connected gaming, video streaming, virtual and augmented reality, education and businesses of all sizes."[9]

The bottom line here is that even in a market where not all stations decide to become early adopters of Next Gen TV, the market expectations may be led not by fellow broadcasters but by MVPDs and wireless carriers. These platform providers may be the ones who capture early and sustainable opportunities that public media might otherwise have won.

4.4 Rise of vMVPDs

Cord cutters and cord shavers, *i.e.*, those abandoning or trimming back MVPD services that they may view as relatively expensive and that may include many unwanted channels, formed the basis for a new type of video services platform, known as vMVPDs.

vMVPDs act as MVPDs do by licensing, aggregating and curating a suite of linear (such as live, local TV stations), on-demand and digital premium content video services (such as network DVR services). vMVPDs such as PlutoTV might be entirely free to the consumer with advertising as the only revenue model. Or vMVPDs such as Hulu+ Live TV can charge a subscription fee for the platform service and combine ad-supported and subscription services as part of the mix.

Most of the major commercial TV broadcast groups (e.g., Sinclair's STIRR, Hearst's AnyScreen), broadcast networks (e.g., CBS All Access), and cable networks (e.g., HBO GO) now offer OTT services featuring their channels in a mix of ad-supported and subscriber-supported linear and on-demand content offerings. vMVPDs aggregate third-party content for OTT distribution and may or may not bundle in their own content. Hulu+ Live, for example, bundles its own premium content along with local live TV stations to provide a video package meant to compete for cord cutters looking for a non-traditional mix of services compared to what MVPDs offer. For local TV stations, including public media, that want to get into the OTT business but are limited by scope or scale of their resources, new options are coming to market.

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[8] Bert, Els, "Cable MSOs – Full Speed Ahead with PON," Nokia blog, December 2, 2014.
https://www.nokia.com/blog/cable-msos-full-speed-ahead-pon/.
[9] "Introducing 10G: The Next Great Leap for Broadband," CableLabs, January 7, 2019.
https://www.cablelabs.com/news/10g-next-great-leap-broadband.

4.5 Section Summary

- It is critical to understand the breadth of technologies, such as 5G, that non-traditional content providers are pursuing, and to become familiar with any timelines for their rollout locally.

- Public media executives should look beyond what local *broadcasters* are doing and learn from what *MVPDs and wireless carriers* are adopting and deploying.

4.6 Station Considerations

MVPD, vMVPD and Wireless Carrier Innovations

1. Are there announced plans for introduction of 5G wireless carrier services or 10G MVPD in our local market? What timeline has been announced for those new services?

2. Are we fully aware of other viable and desirable options that provide ways for audiences to connect with our services, such as OTT content aggregators and platforms such as Syncbak, Hulu Live, YouTube TV, Pluto TV and others?

3. How might we compete or partner with MVPDs, vMVPDs and wireless carriers in our market? What needs in the market are they likely *not* to address, where we could play a significant and valued role?

4. What are the penetration levels of OTT and vMVPD cord-cutter services in our local market? Has there been considerable cord cutting, with significant reductions in MVPD subscriber levels? Has there been any impact on the viewing levels of our local public television station?

5.0 ATSC 3.0 UNDERGOES REAL-WORLD TESTING AND ASSESSMENT

The ATSC 3.0 set of standards is by design a moving target. ATSC's former president Mark Richer notes, "The ATSC 3.0 suite of standards is modular, not monolithic. As needed, standards and recommended practices are revised, based on industry experience and requirements."[10] The modularity of the standards means that public media broadcasters have some flexibility in picking and choosing what parts of ATSC 3.0 they want to adopt and when. It is not an all or nothing decision. This also means that innovation will occur across the elements of the standard specifications at different rates – something that is endemic to technology and to be expected.

To develop the knowledge both to apply and evolve the ATSC 3.0 standard set, the broadcast industry formed several collaborative groups and projects to optimize the technology and develop deeper understanding of what business and service models best address current and future market demand. In the public media community, this includes the PBS Engineering Technology Advisory Committee's (ETAC) ATSC 3.0 working group.[11] Collectively, these initiatives are designed to help the industry better understand and qualify the opportunities ATSC 3.0 makes possible.

5.1 Different Approaches to Market Creation and Evolution

The TV industry is running various testbeds, trials, and experimental operations, in addition to exploring new business and service models. In Appendix A, we provide additional details for some of the major collaborations and initiatives related to ATSC 3.0 testing and deployments. The project descriptions, goals and expected key learnings are wide-ranging from technical proof-of-performance to a variety of business and service models.

The collaborative industry groups include Pearl TV, Spectrum Co, NAB PILOT, and the Public Media Ventures Group. For instance, the Pearl and Spectrum Co initiatives highlight the different and incremental potential opportunities that ATSC 3.0 provides over and above what the current digital TV standard can do. There are capacity plays and service/feature plays that need to be assessed and balanced in overall decision making.

Public media executives should take note that even with the increase in efficiency of spectrum use, they will need to decide ultimately how to use that increased capacity. The uses they decide to pursue may greatly impact decisions about facilities and equipment, which will in turn impact staffing needs and the overall return on investment.

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[10] Richer, Mark, "President's Memo: Picking Up Steam," *The Standard*, ATSC, November 2018, https://www.atsc.org/newsletter/presidents-memo-picking-up-steam/
[11] PBS Engineering Technology Advisory Committee (ETAC), "ATSC 3.0 Position Paper," https://www.publicmedia.co/wp-content/uploads/2017/01/PBS-ETAC-ATSC-3-dot-0-position-paper.pdf

Initiatives by local stations contribute to the state of the art in ATSC 3.0. These include ATSC 3.0 station launches by KSBB, the News Press Gazette station in Santa Barbara, CA and Michigan State University's public station WKAR, each of which received FCC permission to begin experimental ATSC 3.0 transmissions. Others with notable ATSC 3.0 achievements include work by WRAL, University of North Carolina's UNC-TV, KAET/Arizona PBS as part of the Phoenix Model Market initiative and WatchTV in Portland, OR.

Below are a few highlights of the major Next Gen TV undertakings, with more details provided in Appendix A.

5.1.1 Pearl TV's Phoenix Model Market Initiative

Pearl TV describes itself as a "business organization of U.S. broadcast companies with a shared interest in exploring forward-looking broadcasting opportunities, including innovative ways of promoting local broadcast TV content and developing digital media and wireless platforms for the broadcast industry."[12]

Pearl TV established the Phoenix Model Market as "an open test bed for the development of next-generation broadcast television – ATSC 3.0." Pearl TV's goals for this test are determining the appeal of next-generation high dynamic range video and immersive audio content to consumers, assessing TV application features and implementation requirements, testing interactive and addressable advertising functionality, determining consumer device and service appeal, and ensuring effective and efficient interoperability with MVPD systems. In other words, Pearl TV is trying to assess the viability of ATSC 3.0 as a means of enhancing existing local television services.[13]

In early April, participants announced that the Phoenix Model Market would "soon" be expanded from a single Next Gen TV transmission tower to include an additional station with a signal that will be enhanced through the use of a Single Frequency Network (SFN) to help broadcasters evaluate the benefits of SFN transmissions.

At the same time, participants also announced that five audience measurement firms are working together to help Phoenix broadcasters understand the capabilities of Next-Gen TV for providing more accurate and timely information that could someday help viewers tailor the programming they want to watch and enable broadcasters and advertisers to target viewers with messages that would be of specific interest to them.

As part of the Phoenix Model Market project, KAET/Arizona PBS is providing an ATSC 3.0 program feed. KAET informed BIA they have a variety of goals for learning and developing best practices – some of which may differ from those of commercial TV operators. KAET's goals include:

- Understanding the logistics, legal workflows, and complexities of getting on-air.

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[12] Pearl TV, www.pearltv.com.
[13] Phoenix Model Market, www.phoenixnextgentv.com.

- Developing and negotiating agreements for different types of business groups. For example, as a division of state government, KAET's agreements must conform to Arizona state law while many commercial entities in the market are incorporated in Delaware and prefer those laws be the basis of agreements.
- Understanding how, as part of a consortium, a university licensee manages its responsibility for what goes out over the air, including legal safe harbor agreements.
- Developing best practices for clearing of content and rights management. ATSC 3.0 is IP-based which may introduce ambiguity with rights holders in how the transmission is perceived – broadcast vs. streaming.
- Understanding how to work with PBS content that is not bundled with streaming rights.
- Testing the interactivity of PBS Kids content.
- Determining the portability of interactive website content in one-way distribution via ATSC 3.0 for underserved Hispanic, Mormon, and Native American communities in its coverage area.
- Focusing on direct outreach to schools, rather than homes.

5.1.2 Spectrum Co's Single Frequency Network (SFN) Deployment

The Spectrum Consortium ("Spectrum Co") is a joint venture of a number of large commercial broadcasters, including Sinclair Broadcasting Group, Nexstar Media, and Univision. Spectrum Co's president John Hane describes Spectrum Co as, "a platform for member television groups and stations to develop and operate significant new lines of business on their 6 MHz spectrum channels outside of the core OTA television service."[14]

Spectrum Co is building a Single Frequency Network (SFN) in Dallas, TX to provide a unique testbed for broadcasters to learn how to make use of their 6 MHz spectrum in SFN configurations. The construction phase on the ATSC 3.0 SFN comprising four tower sites in the Dallas market was completed in January 2019 by American Tower, which noted, "With these ATSC 3.0 deployments, it is critical to draw on expertise to synchronize SFN towers effectively, including integrating the network components, such as antennas, transmitters, and radios for optimum signal delivery."[15]

The PBS ETAC ATSC 3.0 position paper defines Single Frequency Networks (SFNs) as "a broadcast network planning strategy that allows efficient utilization of spectrum by expanding coverage/service without additional frequency allotment." PBS ETAC also says, "SFNs provide path diversity for reception and increased field strength throughout a coverage area. Though SFN

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[14] "Spectrum Co's John Hane on ATSC 3.0 as Platform for New Business Opportunities," BIA Local Media Watch blog, September 25, 2018, http://blog.biakelsey.com/index.php/2018/09/25/spectrum-cos-john-hane-on-atsc-3-0-as-platform-for-new-business-opportunities/

[15] Kurz, Phil, "American Tower Completes Construction of Dallas ATSC 3.0 SFN," *TV Technology*, February 1, 2019. https://www.tvtechnology.com/atsc3/american-tower-completes-construction-of-dallas-atsc-3-0-sfn

deployment can be costly, the savings to co-located stations could make the concept viable."[16] SFNs with their array of cellular like transmission points can provide separate content feeds through each transmitter, effectively geofencing or geotargeting content to address specific needs in different parts of the market.

While these television groups also consider the enhanced viewing benefits of ATSC 3.0 as important advancements in delivering local television service, they are very interested in the opportunities for additional services utilizing the spectrum. They imagine that these enhancements in the viewing experience along with providing opportunities for other uses of the spectrum as being complementary and key for the future success of local television stations.

5.2 More Public Media Involvement

In addition to KAET/Arizona PBS, Michigan State University's WKAR and the University of North Carolina's UNC-TV are public media leaders in developing, testing, and deploying various ATSC 3.0 initiatives. The Public Media Company and its related Public Media Venture Group, in partnership with Osborn Infrastructure, are working with their membership to assess and develop plans, partners, opportunities, business models, and transition timelines.

- WKAR's focus has been on educational applications and service models.
- UNC-TV has been working with statewide deployments of data and communication services for the first responder community. Priorities in this area include developing upgrades to notification, alert, and warning systems for public safety and first responder communities.
- The Public Media Venture Group's partnership with Osborn Infrastructure exists to develop a nationwide network of converging technology platforms, including Single Frequency Networks and Next-Gen Broadcast and Data Center infrastructure.

5.3 ATSC 3.0 Pilots: Broad Goals and Key Learnings

Looking across the projects, these initiatives are pursuing wide-ranging goals which will provide public media stations with key learnings:

- Testing ATSC 3.0 television services and new business models, while continuing ATSC 1.0 operations and services. The simulcasting will be essential for public media stations as they maintain services to their local communities during the transition.
- Confirming basic TV service parameters and performance and determining the appeal to consumers of an enhanced audience experience offered by next-generation HDR video and audio (e.g., Dolby). These results will help local public broadcasters to determine the attractiveness of these new capabilities and help inform what types of services to offer.

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[16] PBS Engineering Technology Advisory Committee (ETAC), "ATSC 3.0 Position Paper," https://www.publicmedia.co/wp-content/uploads/2017/01/PBS-ETAC-ATSC-3-dot-0-position-paper.pdf

- Assessing TV application features and implementation requirements, testing interactive and addressable advertising or underwriting functionality, and determining consumer device and service appeal. These results will also provide information on what public television stations should offer in the future.
- Field testing of different modulation/coding combinations of the ATSC 3.0 physical layer. These results will help public television stations construct the most cost-efficient technical plant.
- Ensuring effective and efficient interoperability with MVPD systems. Even though traditional MVPD subscriber levels have decreased, they will remain an important delivery system for public television stations for some time.
- Exploring and vetting the practicality of market and partnership opportunities for developing innovative content and data services in education, information, and even connected and autonomous vehicles. For many public media entities, a specific focus on early childhood education; telemedicine and distance education; connected and autonomous vehicles; agriculture; emergency response; and sharing of local information may make sense given their missions. While these opportunities will take some time to completely develop, the early lessons will provide public television stations with useful information for planning.
- Ensuring interoperability for viewers seeking to access information, entertainment and both program and non-program related data services such as downloading web pages, files, graphics and other digital assets using applications as they do on smartphones, computers and over-the-top devices such as Roku, Apple, and Android TV.

5.4 Section Summary

- To develop the knowledge both to apply and evolve the ATSC 3.0 standard set, the broadcast industry formed several collaborative groups and projects to optimize the technology and develop deeper understanding of what business and service models to consider.

- In the Phoenix Model Market project, KAET/Arizona PBS is providing an ATSC 3.0 program feed, which will result in key learnings for other public television outlets.

- Pearl TV is focused on consumer experience enhancements and revenue models.

- Spectrum Co is focused on SFNs.

- Collectively, the initiatives currently being pursued will provide wide-ranging key learnings that will inform public television stations' planning and decision making.

5.5 Station Considerations

ATSC 3.0 Real World Testing and Evaluation
1. Which of the various tests, deployments, and use cases in play are most relevant to our vision and goals? What are the key learnings and how can we apply them to our context?
2. What new types of FCC processes should be reviewed and what commercial contract language should be developed to be ready for new types of services and collaborations?
3. What are the differences between what the commercial TV and public TV entities are doing? How can this inform our own planning?
4. What are core service needs in our local market where we think Next Gen TV can make a positive and significant impact? Is anyone currently addressing or planning to address these needs? If so, do we still pursue these needs but in a differentiated way that adds value?
5. Next Gen TV can enhance the basic audience experience with much higher quality and more immersive audio and video. What do we need to do in our production and operations areas to best take advantage of these capabilities?
6. How can we best design and budget for upgraded facilities allocating what we can to one-time capital budgets versus more challenged operating budgets?
7. What use cases might we have for SFNs, either for geofencing content or for making sure we deliver strong signal coverage throughout our licensed service area?

6.0 OPPORTUNITIES FOR NEXT GEN TV PUBLIC MEDIA BUSINESS MODELS

As public media leaders develop ATSC 3.0 strategies, they should evaluate mission, strategic priorities, governance, resourcing, and the ability to tolerate risk vis-à-vis the need to innovate and pursue innovation and new business opportunities. In this section, we will look at several categories of business opportunities that are likely to arise through a transition to ATSC 3.0 and the deployment of Next Gen TV devices. These include: enhanced audience experience, public safety, and non-broadcast use of spectrum (such as education, wireless networks, and autonomous vehicles).

It is expected that ATSC 3.0 will create improved spectral efficiency, resulting in greater delivery capacity and expanded bandwidth use opportunities. Station leadership must bear in mind that each business opportunity pursued should involve a cost/benefit analysis.

6.1 Enhanced Audience Experience

Public media should seek to provide the most attractive and engaging audience experience possible – one that will stimulate more viewing and participation in its content and services. Developments with ATSC 3.0 could enable public media to significantly enhance its audience experience and meet expectations. Current ATSC 3.0 pilot projects include enhancements such as higher technical quality for programming, expanded program choices, multiple device and platform delivery, targeted content, and interactivity via connected devices.

Higher technical quality for programming. The standard allows for enhancements to picture and audio quality, including 4K/UHD, HDR, and Dolby immersive audio, addressing audience expectations created by OTT and other non-broadcast content providers.

Expanded program choices. The increased bandwidth that will result from the spectral efficiency created by ATSC 3.0 will provide more multicast channel opportunities than currently possible through ATSC 1.0. This will include the potential to broadcast multiple 4K/UHD content streams.

More compelling audience choices can lead to increased content consumption and a greater appreciation for the relevance and value of public media.

Multiple device and platform delivery. Next Gen TV could give broadcasters a new identity as a broadband wireless antenna-based service that serves mobile and fixed points – addressing consumers' needs to watch content when they want, where they want, and on the device of their choice. It could allow broadcasters to reestablish the primacy of their broadcast platform versus retransmission over MVPD and vMVPD platforms. According to Nielsen, "As of May 2018, more than 14% of all TV households—or 16 million homes—have OTA status, and that number is on the

rise. As consumers look for more on-demand and cost-effective options, there has been a resurgence in this type of television household."[17]

Targeted Content. Since programming can be targeted to specific audience segments based on their profiles, new options will likely arise for public media through a transition to ATSC 3.0. For example, station members could be authenticated for access to PBS Passport and receive innovative new services enabled by ATSC 3.0 technology. Viewers could be greeted with personalized recommendations, menus, and choices based on their individual profiles, viewing history, expressed interest areas, and location based on geofencing.

Interactivity. While Next Gen TV inherently is a broadcast platform, it will also incorporate Internet Protocols, so it can seamlessly interoperate with other IP platforms and devices to provide access not only to TV sets but also a full range of content, services, and data-driven capabilities to other devices, including desktop computers, laptops, tablets, mobile devices, and platforms.

6.2 Education

Education is the heart of public media, and its contribution to education—from early childhood through adult learning—is well-documented. Public media's content is regarded consistently as "most trusted" by parents, caregivers and teachers. As classrooms have become more connected, this content has become an even more valuable teaching tool.

By providing high-speed data over a vast geographic area at a significantly lower cost, as well as the capability to provide targeted content, interactivity, mobility, multichannel, cross-platform, high quality content and improved video and audio resolution, ATSC 3.0 stations will be well positioned to drive innovation in educational content -- especially in rural and lightly populated areas.

ATSC 3.0 has the potential to provide personalized and adaptive learning experiences through broadcast, which have not been heretofore possible. Today's learners want to be engaged where they are and want to participate in the creation and curation of their media and learning experiences. When educational courseware and related media content are designed to optimize cross-platform and cross-device interoperability, the value becomes even higher for all concerned.

This new broadcast standard with always-on connections will allow an engaged learner, using an ATSC 3.0 capable mobile device, to access enhanced content and experiences on their phone without data charges, buffering delays and building penetration issues. This will provide a premium experience that can advance educational goals and achievements, and better serve mobile-only audiences with high

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[17] Butts, Tom, "Nielsen Sees 'Resurgence' In OTA Households: Number of Households Labeled OTA Has Nearly Doubled in the Past Eight Years," *TV Technology*, January 15, 2019. https://www.tvtechnology.com/news/nielsen-sees-resurgence-in-ota-households.

quality educational content. Further, the power of an interactive session with educational content on a 4K, HDR, Dolby 65-inch smart TV would be an immersive and highly effective form of learning.

Connections between a local public media station and the community it serves are based on a foundation of collaboration and cooperation. Nowhere is this more evident than in the relationship with local schools and educational facilities. Public stations have played community leadership roles in efforts ranging from early childhood education to confronting the high school drop-out crisis. This trust, established across decades, between public media stations and local schools can accelerate the deployment of new services and access to new and/or non-traditional funding sources for public media. With innovative and unique content, delivered in new and creative ways through ATSC 3.0, the potential to improve educational outcomes is immense.

6.3 Public Safety

Public safety is a core mission of public media. Public television stations are the backbone of the nationwide Warning, Alert, and Response Network (WARN). Together with public radio stations, they ensure delivery of lifesaving alerts in times of national emergency. Stations are increasingly effective partners in the Emergency Alert System working with the U.S. Department of Homeland Security, state and local public safety, law enforcement, and first responder organizations to connect these agencies with one another, with the public, and with vital datacasting and meta-pub capabilities in times of crisis.

The features and functionality of the ATSC 3.0 standard are particularly well-suited to advancing the public safety work of public television stations. Using only a portion of the potential data capacity of the new standard, public television stations could offer first responders and emergency managers an enhanced array of public safety services in their respective communities, thus increasing public television stations' value to the community.

For example, the Next Gen TV standard will enable stations to provide real-time video, geo- targeting alerts and auxiliary data, such as evacuation routes and weather maps. Broadcasters will be able to send alert and warning services to mobile devices and "wake up" receiver devices when an emergency alert is transmitted, which will facilitate the dissemination of critical information, particularly at night, when severe weather or other emergencies may occur.

The FCC's Communications, Security, Reliability and Interoperability Council's (CSRIC) Working Group 2 June 2018 final report on "Comprehensive Re-imaging of Emergency Alerting"[18] identifies three ways Next Gen TV, and specifically public television, can support and improve emergency alerting. Section 6.4 of the Report provides an example of how a public television station can use the new broadcast standard to improve emergency alerting:

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[18] CSRIC Final Report on "Comprehensive Re-imaging of Emergency Alerting." June 2018
https://www.fcc.gov/files/csric6wg29junereportcomppdf

"Next Gen TV: Saving Lives One Alert at a Time, UNC-TV (North Carolina) won first place in the National Association of Broadcasters (NAB) Pilot Innovation Challenge for a proposal that uses datacasting technology in broadcast television to update outdated first responder emergency pagers. Initial stages show potential to decrease a fire station's time to respond to a given alert by nearly one minute for each notification. The project currently uses ATSC 1.0 to reach fire stations across the state. Once ATSC 3.0 broadcasting is implemented, updated receivers connected to mobile devices will allow mobile paging for first responders, even in areas where LTE service does not reliably reach."

The Report further states, "we believe that PBS stations and first responders can find even more ways to identify and utilize opportunities presented by ATSC 3.0."

6.4 Ancillary Uses of Spectrum

Increased spectrum efficiency allows for meeting stations' broadcast mission with the potential for ancillary use of any remaining spectrum.

Entities such as Spectrum Co and the Public Media Venture Group are working on business models that would monetize ATSC 3.0 capabilities in non-core (i.e., other than typical broadcast services) markets. There is concern that other delivery systems, either by existing Internet connections or the expanded capacity of 5G wireless transmissions, may not be enough to meet the potential demand.

Some non-core spectrum uses may provide additional revenue, while others are opportunities for public media organizations to provide expanded services to their local communities. Station leaders should be aware of market developments that warrant further exploration, including:

6.4.1 Third-party Distribution Networks

Content Delivery Network (CDN) providers have indicated their interest in ATSC 3.0's spectrum capabilities for adding cost-effective value to their services. For example, one well-known CDN provider briefed BIA and others about its potential interest in utilizing the last mile point-to-multipoint wireless IP data distribution capacity as a supplement to its existing data distribution solutions during periods of peak capacity demands.

6.4.2 Connected and Autonomous Vehicles

As the autonomous and connected vehicles market develops, critical communication systems and data flow requirements will expand. 5G networks' higher data speeds and lower latencies will play a major role in serving the autonomous car market. However, there may be roles for Next Gen TV.

With its mobile and IP capabilities, Next Gen TV can provide content and other data services for the connected and autonomous vehicle market segments. This could include providing news, educational, entertainment, and other content such as weather and traffic reports tied

to the vehicle's location. Next Gen TV can provide further enhancements to the in-car experience such as updating maps and Points of Interest databases.

Content. In-vehicle entertainment systems will have increased demand for high quality video, audio, and associated program services. ATSC 3.0 can carry and deliver high bandwidth solutions for the connected and autonomous vehicle fleet not only for commercial and public TV but also for other programmers and program services.

Data. ATSC 3.0 may not be an optimal exclusive platform for the estimated two million gigabits of data self-driving cars will require. However, the robustness of an ATSC 3.0 signal, coupled with typically low transmitter downtime, makes ATSC 3.0 viable as at least a baseline data provider to autonomous vehicles. This may be the case in areas where cellular infrastructure will not be sufficient to fully support these needs, including in areas where 5G deployment will lag. In those cases, ATSC 3.0 could fill some service or data capacity gaps. This could argue for the development of Next Gen TV and 5G hybrid solutions that take advantage of 5G's bidirectionality and Next Gen TV's one-to-many broadband wireless mobile capabilities. For example, ATSC 3.0 platforms will be able to offload a large amount of redundant one-to-one traffic from 4G and 5G networks to improve their ability to address data and delivery time requirements.

6.4.3 Additional Mobile Applications and Services

Given the expected broadband service value ATSC 3.0 can provide to a range of mobile devices and use cases, business opportunities are ripe for exploration and development beyond those specific to the connected and autonomous vehicle markets. There may well be incremental benefits and opportunities that public media could exploit with mobile-only business models. While many use cases can be formulated by local public media and perhaps even better by those operating statewide networks, other use cases and business models require a national footprint.

In addition to the need for ATSC 3.0 signals outperforming 4G and 5G mobile services for specific mobile applications, market access requires ATSC 3.0 chipsets to be in mobile devices. Since U.S. mobile carriers have enormous influence in what features and capabilities are built into the devices they sell and support on their networks, broadcasters need to work collaboratively with mobile carriers and device manufacturers to define the market and value proposition. To spur vendor action in a nascent market, Sinclair's ONE Media, with Saankya Labs, VeriSilicon and Samsung Foundry, developed a "System on a Chip" (SoC) that supports ATSC 3.0. Sinclair debuted the chipsets at the 2019 Consumer Electronics Show and offered to provide mobile operators millions of them for free for

inclusion in their mobile devices.[19] Initiatives like this can help jumpstart the adoption of ATSC 3.0 into mobile devices and by wireless carriers.

6.4.4 Wireless Networks

A related non-core use of spectrum could be informed by a practice in which public media entities associated with educational institutions have received Educational Broadband Service (EBS) licenses and are leasing excess EBS spectrum capacity to third parties. In many cases this capacity has been leased in long-term agreements to wireless companies, which are using it for broadband services such as 4G LTE.

In addition to past leasing arrangements, new data agreements could emerge. In a hybrid deployment model, the ATSC 3.0 broadcast signal would deliver video and rich media content while the LTE portion would be tasked with signaling and two-way coordination with the end user.

Whether through expanded lease arrangements or new data agreements, the commercialization of data can offer a public media station a reliable income source.

6.4.5 Telemedicine

Recognizing that security is paramount with respect to patient information, another potential business opportunity is telemedicine. Public television maintains a high level of public trust and has historically been a respected source of content about health-related issues. Using ATSC 3.0 and IP-enabled back channels, stations could provide specific, targeted information to qualified and authenticated users that may not otherwise be connected to the health care system.

6.5 Sizing Potential Financial Opportunities

Metrics regarding market size and growth forecasts for select business opportunity areas discussed are provided in this section. The market segments are all large and growing but have complicated ecosystems for public media to navigate and prioritize for potential service and revenue opportunities. The following chart highlights some market sizing data.

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[19] Frankel, Daniel, "Sinclair Launches ATSC 3.0 Chips at CES," *Multichannel News*, January 8, 2019. https://www.multichannel.com/news/sinclair-launches-atsc-chips.

Table 1. Sizing Potential Market Opportunities

Business Opportunity Area	Market Segment Sizing Indicators
Enhanced Audience Experience, Targeted Content	• Next Gen TV and content targeting in telemedicine education: The global telemedicine market, including tele-education and tele-training, will grow from $18.2 billion in 2016 to $38.0 billion by the end of 2022, nearly a 14.0% CAGR, led by North America. (Zion Market Research)
Education	• The U.S. e-learning market was worth more than $27 billion in 2016 across the two major segments of corporate and academic education. (Docebo, 2016) • The global mobile learning market will grow by a CAGR of 36.3% from $8 billion in 2015 to nearly $38 billion by 2020. (MarketsandMarkets)
Public Safety and First Responders	• The global mass notification system market will grow from $4.7 billion in 2016 to $23.3 billion by 2024. North America represents 46.8% of this market. It is growing at an overall CAGR of 22.9%. (Research Nester, May 2018) • FirstNet provides $6.5 billion in initial funding and 20 MHz of spectrum to build and operate a first responder network that will cost $40 billion over its 25 year life, according to AT&T. (AT&T, March 2017)
Third-party Distribution Networks	• The global CDN market was valued at $7.33 billion in 2017 and forecast to grow to $29.42 billion (26.1% CAGR) by 2023. The U.S. dominates this market. (Morodor Intelligence, March 2018)
Connected and Autonomous Vehicles	• The global connected car market will grow from $72.95 billion in 2017 to $280.36 billion by 2026, a CAGR of 16.1%. This market will be dominated by North America beginning in 4G, with 5G's capabilities offering new use cases. (Stratistics MRC)
Telemedicine	• The U.S. telehealth market is expected to grow to $19.5 billion in the 2017-2025 period, a 14.8% CAGR (Transparency Research, April 2018)

It is reasonable to expect that public television stations can generate meaningful revenue from expanded services after the initial capital expenditures to transition to ATSC 3.0. Increased sponsorships and enhanced underwriting might be possible as commercial broadcasters lead the way with enhanced advertising. Data delivery and spectrum leasing services can provide an additional revenue stream for some public television stations without additional cost. Expanded educational services could find willing sponsors for funding.

The opportunities discussed in this section appear plausible and attractive in the transition's initial planning stage. Which among them provide the most attractive return on the investments that public television stations must make in transitioning to ATSC 3.0? There is currently no clear answer. Further, the answer will ultimately vary from station to station. These opportunities are just beginning to take shape as entrepreneurial television groups and individual stations start exploring services they could provide through ATSC 3.0.

6.6 Section Summary

- When establishing strategies and expectations around ATSC 3.0, it is critical to do so in the context of your station's business plan, resources, governance, and risk tolerance.

- ATSC 3.0 allows broadcasters to offer attractive and engaging services to audiences that will stimulate more viewing and participation in new program-related services.

- With ATSC 3.0, it is possible to provide an enhanced set of public safety services suited to current and emerging priorities.

- Entities such as Spectrum Co and the Public Media Venture Group (in conjunction with Obsorn Infrastructure) are working on business models that would monetize ATSC 3.0 capabilities in non-core services.

- With its mobile and IP capabilities, Next Gen TV can provide content and other data services for the connected and autonomous vehicle market segments.

- ATSC 3.0 enables educational content innovation by providing high-speed data over a vast geographic area, at a cost significantly lower than cable and Internet providers, which is particularly relevant for stations in rural and lightly populated areas.

- The monetization of data capacity can offer a public media station the possibility of a reliable income stream.

- There is potential for opening additional funding sources to public media by providing new types of services to health care facilities.

6.7 Station Considerations

Potential Local Opportunities with a Transition to ATSC 3.0
1. What approach best fits into the strategic plan of your local public television station – improved and expanded television services or expansion into other non-core areas (e.g., educational, datacasting, telemedicine)?   2. What ATSC 3.0-enabled capabilities would best service your local community?   3. Are there other local organizations (e.g., local universities, local hospitals) that are interested in utilizing the capabilities of ATSC 3.0?   4. What new services are other local television stations pursuing? Are the station group owners indicating their intentions?

7.0 WHAT'S NEXT? CHALLENGES IN THE ATSC 3.0 TRANSITION

As mentioned earlier, adoption of the new standard is voluntary, it is not backward compatible, and local broadcast stations were *not* given any additional spectrum for the transition period. The process is complicated by the decision-making needed to determine the nature of each station's participation in their transition solution —either providing a) only ATSC 1.0 (the current TV standard), b) only ATSC 3.0 (the new standard), or c) both – and for what period of time before changing that configuration of service.

It is up to each TV broadcaster—whether public media, other noncommercial, or commercial—to decide whether to adopt ATSC 3.0. Those who do so must continue to provide an ATSC 1.0 service that is substantially similar to the main ATSC 3.0 program stream. Maintaining two broadcast signals can pose technical and operational challenges that require a degree of coordination and planning. The most common scenario is for the Next Gen TV broadcaster to use a "host" or "lighthouse" station operating in ATSC 1.0 mode to transmit that signal. As roll-out will be market specific, a host or lighthouse station can transmit several such streams, including their own, to meet this requirement.

Additionally, consumers will need to purchase new receivers in order to take advantage of the many new services that will be provided via the ATSC 3.0 signal.

7.1 Unique Challenges for Public Television Operations

Some public television stations may find the transition even more challenging due to their existing set up and location of facilities. For example, many public television stations are part of statewide networks. As will be discussed later, this might be problematic as certain stations in the statewide systems might not have other locally based television stations to cooperate with during the transition. Instead, these stations may opt to wait for several years before they decide to "flash cut" to ATSC 3.0, waiting for favorable regulatory and consumer adoption levels.

The issue of not having any other locally based television stations to cooperate during the transition is not only present with a statewide series of stations, but also with other public television stations that are not located near the center of a television market. The need to simulcast using the existing transmission technology while introducing ATSC 3.0 service will be severely hampered in these situations.

7.2 Operational Considerations

In addition to the challenges during the transition period, local public television stations must also consider the new requirements for their operation when they begin transmitting in ATSC 3.0 and all the possibilities inherent in that new system. ATSC 3.0 represents a completely new method of television content deployment. The move away from traditional transmission standards to the IP-based standards at the heart of ATSC 3.0 will offer enhanced service along with many new options and opportunities. The breadth of choice for more highly efficient use of spectrum and flexibility of the technology will require informed operational decision making.

As with any new technology, disruption to the status quo is inevitable. In this case, the disruption will be felt first at the individual station level. While every station within the public media system has similar goals, they vary widely in terms of staff, revenue and size of audience. There is no "one size fits all" approach that will work across the system, though at the same time, lessons can be learned from early adopters.

There are considerations, and some concerns, that should be at least recognized if not fully addressed at the individual station level as well as by the entire public broadcasting system.

1. **Technical Capability:** Capability for technical operations varies widely across stations. Many outside the major markets are still grappling with vestiges of the digital transition a decade or more ago. The initial digital transition focused on the transmission process, but because of the high costs involved, many smaller stations are still using analog equipment in other parts of their operation. Priority was given to the transmission system, often leaving the studio infrastructure and production capability for later. Content distributed nationally was given preference over in-house production. Now that it *is* "later," the ATSC 3.0 standard can leapfrog the entire technical plan; for some, completely disrupting their upgrade schedule and making recent purchases potentially obsolete well before the amortization date. This can be especially true for smaller market stations not moving to new channels in the ongoing repack.

2. **IP Infrastructure:** The IP infrastructure inherent to ATSC 3.0 is a computer-based protocol. Whereas many TV stations have traditionally used individual dedicated pieces of equipment for video processing, signal routing, audio recording and mixing, etc., all of these functions can now be done in software, using a small number of computers. If a station's upgrade plans have been merely upgrading or replacing existing equipment with new stand-alone pieces of equipment, the station may risk misplacing investment on equipment that will no longer be viable in a fully operational ATSC 3.0 facility.

3. **Engineering:** In-house engineering support and capability also varies greatly. Many stations, large and small, are experiencing a significant shortage of engineers because of retirements and/or lack of training in IP-related technique. This industry-wide shortage of technical staff poses a significant threat to a timely adoption of ATSC 3.0 even for well-funded stations, which might require outsourcing of some services and expertise that were previously staffed in-house.

4. **Business Strategies:** Further, institutional and business image problems may also arise. Should a public media station remain on ATSC 1.0 while all or most local commercial stations move to 3.0? This strategy carries with it some risk of the station being branded as obsolete in the eyes of audiences, underwriters, and other important constituencies. Stations sticking to a 1.0 strategy also forgo the potential for reaping benefits from new and/or ancillary ATSC 3.0-enabled business models. A delay in implementing ATSC 3.0 could be problematic in smaller markets where underwriting and other related revenue opportunities are limited, if almost all other broadcasters begin a transition much sooner.

5. **Operations:** For a local station, the potential benefits of ATSC 3.0's enhanced video and audio quality, immersive audio, geo-targeting of content or underwriting messages, expanded emergency services, mobile tracking, and multi-screen compatibility all come with their own set of technical challenges. The limited local production capability of many stations, in everything from camera resolution to set designs, and from editing software to digital storage space, is daunting. Many stations currently struggle to produce anything beyond stereo audio and existing HD video standards. Set design changes needed for compatibility across multiple screens pose another significant challenge to station production and technical staff. In the area of geo-targeting, the simple need to create additional content and promos to take advantage of the new features will raise the workload and output expectations of the station creative staff, which may create resource tensions.

These operational issues that arise from ATSC 3.0 speak to the larger issue of the local public television station's strategic vision and how this new technology's capabilities fit into that vision.

Local public television stations must first consider that question when evaluating transitioning to ATSC 3.0, and the timing of that transition. Overall, many public station staffs are completely focused on the heavy lift of day-to-day operations in the current broadcast environment. Moving to Next Gen TV will pose a different range of challenges to stations – from capacity to skill-matching. Few have the experience, the expertise, or simply the time to be able to deal with the additional demands of moving to ATSC 3.0, especially with the mandate to maintain 1.0 coverage in force for another three years. The luxury of adding new staff to focus solely on a rather disruptive transition is challenging at best to most stations – even the most well-funded and forward-thinking stations are challenged by resource constraints.

Looking outside of traditional and narrowly defined skill areas such as RF engineering, audio and video production, editing, linear storytelling, and content marketing will be important for finding employees able to take full advantage of what Next Gen TV has to offer. New hires with advanced computer literacy, coding and programming skills, and with understanding of interactivity, cross-platform interoperability and the integration of audio and video will be in great demand in the ATSC 3.0 environment. Public media should consider seeking new employees from fields such as IT, wireless, education, and even gaming.

7.3 Technical and Regulatory Considerations

The FCC issued its report specifying the rules governing the transition to ATSC 3.0 in November 2017.[20] As a completely voluntary transition, broadcasters are free to adopt ATSC 3.0 or not on a case-by-case basis, and there is no deadline for doing so. This adds uncertainty about the timeframe and level of adoption of Next Gen TV for all involved – stations, audiences, programmers, vendors, etc. Note that ATSC 3.0 licensing has just recently begun. The FCC started accepting 3.0 license applications on May 28, 2019.

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[20] See In the Matter of: Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard, GN Docket No. 16-142, November 20, 2017.

The FCC has provided some clarity around simulcasting and channel sharing arrangements. All station classes, including both commercial and non-commercial, will be permitted to participate together in simulcast arrangements. They are requiring broadcasters to partner with another local television station to simulcast on both 1.0 and 3.0, and, with respect to a station's "main" program service, the programming on the 1.0 simulcast channel must be "substantially similar" to the 3.0 channel. This means that the programming must be the same, except for features that are based on the enhanced capabilities of ATSC 3.0. The simulcast requirement will sunset five years from the date the new standard was approved, i.e. in November 2022, so broadcasters will be required to be simulcasting for only at most 2 to 3 years from their actual launch of ATSC 3.0 services. This industry-wide transition to ATSC 3.0 is beginning at the same time many local television stations are moving to new channel assignments as part of the spectrum incentive auction and repack process. As a result of the FCC auction in 2017, more than 1,000 local television stations are moving to new channel assignments, with the costs of that change in technical facilities being paid for through a federal appropriation administered by the FCC. The post-auction repack transition is scheduled to be completed in mid-2020.

As stations purchase new transmission and antenna equipment as a result of the repack, they can look to acquire state-of-the-art equipment that is compatible with ATSC 3.0 transmission. While local broadcasters may have to purchase additional equipment to accommodate the transmission standard, the costs of that transition will be less for the stations that were able to acquire compatible new equipment during the repacking process.

From a regulatory perspective, the government has not required, or mandated any urgency in, the adoption of Next Gen TV. It is up to individual broadcast entities to make this decision based on their own strategies and resources, and to base the timing of any transition on whatever urgency they may themselves perceive for bringing new services and revenue streams to market. It seems prudent, however, for all stations, no matter what their strategies and resources, to at least consider the pros and cons of adopting the NextGen TV standard and beginning a transition to its use throughout the station's operations and business models.

7.4 Section Summary

- Each public television station will have to consider their respective resources and priorities to determine the approach to ATSC 3.0 that works best for them, keeping in mind that lessons can be learned from public television's early adopters.

- Key operational areas impacted by the ATSC 3.0 transition include: technical capability, IP infrastructure, engineering, business strategies, and operations.

- Station hiring managers should seek new employees with specific forward-thinking skill sets. Retraining of existing staff will be essential.

- From a regulatory perspective, there is no requirement or urgency mandated by the government to adopt Next Gen TV.

7.5 Station Considerations

Public Media Considerations for Complying with FCC Regulations and Operational Challenges for ATSC 3.0
1. Do any of the other television stations in my local market have facilities that cover my city of license?
2. Do any of the other television stations in my local market reach at least 95% of the population that I presently cover?
3. Do any of the other television stations in my local market reach the headends of the local cable systems presently carrying my station?
4. Where can I find new employees with the necessary skill sets? How can existing staff be retrained to leverage the opportunities offered by ATSC 3.0?

8.0 ATSC 3.0 TRANSITION SCENARIOS

The ATSC 3.0 marketplace has achieved a state of readiness in terms of necessary pre-conditions such as required broadcaster and consumer side technology soon to be available in the marketplace to launch and scale businesses. What is still needed is an assessment of the different kinds of opportunities and which are best suited to achieve business strategies. Bottom line, the adoption curve for ATSC 3.0 in the U.S. is underway as we have seen in numerous demonstration projects, testbeds, industry collaborations, launches of ATSC 3.0 stations with experimental FCC licenses[21], and operational deployment in South Korea.

8.1 Logistics of Transition

Given the requirement for stations transitioning to 3.0 to maintain a "substantially similar" simulcast in 1.0, Next Gen TV broadcasters must support a 1.0 "main programming stream" service, adhering to FCC rules regulating TV broadcasting, but will also have some freedom to develop new and innovative services. The simulcast requirement will sunset in November 2022, unless the FCC decides to modify this decision. In addition, the 1.0 signal must continue to cover the station's community of license and reach at least 95% of the population it presently serves, though the FCC is open to granting waivers on that issue.

8.2 Channel Sharing

In order to continue transmitting under the 1.0 standard while also adopting the NextGen TV standard, a local television station must partner with another local television station and enter into a channel sharing agreement where one of the stations would continue to operate under the old standard, while the other would begin operations under the new standard.

The FCC report on the new standard covered the issue of transmitting an ATSC 3.0 signal while continuing to transmit an ATSC 1.0 signal and at the same time using different local television station signals.

These host stations could be configured as ATSC 3.0 stations and run program streams for one or more stations who want to commence Next Gen TV operations while using their primary transmission facilities for 1.0. Stations that want to convert the primary facilities to 3.0 could be served by 1.0 host stations so they meet the simulcast requirements. In either case, the station must still be providing an over-the-air program stream to their local community via the existing ATSC 1.0 technology.

The FCC also clarified the carriage requirements of public television broadcasters for the MVPDs during the transition. MVPDs will only be required to carry the ATSC 1.0 signals of all local television stations under the existing carriage rules but are not required to carry ATSC 3.0 signals. What that means for local public media

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[21] As of May 28, 2019 the FCC started accepting license applications for ATSC 3.0 transmission. See https://www.broadcastlawblog.com/2019/05/articles/fcc-starts-accepting-atsc-3-0-applications-the-next-generation-of-tv-transmission/.

stations is that if they opt to transmit their ATSC 1.0 signal on another local television station's signal, they must ensure that the other local station's signal covers the headend of the cable system.

Public media stations weighing a simulcast approach to ATSC 3.0 transition and seeking to identify a suitable simulcasting partner must also consider that the efficiency with which spectrum can be used will be different in 1.0 and 3.0 transmissions. Consequently, if a prospective simulcasting partner is already sharing its channel with other broadcasters, it may be less suitable as the partner on which to continue 1.0 transmissions if a public media partner also wants to continue offering program content that it has been offering on digital sub-channels in its 1.0 transmissions. This is not a matter of regulatory compliance, but one of fundamental business strategy.

8.3 Timing of Transition – Pros and Cons

Faced with the issue of simulcasting and entering into a channel sharing arrangement with other local television stations, public television stations have to consider if and when to transition to ATSC 3.0. There are advantages and disadvantages of making that transition early, similarly, advantages and disadvantages of waiting to make that transition. Some of the pros and cons of each pursuit are detailed in the two tables below.

Table 2. Pros and Cons of an Early Transition to ATSC 3.0

Pros	Cons
• Perception of being a leader in the local market • Early provision of expanded services to local market • Potential new revenue from expanded services • Forestalling local competitors in provision of non-broadcasting services (i.e., first-mover advantage) • Early opportunity to partner	• Few television receivers owned by consumers to receive new services • Equipment prices may be high due to manufacturing not scaled up yet • Necessity to be flexible and willing to "fail fast" or recalibrate as the technology, audience, and business opportunities become clearer.

Table 3. Pros and Cons of Waiting to Implement ATSC 3.0

Pros	Cons
• More consumers will have compatible receivers • Learn from early adopters as to best practices for implementation • Learn from early adopters as to most desirable expanded services • Potentially lower prices for equipment as manufacturers have geared up production	• Potentially frozen out from providing some services already provided by early adopters • Perception of technology laggard in local market • Delay in providing new and improved services to local communities • Delay in generating potentially new revenue from additional services.

Clearly, in determining whether and when to transition to ATSC 3.0, local public television stations must consider the full range of relative advantages and disadvantages while also considering relevant financial constraints. The potential for increased underwriting revenue, as well as revenue from non-broadcast uses of the spectrum, is quite uncertain.

8.4 Market-Based Transition

Since the transition to ATSC 3.0 is completely voluntary, the overall industry success will depend upon several factors. One such factor is the participation by local television group owners and how quickly they commit to broadcasting under this new standard. The commitment by the local television industry is key, as equipment manufacturers will be looking at the timeline for widespread 3.0 transmission as they consider producing compliant products.

The local commercial stations are well poised for this transition, as so many are either in markets with commonly owned stations or are affiliated with other stations through joint sales and shared service agreements. Common ownership as well as these other affiliations will lead to situations where one company can have their own ATSC 1.0 and 3.0 lighthouse or host stations.

Markets in which there are a few commonly owned or associated television stations, and thus with convenient channel sharing options, would seem to be the most likely early adopters. Markets in which there is considerable repacking of local commercial television stations are also likely early candidates for transitions, as new equipment purchased for that repack might make it less expensive for transitioning. Finally, larger markets may be early adopters as there may be more consumers who will purchase ATSC 3.0 receivers earlier due to higher incomes, and the revenue potential in providing new services may be greater in these markets.

Besides the market size and market participants' reasons for adoption, other local considerations will also play important roles: one consideration is the centrality of the stations' existing transmitters in the local markets. As mentioned before, for stations transitioning to 3.0, they must continue to service 95 percent of their existing service population with their ATSC 1.0 signal through some lighthouse arrangement. If many of the stations' transmission facilities are close to each other now, then ATSC 1.0 lighthouse arrangements can more easily be completed.

Other considerations could include the local market's economic health and whether or how quickly local consumers will buy ATSC 3.0-capable receivers. Markets that have a large percentage of households that only receive television programming over-the-air could also be markets in which the transition occurs earlier. Finally, markets in states with other markets already in the transition might also be candidates for early adoption, as broadcast companies can use the local knowledge and experience, and possibly employ statewide services such as emergency alert available in ATSC 3.0.

8.5 Section Summary

- While Next Gen TV is a voluntary transition, it is critical to keep in mind the various FCC regulations around it – including but not limited to simulcasting in 1.0.

- The simulcast requirement will likely remain for quite some time, so partnering with other local stations in a lighthouse arrangement could be a viable option.

8.6 Station Considerations

Public Broadcaster Considerations on **Your Local Market Transition to ATSC 3.0.**
1. Are other local television stations part of commonly owned, or commonly affiliated, groups?
2. Are other local television stations part of national groups that have been active in ATSC 3.0 testing and adoption?
3. Are the transmission sites of other local stations near one another?
4. Are the resulting coverage areas of other local stations similar in size and locations?
5. What are other television stations in my market saying about their plans to transition?
6. Are other local television stations committing some of their spectrum for data streaming services?
7. Do any other local television stations in my market have facilities that cover my city of license with market reach of at least 95% of the population that I currently cover?
8. Do any of other local television stations in my market reach the headends of local cable systems that currently carry my station?

9.0 CONCLUSIONS

As seen in the sections above, the issues surrounding a transition to ATSC 3.0 are complex and full of uncertainties. Clearly, some public media entities are already part of this transition, though the timing and involvement of other public media outlets will vary by each station's readiness to be involved and by what is occurring in the station's local market. Public media companies also need to stay on top of what the other local television stations and the groups that own those stations are planning for their own transitions.

Both commercial and public media entities look for investments in ATSC 3.0 infrastructure and services to pay off in both increased usage and growing revenues. Innovation in markets requires an embrace of the unknown in terms of what exact mix of business models will win, while accepting the risk and consequences of those models that come up short in the marketplace. Merely investing in the technology and developing new services will not guarantee success. Indeed, some public television stations may be better off waiting to learn from the early adopters and possibly to transition later, if at all. Nevertheless, being risk-averse and standing still, and not participating in the ATSC 3.0 market, may put those committed to sticking with ATSC 1.0 at a growing disadvantage.

While the legal and technical aspects of ATSC 3.0 adoption have been largely settled and widely disseminated, there are going to be further developments in both areas during the next few years. The current ATSC 3.0 tests and demonstration projects are providing the entire television industry with critical information about the technical capabilities of the new transmission system, as well as the potential for enhanced and new services. Public media companies need to stay on top of these projects.

Due to the complexity and the developments surrounding these demonstration projects, the operations of public media companies need to adapt. Equipment purchases and staff training need to be compatible with the new opportunities afforded by ATSC 3.0. In additional, public media stations need to think more broadly as to the types of services that they can provide. ATSC 3.0 could provide much-needed revenue streams for public media to support their overall mission (e.g., revenue streams for datacasting and/or for other improved and additional services, such as geotargeting, personalization, etc.).

One important aspect of the transition is the widespread support it has within the commercial television industry. The transition will be challenging, but the enthusiasm of the broadcast community is very important, as it emboldens the receiver manufacturers to begin production of ATSC 3.0-capable sets. In similar fashion, the television broadcast community is testing and examining many different business plans for enhanced and new services, many of which public media can also implement.

Aspects of this transition, amid a rapidly changing video marketplace, will require public media companies continuously to stay on top of developments around the country by monitoring advances both in their own markets and industry wide. Even if certain public television stations take a "wait and see" approach, they must make a concerted effort to see what other public and commercial television stations are doing and to learn from those efforts. Additionally, if they plan to move forward with the transition, public media stations

need to retool their capital equipment and train their staffs to take advantage of the many new opportunities afforded by the new transmission standard. By taking these steps, public media should be positioned to successfully transition to ATSC 3.0 and provide more services to their local communities, actively participate and embrace new platforms and technology, and ultimately further their mission.

10.0 NEXT GEN TV RECOMMENDATIONS FOR PUBLIC MEDIA

Regardless of the timing, adoption and implementation of ATSC 3.0 will happen for many, if not all, local television stations. At a minimum, public media stations should be considering the transition in every discussion and decision as soon as possible.

Critical issues:

1. **Strategy and Business Models:** For public media implementing the transition to ATSC 3.0, it likely will not be "business as usual." This implies that an acceptance for learning and executing new business models will be necessary. The ATSC 3.0 platform supports new capabilities and opportunities that can map into public media strategic plans and business models, which can be public service oriented and noncommercially motivated. However, commercially-oriented ventures that return scalable and sustainable revenue streams to public media can also be pursued.

2. **Personnel:** Key existing personnel and new hires should make a commitment to learning about ATSC 3.0 implementation and opportunities that incorporate both traditional elements of broadcasting and digital elements associated more with Internet services. Key personnel will need to understand what learnings that emerge from the various demonstration projects and tests will apply to their stations and areas of responsibilities.

3. **Industry:** Cooperation and collaboration will be essential. If not already in place, regular and continuing involvement with other local television stations, including both other public media entities and commercial operators, is highly recommended. Likewise, participation with industry technical groups and committees (e.g., SMPTE, IEEE, ATSC, SBE), as well as state and national broadcast associations, is advised to build relationships and foster understanding of the entire process.

4. **Governing Body:** As evidenced in both the analog-to-digital transition and the spectrum incentive auction, the more informed and prepared a station's governing body is, the more productive and less challenging the transition process can be. Many sources of relevant information in non-technical language are available to these governing bodies, ranging from trade associations and coverage in the general and trade press, to industry white papers and webinars for station personnel.

5. **Financial:** Stations not currently involved in the repack should not be lulled into complacency. Instead, they should begin planning now for changes and upgrades to the transmission chain. Stations involved in repacking and that have committed to transitioning to ATSC 3.0 should continue to ensure the remainder of the physical plant is ready for an IP-based infrastructure.

6. **Promotional:** The digital transition completed in 2009 provides many lessons on how to interact with station member/donors and viewing audiences. At a minimum, some form of additional converter box/router/dongle will be needed for reception on ATSC 1.0 devices. New antennas and displays may

also be necessary, particularly if a station seeks to focus attention on enhanced viewer experiences with higher-quality video and audio. Without a doubt, any new, high-quality equipment will entail incremental expenses for consumers. A station's promotional and marketing strategy should anticipate pushback and possible confusion and be prepared with well-thought-out messaging about alternatives for consumers to deal with the inevitable disruption of transition on a generational scale.

7. **Legal:** Should transition to ATSC 3.0 play out as planned, there will be many new activities in which local public media stations are not well-versed. Collaboration with commercial stations, non-broadcast data agreements, digital rights management and content streaming royalties, and cooperative agreements with other stakeholders will require experienced legal representation. Pursuing qualified counsel from the onset is prudent.

   Privacy is another legal consideration that has the potential to modify significantly—or even potentially to derail—many of the data-tracking aspects offered by ATSC 3.0. Enthusiasm for new technology should be tempered by a serious and healthy respect for the security of personal data. Public media has a long history of nurturing relationships with member/donors and audiences alike. This experience, along with growing sensitivity about privacy concerns, will need to be addressed at every opportunity during the transition process.

8. **Content:** The promise of ATSC 3.0 is vast. It is therefore unlikely that just one "killer app" will emerge. Rather, each station should focus on benefits that most closely match their market, their skill set, and their organizational plan. Stations that rely primarily on the national feed should consider ways to supplement network content with localized material. Producing stations should consider enhancing content to enrich the viewing experience. Given the lengthy funding cycles and ramp-up time necessary for high quality production, early planning is essential to ensure enough content is available to take advantage of the opportunities offered by ATSC 3.0.

Further resources: Find the latest information on ATSC 3.0 developments on the ATSC organization's website: https://www.atsc.org/

APPENDIX A: CURRENT ATSC 3.0 INITIATIVES

Pearl TV: Phoenix Model Market Initiative

About Pearl TV

Pearl TV is a business organization of U.S. broadcast companies with a shared interest in exploring forward-looking broadcasting opportunities, including innovative ways of promoting local broadcast TV content and developing digital media and wireless platforms for the broadcast industry. Its membership, comprising more than 220 network-affiliated TV stations, consists of eight of the largest broadcast companies in America including: Cox Media Group, the E.W. Scripps Company, Graham Media Group, Hearst Television Inc., Meredith Local Media Group, Nexstar Media Group, Raycom Media, and TEGNA, Inc.

Phoenix Model Market

Pearl TV established the Phoenix Model Market as, "an open test bed for the development of next-generation broadcast television – ATSC 3.0" (www.phoenixnextgentvnextgen.com). It is open to others beyond the initial group of companies and to new projects.

Public TV Role

- Arizona State University's Arizona PBS, KAET Channel 8 (PBS), was granted permission by the FCC to test ATSC 3.0 broadcasting from the transmission facilities of KFPH-CD (Univision).

TV Station Participants

Pearl TV identifies the following twelve Phoenix TV stations and their affiliations as participants in the Model Market ATSC 3.0 launch:

- Arizona State University's Arizona PBS, KAET Channel 8 (PBS)
- Arizona Television's KAZT Channel 7 (Independent)
- E.W. Scripps Company's KNXV Channel 15 (ABC)
- Fox Television Stations' KSAZ Channel 10 (FOX) and KUTP Channel 26 (MyTV Network)
- Meredith Local Media Group's KPHO Channel 17 (CBS) and KTVK Channel 24 (Independent)
- Nexstar Media Group's KASW Channel 49 (CW Network)
- Telemundo Station Group's KTAZ Channel 39 (Telemundo)
- Tegna's KPNX Channel 12 (NBC)
- Univision's KFPH-CD Channel 35 (UniMas) and KTVW-DT Channel 33 (Univision)

Project Goals

Pearl TV's technical goals include:

1. Confirming basic TV service parameters and performance, determining the appeal of next-generation high dynamic range video and immersive audio content to consumers, assessing TV application features and implementation requirements, testing interactive and addressable advertising functionality, determining consumer device and service appeal, and ensuring effective and efficient interoperability with multichannel video programming distributor (MVPD) systems.

2. Testing ATSC 3.0 television service and new business models, while continuing ATSC 1.0 operations and services.

3. Developing collaborations among commercial and non-commercial English and Spanish language stations, as well as maintaining the planned strategy.

4. Developing a framework to facilitate nationwide deployment of ATSC 3.0 service (including best practices).

5. Testing consumer devices as they become available.

6. Collecting real-time consumer input through surveys and focus groups.

7. Testing use cases for ATSC 3.0 delivered to passenger cars (planned for 2019 in association with Avis Budget Group).[22]

Key Learnings for Public TV

- ATSC 3.0 enabled business model insights and perhaps knowledge that could also be transferred to stations intending to continue ATSC 1.0 operations for the foreseeable future.

- Critical issues pertaining to technical and business agreements for ATSC 3.0 operations.

- ATSC 1.0 lighthouse operations and business opportunities for public TV stations.

- Magid conducted consumer research sponsored by Pearl showing that 91 percent of respondents are "interested" or "very interested" in ATSC 3.0. Pearl TV managing director Anne Schelle concluded

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[22] Kurz, Phil, "Avis Budget Group, Pearl TV to Launch In-Car 3.0 Phoenix Trial in Early 2019," TV Technology, October 16, 2018, https://www.tvtechnology.com/atsc3/avis-budget-group-pearl-tv-to-launch-in-car-3-0-phoenix-trial-in-early-2019/.

that, "Consumers find most value in the combination of features. The combination of Enhanced Video – 4K video with High Dynamic Range – and Immersive 3D Audio have the broadest appeal."[23]

- Outcomes specific to public TV include learnings about pace and complexity of decision-making in commercial versus public TV. Some industry executives interviewed for this paper stated that public TV entities need to streamline and speed-up decision-making or "be left in the dust."

- New kinds of commercial contracts and enabling language that can be supported by public TV stations' governance. For example, indemnification terms and conditions are common in commercial contracts but appear to be more of an issue for public TV entities.

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[23] Pearl TV: Picture, Audio Quality Biggest Draws for Next Gen TV," *TV Technology*, January 24, 2019. https://magid.com/pearl-tv-picture-audio-quality-biggest-draws-for-next-gen-tv/.

Spectrum Co: Dallas Single Frequency Network (SFN)

About Spectrum Co

Spectrum Co's president John Hane describes Spectrum Co as, "a platform for member television groups and stations to develop and operate significant new lines of business on their 6 MHz spectrum channels outside of the core OTA television service."[24]

Hane added that, "Spectrum Co is linking together hundreds of ATSC 3.0 stations to create a nationwide data network with unique capabilities and – unlike wireless carriers – no legacy businesses to protect. Spectrum Co will operate separately from and outside of the core OTA business, with its own back end systems, engineering teams and sales force. Even the largest groups cannot field the scale or expertise needed to enter such complex and fast-changing markets. Spectrum Co allows broadcasters to pursue opportunities that otherwise are just theoretical."

Dallas SFN Initiative

Spectrum Co is building a Single Frequency Network (SFN) in Dallas, TX to provide a unique testbed for broadcasters to learn how to make use of their 6 MHz spectrum in SFN configurations.

The construction phase on the ATSC 3.0 SFN comprising four tower sites in the Dallas market was completed in January 2019 by American Tower, who noted, "With these ATSC 3.0 deployments, it is critical to draw on expertise to synchronize SFN towers effectively, including integrating the network components, such as antennas, transmitters, and radios for optimum signal delivery."[25]

At this writing, Spectrum Co is targeting the Spring of 2019 for the operational launch date.

Public TV Role

No formal or announced involvement by public TV as of this writing.

TV Station Involvement

The original target stations for the SFN project in Dallas include:

- KDAF, Tribune Broadcasting CW affiliate (Note: The Tribune station was to participate under the assumption that Sinclair's acquisition of Tribune would go through. This was not the case and so KDAF has not committed to the project as it continues under Tribune ownership.)

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[24] "Spectrum Co's John Hane on ATSC 3.0 as Platform for New Business Opportunities," BIA Local Media Watch blog, September 25, 2018, http://blog.biakelsey.com/index.php/2018/09/25/spectrum-cos-john-hane-on-atsc-3-0-as-platform-for-new-business-opportunities/.

[25] Kurz, Phil, "American Tower Completes Construction of Dallas ATSC 3.0 SFN," *TV Technology*, February 1, 2019. https://www.tvtechnology.com/atsc3/american-tower-completes-construction-of-dallas-atsc-3-0-sfn.

- KSTR, UniMas station
- KTSD, independent TV station owned by Cunningham Broadcasting
- KUVN, Univision affiliate
- Other station(s) may join the initiative

Project Goals

Sinclair's Mark Aitken, who oversees this project, provided details regarding project goals.[26]

1. Develop and implement a project plan to test an ATSC 1.0 to ATSC 3.0 transition including spectrum clearing, channel sharing and broadcaster cooperation.
2. Establish three new SFN sites to host five local Dallas ATSC 3.0 stations in what Sinclair's Mark Aitken refers to as a "multi-channel, multi-tenant SFN."
3. KSTR and KTXD transfer ATSC 1.0 services to be hosted by others in channel sharing arrangement, including additional digital subchannels sometimes called diginets.
4. Provide network infrastructure to operate these facilities by establishing a "Next-Gen Broadcast Operations Center."
5. Stand-up main ATSC 3.0 transmission site (this was to be KDAF).
6. ATSC 3.0 and SFN service launched including all core and diginet channels for all stations participating.
7. Tie the main ATSC 3.0 transmission site into multiple SFNs.
8. Establish operations in the Dallas DMA as a remote site, with the idea that it would be just one of many such SFNs operating in multiple DMAs that would be serviced from a regional hub.

Key Learnings for Public TV

- Fred Baumgartner, Sinclair Broadcast Group's director of next-generation implementation, observed that while the "brick and mortar" elements had come together nicely and on schedule, clearing regulatory hurdles and making sure all the necessary paperwork reached the right people took time.[27] These hurdles included local zoning ordinances, determining optimum power levels and antenna changes.
- Coordinating with MVPDs who need to retune and make service changes.
- Lack of connectivity to the transmission sites is an issue, not all the required fiber is in place.
- Operational costs of backhaul service may be more expensive than broadcasters anticipated.
- Site construction costs and potential scale economies.

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[26] Kurz, Phil, "Q&A: Mark Aitken on Dallas Next-Gen SFN Trial," TV Technology, March 14, 2018, https://www.tvtechnology.com/news/q-a-mark-aitken-on-dallas-next-gen-sfn-trial.
[27] James O'Neal, "Dallas ATSC 3.0 SFN Buildout Nears Completion," *TV Technology*, May 31, 2018, https://www.tvtechnology.com/atsc3/dallas-atsc-3-0-sfn-buildout-nears-completion.

NAB PILOT and CTA: Cleveland ATSC 3.0 Test Station

About NAB PILOT and CTA

The National Association of Broadcasters (NAB) describes its PILOT initiative as, "a coalition of innovators, educators, and advocates dedicated to advancing broadcast technologies and cultivating new media opportunities." The Consumer Technology Association (CTA) hosts the annual CES tradeshow and serves its membership of companies and partners in the consumer technology ecosystem.

Cleveland ATSC 3.0 Test Station

Together, NAB PILOT, the Consumer Technology Association (CTA) and Tribune's WJW TV station in Cleveland launched an ATSC 3.0 test station operating under an experimental FCC license.

Public TV Role

No formal or announced involvement by public TV at this time. PILOT offers the Cleveland test station as an open environment and is accepting proposals for projects that could run over this testbed facility. Public TV stations are welcome to submit proposals.

TV Station Participants

Tribune's WJW TV station is hosting facilities for the testbed.

Project Goals

- NAB PILOT indicates, "The goal of this project, being co-sponsored and co-funded with the Consumer Technology Association, is to provide a testbed to establish 'proofs of concept' for various ATSC 3.0 elements and to act as an incubator for new products and services based on ATSC 3.0."[28]

Key Learnings for Public TV

PILOT reports these results obtained so far from the Cleveland test station that could be applicable for Public TV stations:

- Field tests of the ATSC 3.0 transmission system were conducted using a high VHF channel in early 2016. These were the first industry field tests of the ATSC 3.0 physical layer. The tests showed that the system works in the real world and found no "red flags" for operation in high VHF spectrum.
- Field testing of four different modulation/coding combinations of the ATSC 3.0 physical layer was conducted in February and March 2018. The field tests showed how the robust and flexible nature of the ATSC 3.0 standard facilitates tailoring service applications throughout a major metropolitan area.

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[28] NAB PILOT, November 27, 2018 https://nabpilot.org/atsc-3-0-test-station-in-cleveland/

Public Media Venture Group

About Public Media Venture Group (PMVG)

The Public Media Venture Group (PMVG) is a coalition of 27 public media television licensees representing 100 stations that reach 210 million Americans. Public Media Venture Group stations are committed to working together and investing collaboratively in "Next Generation TV" for the benefit of the American people. Public Media Company is a non-profit company that helps Public Media Venture Group stations plan an effective conversion to Next Generation TV (aka ATSC 3.0), build and develop new Next Generation operating models to expand local public service, and increase and diversify station revenue to support this expanded service.[29]

According to the Public Media Venture Group, it was formed to "explore revenue-generating joint ventures and partnerships, which will fund new streams of content and drive new public service capabilities."[30]

Partnership

In January 2019, the Public Media Venture Group and Osborn Infrastructure announced a partnership to, "develop, own, and operate a nationwide network of converging technology infrastructure platforms, including Single Frequency Networks and Next-Gen Broadcast and Data Center infrastructure."[31] This partnership also seeks to, "provide services to stations in support of their transition to ATSC 3.0, as well as the ongoing management of the infrastructure and related businesses."

Public TV Role

- Public Media Group and Public Media Ventures Group are exploring non-commercial and for-profit commercial opportunities for public media.

TV Station Participants

Stations in the Public Media Ventures Group include:[32]

- Alabama Public Television – Statewide Network
- Arkansas Educational Television Network – Statewide Network
- Cascade Public Media (KCTS) – Seattle, WA

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[29] Public Media Venture Group, November 27, 2018. https://www.publicmedia.co/pmvg/
[30] Public Media Venture Group, "Public Media Company Announces Public Media Venture Group, a coalition of public television stations focused on Next Generation TV."
[31] Public Media Company, "Public Media Venture Group and Osborn Infrastructure Partner to Deploy Single Frequency Networks Nationwide," January 14, 2019. https://www.publicmedia.co/public-media-venture-group-and-osborn-infrastructure-partner-to-deploy-single-frequency-networks-nationwide/
[32] https://www.publicmedia.co/wp-content/uploads/2017/10/Public-Media-Venture-Group-press-release_final-embargoed-until-14-Sept-2017.pdf. Stations in the PMVG, https://www.publicmedia.co/wp-content/uploads/2018/08/PMVG-Member-Station-List-08.27.18.pdf

- Georgia Public Broadcasting – Statewide Network
- ideastream – Cleveland, OH
- Iowa Public Television – Statewide Network
- Kentucky Educational Television (The Kentucky Network) – Statewide Network
- KERA – Dallas, TX
- KQED – San Francisco, CA
- KVIE – Sacramento, CA
- Nebraska Network – Statewide Network
- New Mexico PBS (KNME/KNMD) – Statewide Network
- Nine Network of Public Media (KETC) – St. Louis, MO
- PBS SoCal – Los Angeles, CA
- Rocky Mountain PBS – Statewide Network (Colorado)
- UNC-TV – Statewide Network (North Carolina)
- Utah Education Network – Statewide Network
- Vegas PBS – Las Vegas, NV
- WCTE – Cookeville, TN
- WETA – Washington DC
- WFYI – Indianapolis, IN
- WGBH – Boston, MA
- WJCT – Jacksonville, FL
- WKAR – East Lansing, MI
- WNET – New York, NY
- WOSU – Columbus, OH
- WTTW – Chicago, IL

Project Goals

According to PMC's Mark Hand, PMVG will focus its energies in three key areas:[33]

- **Technical support and guidance**. Helping stations navigate the operational challenges of the 3.0 transition and repack will be critical. Focal points potentially include 1.0/3.0 delivery strategies, lighthouse agreements, equipment purchasing, and working with commercial broadcasters.

- **Media industry coordination**. Public broadcasting is somewhat unusual in that all stations are locally owned and operated. This helps make public media unique but also presents some challenges when many of the other media players are large commercial groups with decisions made at the national

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[33] ATSC, "Chat Room: Public TV Stations Ready ATSC 3.0. Plans," The Standard
https://www.atsc.org/newsletter/chat-room-public-tv-stations-ready-atsc-3-0-plans/

rather than local level. The PMVG will be a bridge between local stations and the commercial and noncommercial entities that are embracing Next Gen TV.

- **New opportunity development**. Ultimately, the PMVG represents the group that will develop and implement new business and social impact opportunities for their stations and communities in the areas of education, public safety, local service, B2B (business-to-business) and government, or even new opportunities that have not yet fully emerged. The PMVG will be a catalyst to generate, develop, test and implement new content and service opportunities for public broadcasters.

Key Learnings for Public TV

While still underway, we will point back to the PMVG's three goals to suggest what key learnings will emerge for Public TV: technical support and guidance, media industry cooperation and new opportunity development. As with the PMVG-Triveni Digital strategic partnership, these new opportunities will embrace commercially oriented ventures expected to generate a positive return on investment.

Michigan State University (MSU): WKAR and NextGen Media Innovation Lab

We call out WKAR's ATSC 3.0 initiatives in a separate section of this report. Key aspects are highlighted in this summary section.

About WKAR

WKAR Public Media comprising radio and TV entities is licensed to Michigan State University and has a history of being technologically innovative on both the public radio and public TV sides of its operations. In June 2018 MSU and WKAR announced its award from the FCC of a license to launch an experimental ATSC 3.0 station that was put on the air shortly thereafter.

WKAR and NextGen Media Innovation Lab

The FCC's award of the experimental ATSC 3.0 station license to MSU and WKAR provides the key resource as a testbed for the new NextGen Media Innovation Lab. The lab is a new research facility within WKAR and the College of Communication Arts and Sciences on the MSU campus. The lab will have an emphasis on outcomes related to education and public media content.

WKAR's first application was to provide rich media access to households without Internet connections. WKAR used the station-produced "Curious Crew" children's science program to kick-off. On the station's website a variety of supplementary material is offered. This is now bundled into the Next Gen transmissions. A second use case is to use ATSC 3.0 to pre-position content rather than relying on the Internet.

MSU's communication college dean, Prabu David, said, "For Curious Crew, the broadcast application will prompt parents to provide the age of the child, which will enable content tailoring. Further, Curious Crew holds many outreach events in the community to spark engagement. The standard program may offer a generic interstitial that promotes community events in the viewing area, whereas the experimental broadcast may provide interstitials geotagged to a specific area, perhaps by zip code."[34]

Public TV Role

- WKAR will offer the opportunity to test ATSC 3.0 applications and share findings to the public media community and other interested parties.

- Other non-commercial education TV stations are welcome to submit proposals for further collaborations.

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[34] David Prabu, "WKAR's ATSC 3 Test Station Taps the Potential of Next Gen TV," NAB PILOT blog, December 11, 2018. https://nabpilot.org/wkars-atsc-3-test-station-taps-the-potential-of-next-gen-tv/

TV Station Participants

- WKAR operating with an ATSC 3.0 experimental license on Channel 35.

Project Goals

MSU and WKAR highlighted goals for the NextGen Media Innovation Lab:

- The experimental license offers MSU and WKAR a test bed to explore new media innovations in education, information and even autonomous vehicles in depth and in the field.

- Specifically, it will focus on early childhood education; telemedicine and distance education; connected and autonomous vehicles; agriculture; emergency response; and sharing of local information.

Key Learnings for Public TV

The NexGen Media Innovation Lab will focus on technology, program and services innovation, education and public media content and generally the creative possibilities ATSC 3.0 engenders.

University of North Carolina (UNC): UNC-TV Public Media North Carolina

About UNC TV Public Media North Carolina

UNC-TV Public Media North Carolina's 12 stations comprise the only statewide broadcasting network providing four full-time digital channels: UNC-TV, North Carolina Channel, Rootle and Explorer Channel.

Next Gen TV Emergency Relay: Public Safety Datacast Paging

UNC-TV's Public Safety Datacast Paging project demonstrates a system for using ATSC 3.0 to increase the interoperability, reliability, and dependability of current paging systems in use by North Carolina's public safety community including Fire and EMS services. UNC-TV won first place in NAB's 2017 PILOT Innovation Challenge for "creative ideas that leverage technological advances in the production, distribution and display of engaging content."[35]

UNC-TV's emergency system relaying statewide emergency notifications from a 911-dispatch center via ATSC 3.0 was successfully tested over-the-air in Raleigh, NC on May 17, 2018.[36]

Public TV Role

UNC-TV Public Media North Carolina is taking the initiative to apply its infrastructure and operational services to support public safety communication.

TV Station Participants

- WRAL-TV Raleigh, NC (NBC affiliated owned by Capitol Broadcasting)
- UNC-TV Public Media North Carolina

Project Goals

UNC-TV's senior director of technology, Fred Engle, stated the overall goal of this initiative, "was to provide a text-based protocol that would provide instant alerts to first responders' pagers and help reduce delays in providing follow up alerts. And providing text alerts would allow those first responders to better retain the information. Cellular was not an alternative because insurance carriers do not recognize cellular as an approved method of delivering this kind of message to first responders."[37]

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[35] "NAB Names UNC-TV Winner of 2017 PILOT Innovation Challenge," UNC-TV
https://www.unctv.org/about/pressroom/nabaward/
[36] "Using Emerging Broadcast Technologies to Save Lives," UNC-TV, May 23, 2018
https://www.unctv.org/about/pressroom/testsuccess/
[37] Tom Butts, "PILOT-Ing A New Communications Option for First Responders," TV Technology, September 6, 2018
https://www.tvtechnology.com/opinions/pilot-ing-a-new-communications-option-for-first-responders

UNC-TV's specific objectives for the demonstration project[38] for utilizing ATSC 3.0 to improve on first responder paging alerts included increased understanding of the following:

- Digital delivery of information greatly increasing the speed of reception, thus, decreasing response times.
- Datacasting capacity allows for dozens of separate dispatches within milliseconds.
- A centralized paging system serving a large region decreases mutual aid requests.
- A larger coverage footprint allows departments to notify members outside their jurisdiction.
- Utilizing transmitting infrastructure already in place.
- Receivers can also support live audio streaming, video, data files, maps, and sensor data.

With the approach of ATSC 3.0 this concept can be expanded to reach beyond to other first responders both in the field and at fixed locations.

Key Learnings for Public TV

- Statewide public TV organizations provide a valuable and existing infrastructure that can be utilized by the first responder community to improve speed, reliability and coverage for its dispatching alerts and related data.
- ATSC 3.0 offers enhanced capabilities to the existing ATSC 1.0 infrastructure for first responder applications that often rely on legacy emergency paging systems.
- Collaborations among commercial and non-commercial broadcasters with state level information technology and public safety agencies can bring game-changing solutions via ATSC 3.0 for better mobile data applications and better structure penetration.

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[38] Allan Sadwoski et al., "Public Safety Datacast Paging," UNC-TV, February 13, 2017
http://files.unctv.org/pdf/Public_Safety_Datacast_Paging_v2017.02.13.pdf

News-Press & Gazette

About News-Press & Gazette

The News-Press & Gazette owns or operates 45 TV network affiliates in ten midwestern and western markets. KEYT is the News-Press & Gazette's ABC-affiliated TV station in Santa Barbara, CA (Market #124). KEYT launched its ATSC 3.0 TV station on October 5, 2018. KEYT reports that, "The federal government gave KEYT approval for this new station. It will use KSBB-CD 17 in Santa Barbara that until now provided the over-the-air signal for KKFX Fox 11 and KCOY 12 (CBS). That signal will now be used for this new technology."[39]

Small Market ATSC 3.0 Commercial TV Station Launch

News-Press & Gazette, with assistance from the NAB and Pearl TV, decided to launch ATSC 3.0 service to improve its offering to viewers. Responding to the recent natural disasters in California, co-owner Eric Bradley says, "This new standard will allow us to deliver highly localized news and emergency information to an even wider variety of devices. That means faster alerts when there is potential danger."[40]

Public TV Role

No formal or announced involvement by public TV at this writing.

TV Station Participants

- KEYT (ABC)
- KSBB-CD 17

Project Goals

NPG's goals include:[41]

- Demonstrate viability of ATSC 3.0 for smaller TV markets.
- Offer viewers access to information, entertainment and data services using applications as they do on smartphones, computers and over-the-top devices such as Roku, Apple and Android TV.
- Television programming, video on demand, and wireless data services will be available without paying for data download charges wherever broadcast transmitters reach today.

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[39] Kacey Drescher, "New Media Technology 'Next Gen TV' Launches in Santa Barbara: Small Market Makes Big Leap," KEYT.com, October 5, 2018 https://www.keyt.com/lifestyle/technology/new-media-technology-next-gen-tv-launches-in-santa-barbara/803222602

[40] "The First Small Market ATSC 3.0 Television Test is a Success," RBR-TVR, October 12, 2018 https://www.rbr.com/the-first-small-market-atsc-3-0-television-test-is-a-success/

[41] "Road to ATSC 3.0: Spotlight Santa Barbara," The Standard, ATSC https://www.atsc.org/newsletter/road-to-atsc-3-0-spotlight-santa-barbara/

- Supporting economic development and community improvement efforts in its markets.

Key Learnings for Public TV

- Understanding the challenges and opportunities in NPG's repurposing of KSSB-CD to become an ATSC 3.0 platform for KEYT.
- Vendors supporting this initiative include GatesAir, Unisoft, TitanTV and Triveni Digital who may be able to offer insights for smaller market non-commercial stations and their ATSC 3.0 launch plans.

WatchTV

About WatchTV

WatchTV Inc. is based in Portland, OR and operates low power TV stations.

WatchTV ATSC 3.0 Distributed Transmission System (DTS) Experimental Broadcasts

WatchTV, based in Portland, OR, was initially granted a six-month experimental license from the FCC on February 14, 2017 to commence ATSC 3.0 broadcasts on multiple frequencies using a Distributed Transmission System (DTS).[42] Sinclair Broadcast Group has offered support for this experimental broadcasting project.

Public TV Role

No formal or announced involvement by public TV as of this writing. However, WatchTV announced that it welcomes interested industry parties, including manufacturers, broadcasters, content purveyors, software developers, and others, to observe and to join in the testing process.

TV Station Participants

The primary signals of WatchTV's four Class A low-power TV stations will be carried by a fifth WatchTV station, KOXO-CD. The four stations involved in the ATSC 3.0 broadcasts are:

- KORS-CD
- KOXI-CD
- KKEI-CD
- KORK-CD

Project Goals

According to WatchTV's experimental DTS application[43] the five objectives of the experiment are to:

- Learn more about the propagation characteristics of ATSC 3.0 by implementing the technology in a geographic area with much more uneven terrain than exists in the Washington-Baltimore area, where Sinclair Broadcast Group, Inc. conducted its recent experimental operations.

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[42] Deborah D. McAdams, "FCC Ok's WatchTV ATSC 3.0 DTS Experiment," *TV Technology*, February 17, 2017, https://www.tvtechnology.com/news/fcc-oks-watchtv-atsc-30-dts-sta.

[43] WatchTV, Inc., "Experimental DTS Application," http://files.constantcontact.com/a5c115f0401/fbcd0a66-c117-4a07-a1f6-1f7ad3848a8b.pdf.

- Explore the capacity of the ATSC 3.0 platform to deliver multiple data services along with television programming in multiple formats, including Ultra-HD (4K).

- Explore the benefits of a multi-frequency network for multiplying the data capacity of the ATSC 3.0 technology across four channels, since previous experiments have focused on single-frequency networks using only one television channel. WTV's program will be the first experiment in which spectrum will be available to test spreading data across multiple TV channels while each channel is also transmitting single-channel video content.

- To explore the benefits of distributed antenna systems by transmitting simultaneously from three transmitter sites initially, with the possibility that a request will be filed at a later date to add more sites.

- To explore the robustness and capabilities of a multi-frequency system to deliver video and other content to mobile receivers.

Key Learnings for Public TV

- Use of Distributed Transmission Systems using commonly located multiple TV stations broadcasting ATSC 3.0 from three sites.
- Spreading data across multiple TV channels while transmitting single-channel video content.
- Learnings about propagation characteristics of ATSC 3.0 in uneven, rugged terrains.
- Robustness and capabilities of a multi-frequency system to deliver video and other content to mobile receivers.
- Capacity of ATSC 3.0 platform to deliver multiple data services in multiple formats.
- How to work with partners and vendors on such implementations, including: Sinclair Broadcast Group, TeamCast, Comark, GatesAir, Acrodyne.

Capitol Broadcasting: WRAL TV

About WRAL TV

Capitol Broadcasting's WRAL-TV operation has long been a pioneer in technology and advanced services in the TV industry, and ATSC 3.0 is no exception. WRAL achieved another milestone on June 29, 2016 with the nation's first launch of a live simulcast of a commercially licensed ATSC 3.0 station. Similarly, WRAL was the first U.S. station to go on the air with ATSC 1.0 the original digital TV standard.[44]

Next-Gen TV

WRAL-TV began operating ATSC 3.0 broadcasting on channel 39 on June 29, 2016 with an experimental FCC license. WRAL-TV has undertaken several initiatives with its Next-Gen TV capabilities including working with UNC-TV for providing datacasting support for emergency first responders and broadcasting the 2018 Olympics held in South Korea. WRAL has an active set of development and demonstration projects.

Public TV Role

WRAL collaborates with UNC-TV for first responder communications.

TV Station Participants

- WRAL-TV
- UNC-TV

Project Goals

- Deliver 4K UHD signals
- On-Demand content
- Interactive services combining broadcast and Internet connectivity
- Access to multiple sources of video to enhance linear viewing
- Provide multiple 24/7 streams of TV and radio programming
- Collaborate with statewide public TV network to provide emergency communications and data to first responders.

Key Learnings for Public TV

WRAL assembled a team of vendors to design, test, and implement its ATSC 3.0 programs. These vendors are leaders in the technology and participate in many of the projects and initiatives we highlight in this report. In

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[44] WRAL Begins Next-Gen TV Broadcast, WRAL.com https://www.wral.com/wral-tv/video/15816810/

addition to WRAL itself, there are several vendors with whom WRAL has worked and that public TV stations might look to for thought leadership, design, and deployment experience in ATSC 3.0 including:

- Electronics Research Inc. – Antenna and Filter assembly
- GatesAir – Transmitter and exciter
- Harmonic – UHD real-time broadcast encoder
- Keepixo – Dash Packager
- LG Electronics – ATSC 3.0 receiving equipment
- Meintel, Sgrignoli & Wallace – Consulting engineers
- Monroe Electronics – Emergency Alert System technology
- Triveni Digital – Signaling, transport generator, ATSC 3.0 analyzer, and system integration support.

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