Update on Broadcast Spectrum Auctions and Repacking
Considering the government’s planned broadcast spectrum recapture process and possible implications for public media

• Today, CPB and Booz & Company will cover:
  – Auction context and project background
  – Station decision-making
  – Auction impact drivers and expected results
  – If/then scenarios for considering possible responses
  – Next steps
The FCC allocates spectrum for a variety of uses in the U.S., with 49 channels allocated for TV broadcasting.

<table>
<thead>
<tr>
<th>Increasing Range</th>
<th>Decreasing Range</th>
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<tbody>
<tr>
<td>VHF</td>
<td>LF</td>
</tr>
<tr>
<td>Very Low Frequency</td>
<td>Low Frequency</td>
</tr>
<tr>
<td>3 KHz–30 KHz</td>
<td>30 KHz–300 KHz</td>
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</table>

- Maritime navigation signals
- Navigational aids
- AM radio
- Radiotelephone
- Aviation air to ground com.
- VHF TV
- FM radio,
- Nav. aids
- UHF television
- Cellular phone
- GPS
- Space and satellite com.
- Radio astronomy

TV Allocation Range (~ 55 MHz–692 MHz)

TV Tower
294 MHz of Spectrum Is Currently Allocated to TV Broadcasters

TV Station
This Amount Is Divided into 49 Station Channels of 6 MHz Each

TV
One 6-MHz Channel Can Carry Multiple Streams of Programming As "Virtual Sub-channels"
In recent years demand for wireless broadband service has increased rapidly, driving up demand for spectrum in turn.

**U.S. Smartphone Penetration**

- **2010**: 63 million users, 27% penetration
- **2011**: 93 million users, 39% penetration
- **2012E**: 116 million users, 48% penetration
- **2013E**: 138 million users, 56% penetration

**Monthly Mobile Data Exabytes/Month North America, 2012–2017**

- **2012**: 0.2 exabytes
- **2013E**: 0.4 exabytes
- **2014E**: 0.6 exabytes
- **2015E**: 1.0 exabytes
- **2016E**: 1.5 exabytes
- **2017E**: 2.1 exabytes

Exponential Growth of Data Volume Drives Bandwidth and Spectrum Demand

+56.5%
In light of these trends, the FCC has set a goal of reallocating 40% of current television spectrum to wireless services.

### Current State of Broadcast Television

- **Current broadcast television is highly localized**, providing for the needs of individual areas.
- **~ 10%–20% of U.S. households** rely *only* on over-the-air (OTA) broadcast TV.
- Reliance solely on over-the-air signal **varies significantly** by geography and demographics.
- Cable and satellite providers rely on OTA signal to access content for redistribution.

### Timeline

- **2010**: FCC set a goal of reallocating 120 MHz of TV broadcast spectrum – approx. a **40% reduction**.
- **2011**: Congress authorized FCC to conduct **incentive auctions**.
- **2015**: The reverse auction is scheduled to take place in mid-2015.
To achieve this, the FCC will move some stations to different channels so it can clear a contiguous block. In some areas, the FCC will offer auction incentives for stations to give up their spectrum.

To Fulfill Target Goal of Freeing Up 120 MHz, a Minimum 4 Channels Need to Give Up Their UHF Spectrum

Cleared for Wireless Use
Proposed FCC auction and repacking process

- **Reverse Auction**
  - Licensees can decide *voluntarily* to bid to relinquish a station’s spectrum by choosing to:
    - Trade a UHF channel for a VHF channel
    - Share channel with another station (for both UHF and VHF channels)
    - Stop broadcasting on that station

- **Repacking**
  - Stations can be *involuntarily* moved to a different UHF channel to either clear contiguous bands of spectrum for wireless use, or to avoid interference as a result of another station being moved
  - FCC reimburses stations for expenses directly driven by moving to a different channel

- **Forward Auction**
  - FCC sells spectrum for wireless broadband to the highest bidder, market by market
  - If FCC can’t collect enough revenue to cover all costs, including reverse auction proceeds, repacking, and auction administration then the forward and reverse auctions will be cancelled

Areas impacting broadcasters
CPB actions to date

- CPB has worked with APTS and PBS to file formal comments with the FCC, and CPB executives and staff have met with FCC commissioners and staff during:
  - 2009 - 2010 — preparation of National Broadband Plan
  - 2010 - 2012 — rulemaking on channel-sharing
  - 2012 - 2013 — rulemaking on incentive auctions and spectrum repacking
Booz & Company provided policy research and an assessment of the implications for public broadcasting

August 12

<table>
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<td>▪ Expected auction demand across markets</td>
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<td>▪ Options for rationalizing channels by stations</td>
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<td>▪ Potential programming and distribution implications</td>
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<td>▪ Potential impacts to public broadcasting funding practices and mission</td>
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<th>Data Gathering and Discovery</th>
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<tr>
<td>▪ Policy and market research</td>
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<tr>
<td>▪ Expert and stakeholder interviews/consultation</td>
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<tr>
<td>▪ Station executives</td>
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<td>▪ Additional industry experts</td>
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<td>▪ Dynamic inquiry</td>
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<td>▪ Auction impact assessment at station level</td>
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<td>▪ Consolidation and documentation of findings</td>
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<td>▪ Presentation to senior stakeholders</td>
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Booz & Company Approach

Final Report

Impact Assessment and Modeling

Data Gathering and Discovery

Initial Auction Assessment

Spectrum: 9
What we heard in talking with station executives

• Station executives’ **understanding of the auction and repacking process varies widely**
• They **have no consistent way of gauging whether an auction will occur** in their market
• Some are **open to participation in the auction**
• Most **believe that continuing to offer multicast, over-the-air channels is critical** to their public service mission
  – Diversity of content for under-served audiences
  – Preferred or accessible distribution for under-served communities
• There is mixed concern about interference in the VHF band, and **some are considering a move to VHF**
Auction context and project background

Decision-making framework for stations

Auction impact drivers and expected results

If/then scenarios for considering possible responses

Next steps
Stations have four options where auctions occur

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
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<tbody>
<tr>
<td>A</td>
<td>Do Not Bid</td>
</tr>
<tr>
<td>B</td>
<td>Give Up Spectrum and Shift to a Lower Band</td>
</tr>
<tr>
<td>C</td>
<td>Offer to Share Spectrum</td>
</tr>
<tr>
<td>D</td>
<td>Offer to Give Up Spectrum and Stop Broadcasting</td>
</tr>
</tbody>
</table>

- **Do Not Bid**: Do not participate in any way in auction process.
- **Give Up Spectrum and Shift to a Lower Band**: Submit a bid to move to VHF channel (for UHF stations) or low VHF (for high VHF stations), giving up rights to current spectrum. May be accepted by FCC in the case where offer price is low enough and insufficient space is available for simple repacking.
- **Offer to Share Spectrum**: Create a contract with another station to share a channel. Submit a bid to relinquish spectrum and participate in auction. With channel partner, develop plans to share spectrum, auction proceeds, and operating costs. Does not require station consolidation. Partner could be either a public or commercial broadcaster.
- **Offer to Give Up Spectrum and Stop Broadcasting**: Submit a bid to simply give up spectrum. Could apply to a subset or all of 6-MHz channels. Licensee could move some programming to broadband distribution, arrange for cable distribution instead of broadband, or simply cease programming distribution.
Historical transactions suggest a wide range of prices is possible

Historical Payouts in $ / MHz-Pop

- $0.13
- $1.00
- $2.00
- $3.00
- $4.00
- $5.10

- Historical broadcaster acquisition prices
- Historical payouts for wireless spectrum (auction 73)

**Market dynamics affecting pricing**

- Level of market congestion
- Likely number of bidders and resulting competition
- Auction mechanics
Option A: “Do not bid” implications

- Station does not submit a bid, does not receive any auction proceeds
- Stations in uncongested markets will not be able to participate, though they may attempt to
- Station may still be repacked, and is entitled to repacking reimbursement from FCC if so

<table>
<thead>
<tr>
<th>+</th>
<th>Pros</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Maintain full multicast channel mix</td>
</tr>
<tr>
<td></td>
<td>Maintain option to leverage spectrum using future technology (e.g., ATSC version 2.0 on-demand capabilities, mobile broadcasting)</td>
</tr>
<tr>
<td></td>
<td>Maintain option to participate in any future (speculative) 600-MHz spectrum auction</td>
</tr>
<tr>
<td></td>
<td>Avoid costs associated with participation and unsuccessful bid</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>-</th>
<th>Cons</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>For struggling stations, the auction could improve financial sustainability</td>
</tr>
<tr>
<td></td>
<td>If the reverse auction is not successful Congress may instruct the FCC to free spectrum involuntarily with no compensation</td>
</tr>
<tr>
<td></td>
<td>Stations could arrange with service providers for participation costs to be contingent upon a successful bid</td>
</tr>
</tbody>
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Option B: “Migration to lower band” implications

- Station bids to move from UHF to VHF or from high VHF to low VHF
- Station’s full broadcast channel is preserved

**Pros**

- Preservation of same must-carry and will-carry cable rights and broadcast channels
- 60% average lower power consumption for VHF versus UHF
- Avoidance of channel interference from tightly-packed UHF post auction

**Cons**

- Higher environmental interference rate in VHF
- Potential drop-off in viewers due to loss of signal penetration
- Viewers may not own VHF antennas
- Potential loss of access to mobile distribution
- Complex transition costs and operations
UHF move to VHF: Decision tree

- **UHF Congested Market?**
  - **No**
  - **Yes**
    - **> 1 VHF Stations in Market?**
      - **No Auction**
        - **Are You Financially Stable?**
          - **No**
            - **VHF Helps Maintain Grants, Cable Carry Rights**
          - **Yes**
            - **High Risk of Viewer Loss with VHF Option**
      - **Yes**
        - **Urban or Rural**
          - **Rural**
            - **VHF May Have Low Loss, High Payout**
          - **Urban**
            - **Measure VHF Against Other Options**

- Existence of other VHF stations belies potential viewer VHF antenna ownership
- Rural VHF signal loss is significantly less than in urban environments
- FCC may allow boosted power in VHF, but this may not negate signal loss
- FCC has expressed interest in allowing bids to move to high VHF only
Option C: “Channel sharing” implications

- Station bids to share with another station in the same market
- Station must reduce either the number of multicasting channels or the visual quality of the programming (or both)

<table>
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<tr>
<th>Option Details</th>
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<table>
<thead>
<tr>
<th>+ Pros</th>
</tr>
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<tbody>
<tr>
<td>Potential reduction in operating expenses if partner has comparable transmission cost</td>
</tr>
<tr>
<td>No fear of losing viewers due signal penetration or antenna type</td>
</tr>
<tr>
<td>May access more customers if moving to new antenna with higher output power</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>- Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely reduce # of channels broadcast and # carried on cable; membership revenue loss may result</td>
</tr>
<tr>
<td>Potential loss of coverage area if moving to a new tower location or antenna height</td>
</tr>
<tr>
<td>May need to reduce image quality due to compression</td>
</tr>
<tr>
<td>If multicasting with partner with much higher transmission cost, operating expenses may go up</td>
</tr>
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Three alternatives for channel sharing

Public Station Option

Share with Commercial Station
- **Pros**
  - Many potential stations to share
  - Greater diversity of stations—more negotiation flexibility
  - Public stations likely own tower
- **Cons**
  - Concerns if partner goes out of business
  - Savings limited to broadcasting ops.
  - Portion of auction proceeds exits public media

Loose Collaboration with Public Broadcaster
- **Pros**
  - Auction proceeds stay public media
  - Option to increase degree of collaboration in the future with no need for near-term commitment
- **Cons**
  - Few opportunities for most broadcasters
  - Sharing with nearest public broadcaster may cut off viewers in original area

Close Collaboration with Public Broadcaster
- **Pros**
  - Maximizes synergies
  - Maximizes impact of auction proceed investment in public media
  - Minimizes programming diversity loss
- **Cons**
  - May be difficult to work out details of agreement for stations with misaligned styles or missions
  - Lack of incentive to start the discussion
Loose collaboration may result in content diversity loss

Station A
- Main Channel
- Primary PBS Programming
- PBS Encore
- FNX

Shared Channel
- Main Channel
- Primary PBS Programming
- PDP PBS Programming

Station B
- PDP PBS Programming
- PBS Kids
- V-Me
By working together closely, public broadcasters can reduce content diversity loss.
Option D: “Stop broadcasting” implications (1/2)

**Full Channel Exit Situation**

1. **“Cash Out”**
   - Educational or Government Institution Exits Broadcasting for Cash Payout

2. **“Alternative Distribution”**
   - Single Station Sells Spectrum to Invest in Alternative Distribution

- **Adherence to mission**: May fail in educational mission to students and audiences or provide service statewide
- **Meaningful payout**: Auction payout may be a “drop in the bucket” compared to state or university operating budgets
- **Finances**: Ceasing broadcasting will cut off all CPB funding. Other revenue also reduced
- **Auction proceeds**: Returns provide insufficient ongoing operating cost support
- **“White Areas”**: Viewers, esp. in low-income or rural areas, may rely entirely on broadcast; ceasing broadcasting may shut viewers off
Option D: “Stop broadcasting” implications (2/2)

- **Cable carry**: Signal loss to cable heads means associated cable viewers will be lost.
- **“White Areas”**: Populations may lose access to public television entirely, but likely not entire metropolitan areas.
- **Investment value**: Stations must trade off investment return against risk of some viewers losing access to signal or some programs.
- **Same as above**
- **Finances**: Operating savings higher than if two licensees were to share channels.
- **Mission**: Keeps proceeds in public broadcasting if weaker licensee would otherwise exit market.

### Full Channel Exit Situation

Organization with More than One Station Sells Spectrum to Better Invest in Mission

### “Full Merge”

Owner 1

<table>
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<th>Owner 2</th>
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Two Licensees Merge and Give Up Channel to Invest in Mission
Auction context and project background
Decision-making framework for stations
**Auction impact drivers and expected results**
If/then scenarios for considering possible responses
Next steps
Auction impact drivers and expected results

• In total, there are 355 full-power public television stations nationwide
• If the FCC pursues an ambitious 120-MHz clearing scenario, 110-130 stations will have to move to different channels in the repacking
• A reverse auction will occur in “congested markets” and possibly border situations
  – Analysis indicates from 25 to 55 markets will experience auctions, in which
  – 55 to 85 public television stations might be eligible to participate
• In the most ambitious spectrum-clearing scenario, as many as
  – 200 to 250 public broadcasting translators (used for remote or hard-to-reach rural areas) may have to change channels (with costs not reimbursed)
  – Up to 200 more translators may have to cease broadcasting
Auctions will occur in “congested markets”, driven by several factors which will result in large variability in auction size

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Description</th>
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<tr>
<td>Population Density</td>
<td>▪ High correlation between population density, auction and stations in a market – <strong>top 30 markets are likeliest to have an auction</strong></td>
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</table>
| Overlap from Other Markets       | ▪ Congestion can also be caused by bordering states or towns  
▪ Example: Congestion in Philadelphia that results from Scranton                         |
| Spectrum Use Border Agreements   | ▪ Spectrum agreements with Canada and Mexico restrict the use of frequencies, sometimes leaving little for U.S. broadcasters                     |
| Technology Concerns             | ▪ **Near channel interference**: may prevent certain stations from being repacked, increasing the number to be vacated in a market  
▪ **T band restrictions**: some metropolitan areas restrict use of certain channels in the “T Band” (channels 14–20) for emergency use, increasing the number of stations which would need to exit |
Larger markets may experience an auction, though opinions differ on auction size by market.

Top 30 Market Population Centers
With DMA Rank

- Seattle (12)
- Portland (22)
- San Francisco (6)
- Sacramento (20)
- Denver (17)
- Minneapolis/St. Paul (15)
- Chicago (3)
- Cleveland (18)
- Indianapolis (26)
- St. Louis (21)
- Nashville (29)
- Atlanta (9)
- Dallas (5)
- Houston (10)
- Tampa (14)
- Providence (53)
- Buffalo (52)
- New York (1)
- Philadelphia (4)
- Baltimore (27)
- Washington (8)
- Boston (7)
- Rochester (78)
- Buffalo (52)
- New York (1)
- Philadelphia (4)
- Baltimore (27)
- Washington (8)
- Boston (7)
- Rochester (78)
- Buffalo (52)
- New York (1)
- Philadelphia (4)
- Baltimore (27)
- Washington (8)

- Top 30 market – potential auction
- Not top 30, but auction still likely due to interference
We estimate 800–850 commercial and 110–130 public TV stations may be repacked in a 120 MHz clearing scenario.
Average repacking cost per transmitter estimated at $1.4m to $2.6m – possibility that the FCC’s budget will be insufficient

**Total Repacking Costs**

By Cost Estimate and Repacking Scenario, Consistent Repacking Scenarios

<table>
<thead>
<tr>
<th>Clearing Scenario</th>
<th>Number of Impacted Transmitters</th>
<th>Low Repacking Cost</th>
<th>High Repacking Cost</th>
<th>Total Repacking Public Television</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 MHz Consistent Clearing</td>
<td>910–980</td>
<td>$1,300Mn</td>
<td>$2,500Mn</td>
<td>$160Mn–$340Mn</td>
</tr>
<tr>
<td>84 MHz Consistent Clearing</td>
<td>620–680</td>
<td>$890Mn</td>
<td>$1,760Mn</td>
<td>$100Mn–$210Mn</td>
</tr>
<tr>
<td>60 MHz Consistent Clearing</td>
<td>425–485</td>
<td>$610Mn</td>
<td>$1,260Mn</td>
<td>$75Mn–$155Mn</td>
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Does Not Include “Write-down” of Hardware Not Yet Depreciated

<table>
<thead>
<tr>
<th>Total FCC Allocated Repacking Budget</th>
<th>$1,750Mn</th>
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<tbody>
<tr>
<td>- Repacking Budget Allocated to Move Channel 37 users</td>
<td>$300Mn</td>
</tr>
<tr>
<td>= Net Reimbursement Proceeds Available to Stations</td>
<td>$1,450Mn</td>
</tr>
<tr>
<td>Maximum Estimated Potential shortfall</td>
<td>$1,050Mn</td>
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Above FCC allocation
Repacking process may have broad impact on TV translators, cutting off access for some rural populations

- **Congress did not authorize the FCC to protect translators** in spectrum repacking
- Up to 250 translators that carry public broadcasting on high UHF channels may be forced to change channels as part of the repacking process
  - **They would receive no compensation** to pay for the switch
  - **Total unreimbursed cost systemwide of $3Mn–$4Mn**
- **Up to 200 translators** whose signal overlaps with auction markets may lose all broadcast rights, introducing rural “white areas”
- Utah, New Mexico, Oregon, Wyoming, Idaho, Colorado, and North Carolina are all highly reliant on translators to get over-the-air public television to rural populations
Auction context and project background
Decision-making framework for stations
Auction impact drivers and expected results

**If/then scenarios for considering possible responses**

Next steps
Potential scenarios for consideration

1. “Empty Zones” in some Cities
2. “Empty Zones” in Rural Areas
3. Many Licensees Have Less Bandwidth to Program
4. Auction “Winners” and Repacking “Losers” with Uneven Distribution of Benefits and Costs
5. Repacking Underfunded

- Reduced nationwide access
- Reduced programming diversity
- Major drop in membership and revenue
- Reduced content provider funding, especially PBS
- Damaged brand
- Potentially lower Congressional funding
- Increasing pressure on public broadcasting and more stations go under over time
- A few stations in large markets establish major endowments and benefit in the long-term
- Capital campaigns for repacking fatigue viewers; some stations cannot afford repacking costs
Public stations considering auction participation must assess impacts on revenue, cost, and service, tempered by feasibility.

**Feasibility drivers**
- Will an auction occur in a market?
- Are there stations to consolidate with?
- Is there room to move in UHF or VHF?
- Is there room to channel share in UHF/VHF?

**Service drivers**
- Diversity of content
- Quality of content
- Access to viewers/segments
- Digital investment

**Revenue drivers**
- Governmental revenue
- Non-governmental revenue
- Expected return on investment in new services
- Endowment returns

**Cost drivers**
- One-time costs
- Recurring costs
CPB must also consider implications of the recapture process for public media as a whole

**Market dynamics drivers**
- Number of markets with auctions
- Number of public stations repacked
- Number of public stations participating in auctions
- Impact on public translators

**Funding drivers**
- Grant distribution implications
- Appropriations implications
- Nationwide financial imbalances

**Public Service Mission**

**Cost drivers**
- Potential “domino” effects to public media if repacking costs are not reimbursed
- Costs for new distribution methods

**Long-term impact to public media mission**
- Ability of public media to reach viewers in need
- New content distribution strategies and business models
- Overall reach
- Impacts to viewership demographics
- Impacts to content providers
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