# THE LONG REVOLUTION OF DIGITAL TELEVISION

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**(Working draft)**

## Introduction

On December 24, 1996 the Federal Communications Commission (FCC) issued its Fourth Report and Order in the Matter of Advanced Television Systems and sanctioned a transmission-only "DTV Standard" for broadcast television. In doing so, the Commission transferred the standardization of receiver and production equipment to the highly competitive electronics market. The FCC rationalized its decision to adopt a narrow DTV standard by noting that the dramatic shift to digital media was creating a new paradigm in television towards technical/industrial convergence, digital commodities, and unfettered global competition (FCC, 1996). Thus, the movement from analog to digital television system represented more than simply providing better pictures and static-free transmissions. Rather, the development of DTV embodied a larger economic transformation to "digital capitalism" and the utilization of digital

media as "a uniquely supple instrument for cultivating and deepening consumerism on a transnational scale" (Schiller, 1999, xiv).

From the beginning, advanced television (first known as high-definition television and later DTV) became a fiercely contested terrain for the US government. The FCC and Congress were fully aware of the importance of broadcast television as a national and local-based entertainment and information source. Any disruption in TV service during the transition was not viewed as an option. Additionally, the transition to the new digital TV system required the careful consideration of various areas such as spectrum management, technical standards, electronics manufacturing, and public interest obligations. Most importantly, the computer-aided advancements of digital technology in the 1990s revealed an important transformation in television, and media more generally, in which traditional industry players, such as broadcasters and TV manufacturers, would no longer dominate the marketplace. The market exploitation of TV in the digital era now included a larger pool of corporate interests. In this respect, the conversion from analog to digital TV is vastly different than previous technical advances in television. In other ways, the DTV development is experiencing some of the same problems as earlier television modifications – like the movement from black-and-white to a color format in the 1950s, and the

expansion of television service into the Ultra-High Frequency (UHF) band in the 1960s.

In an effort to understand the transition to broadcast digital television, this paper examines the economic and policy issues that are currently shaping the changeover to DTV. There are three main policy areas currently shaping the long revolution to DTV: 1) digital transmission and programming; 2) interoperability and compatibility; 3) copyright protection. Before discussing these areas, I first examine reasons why the transition to DTV in the United States is experiencing many delays. What do the delays mean for the long awaited convergence of television and the Internet? This paper also examines two "monumental" changeovers in the history of analog television in the US – the debate over global standards for color TV and the integration of UHF within the well-established VHF system. How are the stakes in DTV different from these other "radical" changes in television system history? My aim is to provide a broad outline of the issues in order to foster a discussion about the property creation of new media, and the ways in which political, economic, technical and cultural imperatives are at the forefront of DTV.

**The Transition to DTV in the US**

Digital television represents a new era of television, at least that's what industrial players and policymakers want the public to believe. According to Brinkley (1997), the transition from analog to digital TV will have the largest impact on media since the NTSC standard transitioned from black-and white to color technology. Indeed, the move in the United States to an advanced, digital media system is not one that follows a simple trajectory in which consumers merely turn off a set of technologies one day, and turn on another system the next. The transition to DTV is becoming a complex political, economic and cultural transfer that is enmeshed in turmoil. Some of the problems range from political maneuverings to economic disincentives, cultural resistance, and the September 11th tragedy. These challenges are causing major delays in the transition to DTV, and according to FCC Chairman Michael Powell, restricting its development (Howe, 2002, E1).

After many TV broadcasters failed to meet the transition deadline on May 1, 2002, it became clear to policymakers that DTV has now become a severe government problem. The FCC's creation of a Digital Television Task Force reinforces the need to address DTV in a more systematic manner. FCC Chairman Michael Powell has taken further initiative by developing a voluntary policy in which various sectors of the DTV industry are highly encouraged to boost the

production of DTV equipment, programming and distribution networks (Healey 2002a). In a letter to congressional and industry leaders, the Republican FCC Chairman urged the broadcasters and cable operators to begin transmitting digital programming, and asked the manufacturers to begin incorporating digital tuners to their digital TV sets (FCC, 2002a). The action by Powell is in part a response to the aforementioned missed deadline. As noted, the majority of TV broadcasters did not have their digital signal on the air by the May 2002 due date.

Unlike the slow, evolutionary development of analog television in the 20th century, both the government and industry agreed in the late-1980s that digital television would not have such a luxury in the 21st century (Senate, 1996). The economic value of television in the areas of advertising, consumer equipment, and programming as well as its cultural significance in the areas of news and information practically mandated a swift transition to digital. The much anticipated, trouble-free conversion has not occurred.

From the beginning of the advanced television in the US, delays have characterized the development of new generation TV. This is due largely to the fact that policymakers and the business community imagined that only certain sectors of over-the-air television would be affected, primarily broadcast stations, content programmers, and local TV audiences. The failure to fully acknowledge

the interlinked dependence between media systems and their various components – e.g., cable TV, satellite television, the computer industry – unfortunately limited the incorporation of non-broadcast voices in the policymaking process of DTV (Paredes, 2000). The failure to fully incorporate these "alternative" perspectives created unanticipated delays. In response, the FCC adopted a competitive framework for DTV policymaking and moved away from imposing a predetermined policy model in order to deal with the various interests. In doing so, the US embraced broad, market-oriented policies for DTV.

The market-based approach is most significant in the area of transmission scanning. Currently, consumers have a variety digital TV set choices that extend beyond the large screen, small screen divide. Consumers can choose to buy a model with 720 progressive scanning, 1080 interlaced scanning, or integrated high-definition sets at the cost of two thousand dollars or more. The price for having a choice is prohibitively expensive, more than five times what consumers normally spend on 30" analog TV sets. The unwillingness by consumers to pay the high ticket prices for sleeker DTV sets is a serious hurdle that the government, broadcasters and equipment manufacturers are trying to grapple with. Currently, there is very little information about the benefits of replacing an analog set with a digital model. Having prettier pictures is simply not incentive enough for consumers to make the switch to digital.

An analysis of the development of DTV shows that there are different types of challenges that the broadcast industry and government are attempting to overcome. Such obstacles include negative consumer response; the failure by manufacturers to incorporate digital tuners in analog TV sets; the lack of high-definition programming; and the refusal by cable operators to carry both the digital and analog signals of local TV stations. Most importantly is the long, drawn-out movement by local broadcasters build digital transmission towers, vacate analog spectrum frequencies, and switch entirely to the digital system. These setbacks are making it very difficult for the new digital television system to make substantial progress.

Yet, contrary to reports by the National Association of Broadcasters, these obstacles are not primarily technical (Pramik, 2002). They are largely political, economic and cultural challenges that are not easily resolved by market-based policies. In this sense, today's transition to DTV embodies continuities with earlier changes in television. The next section will illustrate how the battle to include UHF frequencies in the American TV system and the debate over global color TV standards was not inherently technical. However, the transition to DTV also illustrates distinct discontinuities with the ways in which television "upgrades" were handled in the past. Later in the paper I will demonstrate how the current changes in television "do not entail any fundamental break with

historical patterns…but the current stage" of DTV development illustrates how the "global political economy is being redefined" in ways that were not essential in earlier TV adjustments (Mosco and Schiller, 2001, 4-5).

**Antecedent Changeovers in Broadcast Television**

In the early days of television, broadcast stations were allocated to VHF-only (Very High) frequencies. During the 1948-1952 debates over television frequency allocations (better known as the "license freeze" since the Federal Communications Commission halted new license assignments during that period) companies such as ABC and DuMont petitioned the Commission to utilize the license suspension as an opportunity to move the still-unfolding television service to the UHF (Ultra High) frequency band (Kittross 1979, 7-8). The creation of a UHF-only TV allocation table would have equalized all broadcasters rather than privileging the VHF broadcast firms with pre-war channel assignments and large capital investments – most notably CBS and NBC. UHF spectrum frequencies were a bit longer than the VHF airwaves and thus provided more coverage in a given territory.

In 1952, the FCC ended the dispute and lifted the frequency license ban by adopting a VHF/UHF intermixed TV allocation/assignment table. The commission reasoned that the "enormous investments in receiving and

transmitting equipment made it difficult to move the [entire] broadcast television service to the ultra-high frequency band" (Ibid., 1979, 293). The regulatory decision to maintain pre-war television allocations also furthered the FCC's goal of creating a national, but locally based TV service. The wavelengths in the VHF/UHF bands did not travel more than 50 miles (except when using a very high antenna). This line-of-sight operation required that the FCC license TV stations in every city across the nation (Ibid., 200). Thus, as Kittross (1957) attests, the Commission's decision to allocate television service in the VHF/UHF bands relied more on the fixed investments of broadcasters and the political pressure from the industry than on purely technical requirements.

A similar line of reasoning regarding fixed investments emerged ten years later during the attempt to develop a European (and international) color television standard. At the time, the black and white television world was fragmented into three markets, each with its own transmission standard: Phase Alternation by Line (PAL) developed in Germany; Sequential a Memoire (SECAM) developed in France; and National Television Standards Committee (NTSC) developed in the US. The development of an international color TV technical standard would prevent the issues of incompatibility and technical fragmentation in the color television era. A world standard for the color TV market would allow the manufacturing industry, TV programmers, content

producers, and retailers to maximize the economies of scale in production and distribution more effectively. On the other hand, as Crane (1979) notes, "incompatible color television systems would impose numerous disadvantages on program exchanges among countries possessing different systems: recordings on one standard would not operate on another; elaborate conversion techniques would be necessitated; program costs would be raised; the exchange of programs would be complicated, and the technical quality would be lowered (11).

Yet, the battle over the making of an international color television standard was not simply a matter of choosing the best technical protocol. At stake was the global market expansion of electronics in the post World War II era and the increasingly critical role of communications in the domestic economy (Schiller, 1989). Color television was one area in which the United States, Germany and France attempted to shape and control the export market for television electronics as well as sway programming conditions in their own favor.

Of the three countries, the French government most fervently opposed "being tied like a dog to a leash;" dependency on another country was not an option (Crane, 1979. 45). France utilized incompatible standards to hinder the US and Germany from establishing a competitive TV market in France. According to French officials, such "invasion" threatened the national and cultural

independence of France. On the other hand, these same officials also hoped that the France-developed SECAM color model would gain global acceptance, and thus bolster the French color television industry (Crane 1979, 58).

During this time, the United States formed an NTSC-based standards bloc with Canada, Japan, and Mexico. Officials hoped that the sheer size of this coalition would operate as a non-tariff barrier against non-NTSC color TV systems. With each side protecting its interests, it is no wonder the worldwide television industry remained segregated. The NTSC (color compatible 525 lines/60 Mhz) standard prevailed in North America, Latin America and parts of East Asia.[1] The color compatible PAL (625 lines/50 MHz) standard prevailed in Europe and parts of the Middle East and Asia.[2] Lastly, color compatible SECAM

[1] Antigua, Bahamas, Barbados, Belize, Bermuda, Bolivia, Cambodia, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Greenland, Guam, Guatemala, Honduras, Jamaica, Japan, South Korea, Mexico, Nicaragua, Panama, Peru, Philippines, Puerto Rico, Saipan, Samoa, Surinam, Taiwan, Trinidad, Tobago, United States, Venezuela, and Virgin Islands.

[2] Afghanistan (Kabul), Algeria, Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Brazil, Brunei, China, Cyprus, Czech Republic, Denmark, Finland, Germany, Ghana, Gibraltar, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jordan, Kenya, North Korea, Kuwait, Liberia, Luxembourg, Malaysia, Malta, Monaco, Netherlands, New Guinea, New Zealand, Nigeria, Norway, Oman, Pakistan, Paraguay, Poland, Portugal, Qatar, Romania, Saudi Arabia, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Tanzania, Thailand, Turkey, Uganda, United Arab Emirates, United Kingdom, Uruguay, Yemen, Yugoslavia, Zambia, and Zimbabwe.

(625 lines/50 MHz) predominated in the former Soviet Union and countries of the old-French Empire (Department of State 2000; Crane 1979, xxi).[3]

The public and corporate investments of these countries in the initial adoption of monochrome television based on the NTSC, PAL, and SECAM standards made it difficult for national governments to do away with the established infrastructure in the color TV era. The debate over global color television standards shows that standardization and new media creation processes do not always adhere to technical imperatives. In fact, "the industrial and political interests of the countries [shaped the longstanding divisions, and] this conflict eventually made agreement upon a single color television standard impossible" (Ibid., 20). These historical material relations in television electronics not only led to the failure to develop a worldwide color TV standard in the 1960s, but also became a point of contention in the development of digital television standards thirty years later.

[3] Albania, Benin, Belgium, Congo, Djibouti, Egypt, France, Gabon, Greece, Guadaloupe, Guyana, Haiti, Iran, Iraq, Ivory Coast, Lebanon, Libya, Madagascar, Martinique, Mauritius, Mongolia, Morocco, New Caldonia, Niger, Reunion, Russia, Senegal, Syria, Tahiti, Togo, Tunisia, USSR (former) Vietnam, and Zaire.

**Current Policy Issues of DTV**

DTV became a point of contention at the dawn of the 21st century because policymakers and industrial interests regarded digital technology as the driving force that would transform the television industry and the emerging National Information Infrastructure. In the early days of electronic media, television was viewed as a technology and service that would revolutionize the national communications system. Thus, making connections to the past and examining the current areas of contention within DTV are important for understanding the "basic contours of cultural, political, and economic continuity and change" across the media and social landscape (Meehan, Mosco, and Wasko, 1993, 114). In the context of DTV, there is much continuity with the analog system, but there are also unanticipated changes that the FCC and Congress are attempting to grapple with.

The three important policy areas currently being investigating in DTV development are: 1) digital transmission and programming; 2) interoperability and compatibility; and 3) copyright protection. According to the FCC and Congress, these areas are broadly defined and include various issues: DTV build-out costs; spectrum frequency interference; channel assignment disputes; digital low power TV operations; translator and booster television services; DTV integrated sets; cable and DBS compatibility and carriage; standards

coordination across the Americas; intellectual property right protection of programming; and content reproduction capability for consumers. Since the beginning of DTV, the US government has approached these issues in a non-directive manner. However, the inability of the market to spur the transition, and in fact cause many of the delays, is causing lawmakers to reconsider legislative intervention. For companies outside of the television industry but within the vicinity of DTV, regulatory action is an objectionable solution.

***Digital Transmission and Programming***

When the FCC originally adopted the Sixth Report and Order, thereby officially sanctioning broadcast digital television, the Commission envisioned 2002 as the midway point of the DTV conversion. However, as of May 1, 2002 only twenty percent of all television broadcasters were transmitting in the digital format. This means that out of roughly 1600 local television stations in the US, 256 stations have made the switch (Howe, 2002). It is also important to note that the majority of these operating digital stations are located in the top thirty markets. Although this translates (ideally) into a seventy-six percent household penetration rate, the fact that digital receiver sets are expensive and incompatible with cable service means that the majority of Americans are not viewing DTV broadcasts.

In addition to the inconsistent and slow conversion by local TV stations and consumers, there is an insufficient amount of digital and high-definition programming. Without such content, there is no "sufficient incentive" for consumers to spend three thousand dollars or more on DTV adaptable and DTV integrated sets. Broadcasters are responding to the scarcity of new digital programming by informing viewers of its availability and encouraging consumers to purchase interactive on-line services. This approach is being met with skepticism and anger because it moves broadcasters farther away from the key purpose of broadcasting: free, over the air television service (FCC, 2002b).

In an effort to rectify the situation, FCC Chairman Michael Powell asked the major broadcast and cable networks, including pay cable channels to provide High Definition Television programming (or something similar) beginning fall 2002. Hence, programming is believed to be one of the factors that will motivate consumers to dole out thousands of dollars for new generation DTV sets. The indirect way in which the FCC is influencing media content is also evident in its support of digital must- carry rules for cable television. That is, cable television, most notably digital cable, should carry and transmit all the digital broadcast channels, including pay-for interactive services provided by broadcasters.

***Interoperability and Compatibility***

The issues surrounding interoperability and compatibility first began in the mid-1990s when the computer industry entered into the advanced television discussion at the FCC, and promoted open standards in order to facilitate computer/television convergence. Although companies are rethinking the feasibility of such a technical convergence, the union of the Internet and digital television entertainment is indeed the future, and cable television and digital broadcast services will be entry points where this looming confluence will occur. Consequently, cable television and DBS will be critical distribution outlets for digital TV broadcasts.

However, DTV broadcast programming cannot reach audiences if cable operating systems do not allow for the carriage of digital channels or if equipment is not compatible. The fact that the digital set top boxes for cable are incompatible with the digital broadcast programming, – (set top boxes lack digital specifications) – creates difficult problems for the transition to DTV. The lack of compatibility limits interoperability, and this diminishes consumer motivation for purchasing digital television equipment and services.

The "harmonization" of standards across industrial boundaries is not a new concept in digital television. In fact, it was the mantra of the computer industry during the advanced television inquiry at the FCC. Standards harmony

bolstered the interconnection between software and hardware, thus expanding market possibilities (Digital Equipment Corporation 1991). Computer manufacturers, software producers, and alternative media creators promoted technical compatibility in order to ensure the production of interoperable, scalable and extensible DTV transmission codes (Felker 1991, 13; Cole 1991, 29). The House Subcommittee report claimed that these harmonizing characteristics were "essential" for the convergence between broadcasting and computer applications. "Interoperability," noted the House report, "allows a receiver to identify different data streams in any variety of digital formats and display them to the user. Extensibility permits a receiver to handle future technological advances and scalability is the capacity to receive and display images of different degrees of resolution" (House 1992, 19).

The FCC ultimately applied the 1962 All Channel Receiver Act to the DTV proceedings, and thus required television set makers and display electronics manufacturers to produce digital receiver equipment suitable for both display resolutions, high-definition and standard-definition, as well as the two scanning modes, interlaced and progressive. By applying the 1962 Act, "decisions about how to display the signals that are received [would] be left to the marketplace in order to ensure optimal consumer choice" in the digital television set arena (Hitachi America Ltd 1995; Information Technology Industry Council 1995).

But the FCC has also been limited in its power to pass too many regulations. At this point, the US Congress has to pass legislation that mandates the inclusion of DTV tuners within analog and digital receiver sets. This means that television sets will have the capability to display DTV broadcasts. At this time, a consumer can buy a digital TV set but it may not necessarily have the capability to show DTV broadcast content (it may only be digital in display, not transmission). Likewise, cable set-top boxes do not automatically have the capability to show high definition television content or offer plug-and-play interoperability with DTV sets. Hence, FCC Chairman Michael Powell is encouraging Congress to adopt legislation that mandates manufacturers to include digital tuners in all DTV sets that are 36" or larger.

***Copyright Protection***

Broadcasters, cable TV operators, content programmers, and television set manufacturers agree that even if the digital transmission and interoperability issues are settled, the current problems of utilizing digital technology to enhance illegal reproductions and expand piracy, do not disappear. Broadcasters complain that the Internet is a threat for the illegal retransmission and distribution of digital and high definition content. The appealing qualities of digital technology, for instance clearer imaging, are also a dilemma for the

industry. As one of the heads of the Fox group argued, the movie and television industries want to prevent the "Napsterization of digital television" (Healey, 2002b, 1).

Currently, there are no technologies in the marketplace that prevents consumers from recording and redistributing copyright protected content on the Internet. This is one of the reasons why digital programming is taking place very slowly – there are no technologies guaranteeing copyright protection. At present, over 1 million movie files are transferred and copied online everyday (ibid). The inter-industry Broadcast Protection Discussion Group is investigating the creation and incorporation of electronic tags within a program that is digitally broadcast on television. Unlike the electronic tags we see on merchandise at local stores, these tags will not be visible to the public. If this succeeds, the federal government will need to pass legislation in order to ensure that every digital TV set sold in the US carries such tags and imprints digital broadcast content. The Broadcast Protection Discussion Group thus wants to incorporate the tags into every digital signal and receiver set in the US, and perhaps worldwide.

The predicament for Congress is dealing with constituents who have bought HDTV sets without the copyright tags, and therefore would be required to buy new receivers. Yet without copyright protection devices and software,

movie studios are reluctant to transmit their films over the broadcast DTV system. Internet piracy is an issue that the various sectors of the media industry are trying to grapple with but are unable to move forward on because of the proliferation of broadband networks, file sharing capabilities, and the global arrangement of the Internet. The development of public policy in the area of digital copyright will be critical in order to protect consumers engaged in legal activity. Careful consideration is necessary since any legislative intervention in this area will greatly impact the entire communications industry, including traditional and emerging media like interactive television (ITV). For the industry, "at stake are the billions of dollars in digital entertainment sales and the future development of the Internet, cable TV and other communications networks capable of delivering digital content to consumers" (Shiver, 2002).

**New Generation of Media**

While similarities with previous technical changeovers exist in television history, it is undeniable from the policy issues discussed in the previous section that DTV represents a new generation of media. The transition to the era of broadcast digital technology, however, is not occurring as rapidly as policymakers anticipated in 1987. Arguments over technical standards and spectrum channel assignments became considerable hurdles in the development

of DTV, and the continuous coverage of the terrorist attacks on September 11th 2002 and the "War on Afghanistan" also became stumbling blocks in the road to digital. Consequently, the FCC extended the changeover deadline to 2003 for TV stations experiencing economic hardship, particularly if it was caused by the 9-11 broadcasts. The majority of the stations (more than ¾ of 1600 licensees) accepted the extension claiming that without a longer transition phase, free over-the-air television will basically cease to exist (Halonen, 2002).

At a recent congressional hearing on digital television, Energy and Commerce Committee Chairman Billy Tauzin noted that he did not want consumers to bear the brunt of the new DTV system. In a prepared statement he said: "Indeed, this is intended to be the first in a series of subcommittee hearings intended to explore why the transition to digital television is 'off-track' and how to put it back on track. To the extent the Committee can determine why the digital transition is being delayed, Congress stands in a position to encourage a more orderly process. While this hearing may get a bit chaotic with everyone on one panel, I think it encourages [committee members] to see the entire DTV picture. Thank you" (2002, 3). It's apparent from congressional interest that issues surrounding the new generation of media are complex and not easily resolved.

**Conclusion**

The paper is an attempt to begin thinking about the challenges that policymakers, TV broadcasters, equipment manufacturers, and consumers are facing with the transition to DTV and the ways in which the change to DTV embodies continuities and discontinuities with previous TV technical modifications. Reexamining the former "revolutions" of television is important and constructive for developing parallels with the present conversion to digital TV. Unlike the changeover to color technology or the inclusion of UHF in the NTSC transmission standard, the current switch to digital is in many ways fundamentally different. It is argued that digital television, and digital media more generally, "will radically alter the multibillion-dollar US telecommunications business and enhance the nation's ability to compete abroad in advanced communication services and equipment" (Cohen and Hetter, 1996, 49). Hence, with so much at stake, the change to DTV and its far-reaching implications will continue to be hotly contested for quite some time.

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