

Underlying Motivations in the Broadcast Flag Debate

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Abstract

The MPAA (Movie Picture Association of America) claims that the broadcast flagging scheme will protect its constituents' content when broadcast free over the air on digital terrestrial television. We begin this paper with a description of the broadcast flag, and examine the MPAA's claim with a formal threat model analysis to determine that the broadcast flag, while not successfully keeping content off the Internet, will offer the MPAA several other concrete benefits, quite different from the one publicly stated. Having determined the role of the broadcast flag, we turn our attention to the full range of players, including consumer electronics companies, broadcasters, the major television networks, consumer groups, cable providers, the FCC, and Congress, and use a cost-benefit analysis to unpack the motivations and incentives each player has for supporting or opposing the flag. We then compare our analysis with the public statements by each of the players regarding the flag, to evaluate the sincerity of their claims and affirm our analysis. Ultimately, it appears that the underlying motivations of key players in the broadcast flag debate are quite different from the stated goals of the broadcast flag, and relate far more to DTV in general than digital content protection. We conclude that support for the broadcast flag is based on ulterior motives. If this costly policy is to be implemented, we feel a more accountable case should be made prior to acceptance.

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1. Introduction

Digital content protection has grown into a huge issue over the past 10 years, as the ability to make and distribute perfect copies of digital content becomes ubiquitous and cheap. Content owners fear that the wide spread dissemination of their copyrighted materials over the Internet, particularly over peer-to-peer systems that have proven hard to shut down. The advent of Digital Television offers yet another benefit of the digital information age, but also threatens to open other means of digital infringement if users can freely capture and distribute broadcast TV shows and movies. One of the main drives behind Digital Television is the release of Hollywood movies, yet Hollywood companies, represented by the Motion Picture Association of America (MPAA), are reluctant to release their content without some sort of protection.

The resulting proposal, after working with various interested actors, is the broadcast flag. This flag, attached to a digital broadcast signal, would control to how the content could be used: to which devices it could be sent and how many times it could be copied. The MPAA claims that this scheme will protect their content and, if it is implemented into the DTV infrastructure, they will freely release their content. Implementation requires the support of a variety of other actors, each of whom claims to support the flag as well.

This paper proposes to examine the veracity and robustness of the MPAA's claims, as well as the claims of other key actors in the debate. Each interested group has a stated motivation for supporting the broadcast flag, and has used that motivation to push for the implementation of a broadcast flag regime. We find that, while the broadcast flag does offer significant benefits to many of the key players, these benefits are seldom directly related to the stated motivation, and often have little to do with the broadcast flag at all.

We begin this paper with a description of the broadcast flag, paying particular attention to the benefits purported by the MPAA itself in section two. Since the MPAA claims that the flag will effectively stop unauthorized Internet distribution, we evaluate the robustness of the flag with a formal threat model analysis in section three. We also examine other possible benefits of the broadcast flag under this framework, and determine that, while not successfully keeping the content in question off the Internet, it will offer the MPAA several other concrete benefits, quite different from the one publicly stated. In section four, we turn our attention to the full range of players, including consumer electronics companies, broadcasters, the major television networks, consumer groups, cable providers, the FCC, and Congress, and use a cost-benefit analysis to unpack the motivations and incentives each player has for supporting or opposing the flag. We then compare our analysis with the public statements by each of the players regarding the flag, to evaluate the sincerity of their claims and affirm our analysis. Ultimately, it appears that the underlying motivations of key players in the broadcast flag debate are

quite different from the stated goals of the broadcast flag, and relate far more to DTV in general than digital content protection. We conclude that support for the broadcast flag is based on ulterior motives. If this costly policy is to be implemented, we feel a more accountable case should be made prior to acceptance.

2. History of Digital Television (DTV) and the Broadcast Flag

The broadcast flag was suggested as a consequence of the emergence of digital television. Digital television offers many benefits over analog television, including improved picture and sound, while requiring less bandwidth for broadcast transmission. Following the FCC creation of the Advanced Television Systems Committee in 1995, which was mandated to develop standards for digital television, broadcaster began implementing the switch to digital television. While maintaining analog broadcasts, digital broadcasts began using additional spectrum granted by the FCC. By late 1998, the 26 TV station in the country's most populous cities would begin broadcasting the using the Grand Alliance DTV system. This initial broadcast would reach 30% of U.S. television households. By 1999, that number would expand to 40 stations and by 2000, that number would reach 120 stations. By 2006, every station would be expected to transmit all content digitally for fear of losing the FCC license¹.

Since digital television offers an enormous amount of compression compared to what is possible in the analog domain, when the transition to DTV is complete, the FCC will regain the old spectrum and license it for different uses. Seeing the tremendous reductions in spectrum use, the government would like to encourage investment in digital television. They would like to regain and resell the original NTSC spectrum granted to FCC licensed broadcasters in exchange for DTV spectrum with the same bandwidth.

By 2001, adoption of digital television had been slow. The Consumer Electronics Association stated that after more than two years of availability, HDTV shipments totaled only 625,000 in 2000 compared with 25 million TVs overall². Networks attempted to encourage HDTV subscriptions through new hit series such as "The Sopranos" in high definition format. However, the lackluster adoption gave broadcasters little reason to broadcast in HDTV format, and gave consumers little reason to invest thousands of dollars for digital television sets³.

Congress attributed the slow adoption of digital television to the lack of quality content on terrestrial television, and looked to the MPAA (Movie Picture Association of America) to provide that content on digital television. However, the MPAA had stated that it would not release content without copyright protection enforcement. Unlike DVDs and cable, which are either decrypted when played or broadcast encrypted, digital

¹Whittaker, Jerry. "Broadcast History: Milestones in the Evolution of Technology ." Retrieved November 22, 2002, from <http://www.tvhandbook.com/History/History.htm>.

² *Ibid.*

³ Goroch, Antonette. "HD in the Clouds? DBS seek to stay ahead, despite slow growth in HDTV." January 22, 2001. Retrieved November 21, 2002, from http://www.broadbandweek.com/news/010122/010122_wireless_hdtv.htm.

broadcasting must be delivered unencrypted. In fact, the FCC requires that this terrestrial broadcast television be sent “in the clear”. The MPAA fears delivering high-quality, unencrypted content digitally, because viewers could record shows and later make them available on the Internet. The MPAA feels that their refusal to deliver content without protection is justified, and that such protection should be supported via the DMCA (Digital Millennium Copyright Act) that made circumventing copy protection measures illegal and that provided corporations with a legal tool to protect their intellectual property.

The Copy Protection Technical Working Group (CPTWG), composed of representatives from entertainment, information technology and consumer electronics industries, formed the Broadcast Protection Discussion Group (BPDG) to develop guidelines for copy protection of content provided by parties such as the MPAA over digital terrestrial television. The goals of the group include:

- To provide a technical specification for the broadcast flag
- To provide secure handling of content marked with the Broadcast Flag⁴
- To recommend the implementation of the Broadcast Flag⁵

In addition, a drafting committee was formed to provide documentation for “Broadcast Flag Compliance and Robustness Rules”. The group met from December 2001 to June 2002 to draft the standards for implementing the broadcast flag. In June of 2002, the BPDG proposed that the digital TV signal has broadcast flag imbedded and that all digital devices would be forced to recognize the flag. This flag, they presumed, would assuage the copyright holder’s fear that the content will be distributed on the Internet. The BPDG was been quoted as saying that “the proposed technical solution does not interfere with the ability of the consumers to make copies of the DTV content, and to exchange such content among devices connected within a digital home network.”⁶.

The MPAA has released several technical details about the broadcast flag, whose goal is to prevent redistribution of copyrighted material over the Internet. The MPAA has specifically stated that it is only concerned with redistribution and not with digital copying of content⁷. MPAA has also stated that not all programs will be flagged, and that the broadcast flag will be set to “on” or “off” depending on private conceptual agreements between content providers and broadcasters. In addition, the MPAA claims that PVRs (Personal Video Recorder)⁸ with no digital outputs, such as TiVo will be

⁴ A proposed measure to prevent illegal distribution of digital content over the Internet. The details of the flag are described below and in the Appendix.

⁵ “-----.” “April 25, 2002 CONTENT PROTECTION STATUS REPORT.” Retrieved November 15, 2002, from http://judiciary.senate.gov/special/content_protection.pdf.

⁶ Wiley, Lauren. “BPDG Proposes Broadcast Flag to Protect DTV Broadcasts.” Retrieved November 15, 2002, from http://www.emedialive.com/r10/2002/news0802_02.html.

⁷ “-----.” “Broadcast Flag Frequently Asked Questions.” Retrieved November 22, 2002, from http://www.mpaa.org/Press/Broadcast_Flag_QA.htm.

⁸ A set-top-box capable of recording broadcast or cable television programs for later viewing.

permitted to record broadcast digital programs⁹. However, those personal computers using PVR software will need to be equipped with digital TV tuner cards to prevent unauthorized redistribution of the programs to the Internet. With this technology, the MPAA has stated that it is possible to record a movie or television show, provided that the broadcast flag allows this, store the show on a hard drive (but one that does not allow the hard drive to have an Internet connection), parse it, and ship it to a bedroom TV, for example. One possibility, however, is that the technology will prevent people from watching a recorded movie at the house of a friend¹⁰. In general, the BPDG, on behalf of the MPAA has stated that it wants to design all devices interfaced with DTV to “frustrate user-end modifications¹¹.” With similar efforts in mind, the BPDG has proposed a ban on all open source software such that no software is written to interact with DTV signals to prevent users from modifying receivers to circumvent broadcast flag restrictions.

3. Threat Analysis

How effective will the broadcast flag be at doing what it is supposed to do? The MPAA claims that the broadcast flag is designed only to prevent “unauthorized redistribution of copyrighted content, not prohibit digital copying¹².” However, the MPAA also states that “copies made by future digital recorders that comply with the broadcast flag will not be playable on legacy playback devices and consumers will still be able to tape the digital broadcasts for traditional time-shifting uses with analog recorders such as VHS¹³.” While the MPAA is clear that it means only to prevent movies from being traded on the Internet, the broadcast flag has other effects that may also be hidden goals of the MPAA. In the threat analysis, we examine the effectiveness of the broadcast flag in accomplishing the stated goal of the MPAA, in addition to other possible motives. In doing so, we examine all possible threats to the broadcast flag, and the parties that may accomplish these threats. We conclude that the broadcast flag is not an effective means of preventing digital content distribution over the Internet, but will be successful in promoting other possible, although unstated, goals of the MPAA.

The threat analysis uses two assumptions. The first assumption is that the broadcast flag, as part of digital television, is commonplace. The FCC has convinced consumers to switch to digital television, and has discontinued analog broadcasts. Almost all homes have replaced their legacy televisions with digital televisions.

The second assumption is key and states the following: *the analog output from all digital television tuners has been restricted*. This is, in effect, plugging the so-called ‘analog hole¹⁴.’ The justification for this assumption is that if the analog hole is not

⁹ Whittaker, Jerry. “Broadcast History: Milestones in the Evolution of Technology.” Retrieved November 22, 2002, from <http://www.tvhandbook.com/History/History.htm>.

¹⁰ King, Brad. “HDTV Battle Wages On.” Retrieved November 22, 2002, from <http://www.wired.com/news/digiwood/0,1412,53835,00.html>.

¹¹ Doctorow, Cory. “Understanding the Broadcast Flag.” Retrieved November 15, 2002, from <http://www.techtv.com>.

¹² “-----.” “Broadcast Flag Frequently Asked Questions.” Retrieved November 22, 2002, from http://www.mpaa.org/Press/Broadcast_Flag_QA.htm.

¹³ *Ibid.*

¹⁴ The “Analog Hole” is discussed in the Appendix.

blocked, then the broadcast flag will have no effect in preventing the Internet redistribution of movies, since it is trivial to redigitize an analog video stream. By trivial, this analysis does not imply that the average consumer will redigitize his own movies. However, the analysis does assume that since redigitization from the analog output is relatively prevalent under an NTSC paradigm, it will continue to be so in the future if the analog output is not restricted. We are not alone in realizing that the analog hole poses a serious problem to the success of the broadcast flag; as mentioned in the Appendix. In October 2002 Representative Billy Tauzin (R-LA) introduced legislation on the broadcast flag that included a proposal to remove all analog outputs from digital devices that interacted with broadcast DTV signals.¹⁵

For the purposes of the threat analysis, we identify four main goals of the MPAA in proposing the broadcast flag: to eliminate the illegal distribution of movies on the Internet; to restrict the personal recordings of movies for time shifting or library building; to reverse the societal norms allowing copyright infringement; and to put the control of content into the hands of the copyright holder. These four goals have not all been publicly identified as being goals that the MPAA wishes to accomplish by passing broadcast flag legislation. Rather they are goals that seem reasonable in light of what the broadcast flag makes possible. The following chart summarizes the four potential goals of the MPAA, the agents that pose a threat to those goals, and categorizes the threat that these agents pose:

Goal	Adversaries	Threat
Prevent Distribution of Movies on the Internet	Average Consumers	low
	Nefarious Infringer	high
	Organized Crime	low
Restrict Personal Recording of Movies for Time-Shifting or Library Building	Independent Individuals	low
	Consumer Electronic Companies	medium
	Malintentioned Groups	low
Reverse Societal Norms of Copyright Infringement Acceptance	Average Consumers	low
	Congress	medium
Move Content Control to Copyright Holder	FCC / Congress	high

Each of these goals and consequent threats to the goals are examined below.

¹⁵ “-----.” “Draft TV Mandate Bill Freezes Innovation.” Electronic Frontier Foundation. Retrieved December 7, 2002, from http://www.eff.org/IP/Video/HDTV/20020919_eff_pr.html

3.1 Goal 1: To Eliminate Illegal Distribution of Movies on the Internet

The MPAA's stated goal of the broadcast flag is to prevent the illegal distribution of movies over the Internet. According to the MPAA, the broadcast flag "signals that the program must be protected from unauthorized redistribution." It is plainly seen that the unauthorized distribution the MPAA is referring to is Internet distribution; "If unauthorized copies of programs are widely available on the Internet they cannot be sold in ancillary markets and the owners cannot cover the costs of production¹⁶." MPAA constituents may fear a loss of revenue through this unauthorized distribution chain, and may wish to prevent this problem before it escalates. Currently most consumers do not have the bandwidth to download full-length movies in a reasonable amount of time. For example, a 2-hour movie encoded using the DivX codec takes about 10 hours to download over a cable modem, compared to 2 minutes for the average song encoded in the MP3 format. While illegal copies of movies are not as prevalent as MP3 music files on the Internet, it is possible that future advances in bandwidth will give rise to a movie trading community, perhaps over peer-to-peer networks. Regardless of the motivations of the MPAA, it has made this goal clear.

For the purposes of this threat model, we assume that the attack has been successful if even one person manages to release a movie on the Internet. Since this assumption has important repercussions for the threat analysis, it is valuable to justify this assumption.

With the birth of peer-to-peer networks in 2000, it became very easy to share and download digital media over the Internet. Decentralized networks, such as Gnutella and Limewire, have proven resistant to attempts to shut them down, either by technical means or through legal action¹⁷. In these peer-to-peer networks, if users are searching for a file, the availability of the file grows exponentially as users download the file, since there are a growing number of hosts from which to download the file. Therefore, in a peer-to-peer network, if the original source of a file is not stopped prior to sharing of the file, it is impossible to prevent the spread of the file, provided the file is in demand. We do not analyze the financial repercussions of Internet redistribution of movies because the MPAA focuses only on limiting Internet redistribution as a goal of the broadcast flag.

Another assumption made is that the MPAA is only concerned with the distribution of HDTV-quality movies. For the purposes of this threat analysis, we will ignore the Internet distribution of movies that are "ripped" from DVDs, rather than broadcast HDTV. Since the DVD encryption system has already been broken, as long as DVDs continue to be sold, movies of SDTV quality will be distributed on the Internet.

There are many threats to the goal of preventing unauthorized distribution of movies on the Internet. We distinguish between three capable adversaries to meeting the

¹⁶ "-----." "Broadcast Flag Frequently Asked Questions." Retrieved November 22, 2002, from http://www.mpa.org/Press/Broadcast_Flag_QA.htm.

¹⁷ Von Lohmann, Fred. (2001) "Peer-to-Peer File Sharing and Copyright Law after Napster." Retrieved December 7, 2002, from http://www.eff.org/IP/P2P/20010227_p2p_copyright_white_paper.html

goal of preventing Internet distribution of digital content, whom we label as follows: average consumers, nefarious infringers, and groups with resources.

3.1.1 Adversary 1: Average Consumers

The average consumer may wish to distribute movies on the Internet to share them with friends, or simply to share them to anyone. Movies may be distributed in their entirety, or as short clips. Since we assume the analog output would be disabled, digitization of content is not an option. Consumers will somehow have to work around the broadcast flag to disseminate movies over the Internet since the broadcast flag is designed explicitly to prevent movies from being moved to computers.

To analyze the threat that the average consumer poses to meeting the goal of preventing Internet distribution, it is useful to understand the likelihood that the average consumer will use a circumvention device. While the broadcast flag is not currently in use, comparisons can be made to older copy protection methods, such as the CSS encryption used in DVDs. CSS encryption was broken in 2000, and DVD decryption software is widely available on the Internet. However, it is the belief of the authors that the average consumer is apathetic towards this, and most consumers have never ever considered the possibility of making their own DivX encoded movies to trade on the Internet.

Since consumers today may be dissuaded from trading movies because of bandwidth limitations, it is helpful to inspect the trading of MP3s on the Internet. MP3s have become commonplace, and many groups of consumers (especially college students) have extensive collections of music in MP3 format. However, rather than creating their own MP3s, most consumers get MP3s from friends or from anonymous computers on networks such as Kazaa and Gnutella. A search for “mp3” on Download.com reveals that the most popular download is Kazaa, with 161 million downloads. For comparison, first search result that actually encodes mp3 is MusicMatch Jukebox, twelfth in popularity, with only 3 million downloads. Assuming these alternate sources continue to exist, we can expect future consumer action to remain similar to this.

Using evidence from MP3 trading and current movie trading, we claim that even if consumers are given the tools to circumvent the broadcast flag and distribute movies on the Internet, they usually will not actively copy movies and post them for public distribution. Therefore, the average consumer does not pose a serious threat to the broadcast flag’s primary goal.

3.1.2 Adversary 2: Nefarious Infringers

The techno-savvy infringer is very different from the average consumer as a threat of the stated goal of the MPAA in preventing Internet distribution of its digital content. This “nefarious infringer” has some technical knowledge, and is willing to expend energy in learning how to circumvent copy protection mechanisms. This group may distribute movies on the Internet for monetary compensation, but the more likely reason is that they simply enjoy distributing movies. Monetary compensation is unlikely to be a driving force of nefarious users because of the difficulty in receiving payment for the sale of

illegal merchandise without getting caught. To continue the prior comparisons, this is the group that converts songs to the MP3 format for Internet distribution, and compresses decrypted DVD content for distribution.

To distribute HDTV-quality movies on the Internet, this group must circumvent the broadcast flag. Circumvention of the broadcast flag means that individuals will have to develop such techniques themselves, or they will learn these techniques from other individuals in this group. The threat posed by this group depends on the robustness of the broadcast flag. A complete discussion of the robustness of the flag is beyond the scope of this paper; however, we have attempted to make a brief analysis here for the purposes of the threat model.

It is the belief of the authors of this paper that the broadcast flag is not a reliable *technical* solution to prevent copyright infringement. Rather, it is a legal solution, depending heavily on legislation mandating the compliance of all digital devices. Due to FCC regulations, all digital television signals must be sent in the clear, preventing broadcasters from employing proprietary encryption as is used in digital satellite and digital cable. The broadcast flag is simply a tag that marks copyrighted content, and legislation is the only way to ensure that consumer electronic devices respect the broadcast flag.

To prevent these users from hacking DTV tuners, the BPDG has released a set of robustness requirements for consumer electronics. These include various requirements, such as ensuring that all busses are encrypted, and that all integrated circuits are soldered, not socketed, to boards. The requirements even go as far as naming screwdrivers in a list of tools that should not be able to be used to defeat the copy protection system in DTV products.¹⁸ These countermeasures are likely to deter many people from finding weaknesses in DTV systems. However, the cost of consumer electronics must be kept low. The BPDG realizes this, and has decided to forgo any countermeasures that would deter hackers using more sophisticated tools, such as logic analyzers. Herein lies a sticky problem pointing to the weakness in the broadcast flag implementation: the system should be secure when distributed to millions of people, but should also be cheap.

The BPDG may feel that adversaries with logic analyzers do not pose a significant risk because of the limited number of people with both access to logic analyzers and the technical knowledge with which to hack DTV systems. However, one person who defeats copy protection on a DTV device may be able to share enough information about the method for others to circumvent copy protection on identical devices. Indeed, a similar situation existed with Microsoft's X-Box game system, which was designed to execute only Microsoft-authorized (signed) code. In 2002 MIT graduate student Andrew Huang, having spent many hours in a well-equipped lab, successfully crafted a method to run unsigned code on the X-Box. While not everybody has access to

¹⁸ “-----.” BPDG Compliance and Robustness Rules (n.d.). Retrieved December 1, 2002, from http://www.eff.org/IP/Video/HDTV/20020414_bpdg_compliance_rules.pdf

logic analyzers, the directions and information Mr. Huang provided helped others to run unsigned code on their X-Box.¹⁹

Developing a workaround for the copy protection on a broadcast flag-compliant device is not the only way to move movies to a computer. Another method, which may be much easier, is to use a DTV receiver that simply ignores the broadcast flag. Legislation will obviously make it illegal to import these devices from overseas, but US law cannot prevent their manufacture overseas. The harsh reality is that since DTV broadcasts will not be encrypted, it will be almost trivial for a company to make a DTV tuner that demodulates the digital signal while ignoring the broadcast flag. If these devices are available overseas, then it is very likely that a nefarious user will successfully bring one into the United States for the explicit purpose of distributing movies online.

The BPDG is taking care to deter nefarious users from hacking broadcast flag-compliant devices by having robustness rules for compliant devices. However, the fact that the broadcast is unencrypted means that it is very likely that devices will be available which do not respect the broadcast flag, despite legislation making such devices illegal for sale in the United States. The threat of nefarious users making content available on the Internet is very high.

3.1.3. Adversary 3: Organized Crime

We now examine a third adversary to MPAA's goal of stopping Internet distribution of its digital content with the broadcast flag: organized crime. While most nefarious users do not have monetary gain as motivation to distribute movies on the Internet, there are groups whose motivation is of a monetary nature. These groups are analogous to the groups that currently copy movies and sell them on VHS tapes or DVDs on city streets, often based in off-shore operations. Since these groups have more financial resources than individual consumers, it stands to reason that they will be more likely to succeed in an attack on breaking the copy protection on DTV devices.

Any group with resources is more likely to have the technology necessary to circumvent the copy protection mechanism on DTV devices. However, their motivation of profit affects the likelihood that a group will actually distribute movies over the Internet. In order to make money selling illegal Internet copies of movies (a risky business model anyway), the groups will be giving up their anonymity. This lack of anonymity would lead to prosecution in the United States, or in many other countries (including the E.U. member nations) for copyright infringement. For fear of prosecution, it is unlikely that groups with resources pose a serious threat to the broadcast flag's attempt to keep movies off the Internet.

¹⁹ "-----." "Hackers Play with the Xbox." (n.d.). BBC News. Retrieved December 7, 2002, from <http://news.bbc.co.uk/1/hi/sci/tech/2067045.stm>

3.2 Goal 2: To Restrict Personal Recording of Movies for Time-Shifting or Library Building

We now examine a possible, although unstated goal of the MPAA in desiring to implement the broadcast flag, and conclude that this goal of restricting personal recording of movies for time-shifting purposes or library building will likely be met.

Time-Shifting and Library Building privileges go back to the *Sony vs. Universal Studios* Supreme Court decision. However, the *Sony* case did not establish these as rights, rather it upheld time shifting as legal within the scope of copyright law, protected under the fair use doctrine. The advent of the broadcast flag affords the MPAA a great opportunity to effectively reverse the *Sony* decision. While this is not a stated goal of the MPAA, it follows as a direct repercussion of the broadcast flag. This section examines the likelihood that the broadcast flag will be successful in restricting “fair use” copying. Without an analog output on DTV tuners, the only way consumers will be able to record broadcasts is via the copy protected digital output. By creating the standards for broadcast flag compliance, the MPAA (through the BPDG) will be able to set restrictions on recording for time shifting or library building. Additionally, under the Digital Millennium Copyright Act, it will be illegal to circumvent any copy protection afforded by broadcast flag compliant devices, locking these new restrictions into current law.

3.2.1 Adversary 1: Independent Individuals

Individuals working alone pose a threat to this goal if they are successful in circumventing the copy protection system in a DTV system. This group is motivated by the desire to have the same capabilities in the new DTV world as in the analog TV world. To be successful these individuals would have to reverse engineer a DTV tuner and/or digital recorder, which will probably be difficult without specialized equipment. Regardless, their effect will be limited if they are not able to share this knowledge with others; the overall system still restricts copying for most of its users. Thus, independent individuals will not be successful in deterring the broadcast flag from restricting personal recording of movies for time-shifting and library building purposes.

3.2.2. Adversary 2: Consumer Electronics Companies

A consumer electronics company shipping a defective product, or one without a robust copy protection system, poses a large threat to the goal of restricting the copying of broadcast television. Unlike the other threats, the CE will not intentionally attempt act as a threat to the goals of the MPAA. It is actually in CE manufacturers best interests to ship products that adhere closely to the copy protection specifications, as shipping a defective product may be against the law under broadcast flag legislation, and because of the strict requirements that CE devices must pass to be approved devices.

There are a few different ways that CE manufacturers may be threats to MPAA’s goal. One way is to ship a product that does not adhere to the copy protection guidelines at all. This threat is very unlikely, as products will have to be approved as broadcast flag compliant before allowed to be imported (or sold) in the United States. Another way of acting as a threat to the MPAA’s goal of restricting time-shifting and library building by CE manufacturers is to ship a product that is easily altered by consumers to ignore the

broadcast flag. This threat is also unlikely because of the robustness rules issued by the BPDG. However, though it is unlikely, since CE units ship on the order of millions, a flaw would allow many consumers unrestricted recording ability. Thus, consumer electronic groups provide a medium risk to the MPAA in accomplishing its unstated, although quite possible, goal of restricting time-shifting and library building via the broadcast flag.

3.2.3. Adversary 3: Malintentioned Groups

Individuals who work in groups pose a larger threat than do independent individuals. Groups are thus inherently different than individual circumventers because of the difference in motivation and actions. Malintentioned groups with infringement in mind have as a goal circumventing copy protection in a way that is easy for others to replicate. Additionally, groups allow more widespread sharing of information than individuals. Another motivation may be monetary gain, if the group wants to sell modifications that disable copy protection. This would be similar to chip modifications of Sony Playstation video game consoles, allowing the modified systems to play games copied to CD-R discs. However, actions that would accomplish circumventing the MPAA's second potential goal violate the DMCA, so it may be risky to run such a business. It may also be difficult to create chip modifications that work across systems. Unlike Playstation consoles, every model DTV tuner may be different.

Since consumers are not likely to take action by themselves to defeat copy protection, the larger threat is that someone will sell a service of modification to a DTV device to defeat copy protection. However, this threat is also not very significant because of the problem of charging for such a service. Under the DMCA this service is illegal, and the people involved in such businesses could be prosecuted. (Chip modifications to Playstations occurred prior to the DMCA.) Thus, the threat of malintentioned cooperative groups in acting as a threat to MPAA's goal of restricting time-shifting and library building via the broadcast flag is low, similar to the threat posed by independent individuals.

3.3 Goal 3: To Reverse Societal Norms of Copyright Infringement Acceptance

This section examines reversing societal norms of copyright infringement acceptance as a possible goal of the MPAA in seeking to implement the broadcast flag. We find that of the two possible adversaries to this goal, the average consumer poses a low risk, and Congress poses a medium risk.

Currently, several societal norms exist regarding copyright infringement acceptance that the MPAA may wish to reverse. The *Sony vs. Universal Studios* case kept VCRs on the market, but even without VCRs copyright infringement would happen. Today, it is commonplace, and widely condoned to make a copy of a tape or a CD for a friend, or make mix tapes of songs from friends. Many people have made CD-R copies of music CDs, or mix CDs for friends. While there are certain copyright violations that actually fall under fair use, such as making a tape for one's own use of a CD one owns, distributing unauthorized copies of audio CDs to friends is actually a copyright violation,

though most people think nothing of it.²⁰ This section examines the possibility that the broadcast flag will reverse these societal norms regarding copyright violations.

However, the attitude of general acceptance of copyright infringement has spread even further than CDs. This lax attitude towards copyright infringement has continued into the Internet era, where many people download MP3s of songs they do not own, while maintaining a clear conscience. This has frustrated record labels, which have gone to such lengths as printing full-page ads in the New York Times with quotes from famous artists explaining that downloading MP3s is actually wrong, despite public perception.

While copyright infringement over movies is not as widespread as infringement over music²¹, it is fair to say that the average American also thinks nothing of copying a movie for a friend. The main reason for this societal acceptance of copyright infringement is that historically copyright law has not been applied to individual people.²² This meant that some copyright infringement, like copying a movie for a friend, was tolerated. To reverse these societal norms, the broadcast flag would have to create a digital world in which personal copying was limited, and make this limited copying the new baseline for acceptance. This reversal faces two threats, one in the form of social backlash by consumers, and another in the form of Congressional legislation that codifies fair use rights.

3.3.1. Adversary 1: Average Consumers

At the end of the day, the companies represented by the MPAA are answerable to its customers: the average consumers who actually buy Hollywood products. Without the financial support of the average consumer, the MPAA member companies cannot exist. These consumers pose a threat to the MPAA's attempt to change the social perceptions on copyright infringement. If consumers were to speak out against the MPAA, or organize a boycott of movies because they were unhappy with restrictions on copying broadcast television, then the companies represented by the MPAA would be forced to answer. Unfortunately, even with organizations like the EFF and the HRRC, this threat is not large. These organizations rarely enact social change directly; rather they lobby politicians and work through the legislature. Without leadership, the average consumer is not likely to be organized enough to mount a worthwhile attack against the MPAA regarding its goal of reversing societal norms of copyright infringement acceptance.

3.3.2. Adversary 2: Congress

Unlike their European counterparts, residents of the United States do not enjoy codified fair use rights. Rather, fair use is a defense against copyright infringement, and fair uses are not guaranteed rights under law. Congress poses a threat to the MPAA's attempt to reverse societal perceptions because it may pass legislation codifying fair use rights. Congressional motivations may include pressure from groups such as the EFF, and a desire to remove individuals from the mess of copyright law. Congress has passed similar legislation before, such as the Audio Home Recording Act of 1992, which

²⁰ Litman, Jessica. *Digital Copyright*. Amherst, NY: Prometheus Books, 2001. pp 161-162.

²¹ Litman, Jessica. *Digital Copyright*. Amherst, NY: Prometheus Books, 2001. pp 169.

²² Litman, Jessica. *Digital Copyright*. Amherst, NY: Prometheus Books, 2001. pp 18-19.

exempted consumers from lawsuits for copyright violation in specific cases in return for mandating certain copy protection mechanisms in home audio recording equipment. It is difficult to gauge the risk that Congress poses due to its fickle nature. The AHRA was passed with the support of consumer electronics groups, and it is not clear whether they would mobilize sufficiently to overcome the MPAA and fight for these carved out rights. Overall, the authors of this paper predict that Congress poses a medium threat in preventing the MPAA goal of reversing societal acceptance of copyright infringement.

3.4. Goal 4: To Move Content Control to Copyright Holder

This section examines whether the two adversaries of the MPAA's goal of moving content control to the copyright holder, FCC and Congress, presents a viable threat to this goal. The analysis concludes that the FCC and Congress jointly present a high, and extremely viable, threat to this potential goal.

If the broadcast flag legislation is passed, it will mark the first time that the content creator and copyright holder (MPAA constituents) both dictate how the content can be used, and architect the technological framework to enforce those decisions. To date, the copyright holder has not been able to prevent infringement. Instead, the copyright holder sues after infringement has occurred. Using the broadcast flag movie studios will proactively be able to restrict the use of their content, which is obviously self-beneficial. In the case that broadcast flag legislation is passed, only two groups pose a threat to the movie studios' goal of putting themselves in charge of every use of their content. These two groups are the FCC and Congress.

3.4.1 Adversary 1: FCC / Congress

Since the FCC has authority over the public airwaves, it may pass a mandate specifying the encoding rules for broadcast DTV. This could force the MPAA to allow a certain number of copies, or allow some other fair use copying. The FCC would be interested in doing this to placate consumers unhappy about the DTV transition.

In a similar vein, Congress could pass legislation specifying the encoding rules for broadcast DTV. Congress may do this to uphold consumer rights or as a compromise with the passing of the broadcast flag legislation. The threats posed by the FCC and Congress are hard to determine. The risk from the FCC is probably minimal, because the FCC will likely defer responsibility to Congress, as it appears to be doing with the broadcast flag legislation. The threat from Congress is serious, as there is already proposed legislation requiring digital fair use. This legislation, the "Digital Choice and Freedom Act of 2002" was introduced in October 2002 by Zoe Lofgren (D-Ca)²³.

3.5. Threat Analysis Conclusion

As shown through the above threat analysis, the broadcast flag does not provide a robust technical solution to the problem of Internet redistribution of movies. Rather, it provides a legal solution which is ultimately not likely to successfully keep unauthorized movies off the Internet. The nature of existing online distribution chains such as peer-to-

²³ "-----." "Electronic Frontier Foundation Supports Digital Media Bills" *Electronic Frontier Foundation*. Retrieved December 7, 2002, from http://www.eff.org/IP/DMCA/20021003_eff_pr.html

peer networks allow a “break once, run anywhere” model, permitting a few advanced users to crack the broadcast flag protection and then allowing others to share with impunity. However, the threat model does show that the broadcast flag has the potential to prevent consumers from enjoying uses of content previously considered as “fair uses” in the analog realm, and to give MPAA control over the use of its content. Though its stated goals are not met, the MPAA and its constituents would derive considerable benefits from the broadcast flag regime.

4. Cost-Benefit Analysis

Having determined the role of the broadcast flag, we now turn our attention to the full range of players, including consumer electronics companies, broadcasters, the major television networks, consumer groups, cable providers, the FCC, and Congress, and use a cost-benefit analysis to unpack the motivations and incentives each player has for supporting or opposing the flag. In the sections that follow, we additionally compare our analysis with the public statements by each of the players regarding the flag, to evaluate the sincerity of their claims and affirm our analysis. Ultimately, it appears that the underlying motivations of key players in the broadcast flag debate are quite different from the stated goals of the broadcast flag, and relate far more to DTV in general than digital content protection.

Embroidered in the question of the broadcast flag are several key groups representing specific interests. Each group will be affected in different ways by an implementation of the flag, incurring some costs and deriving some benefits; a cost-benefit analysis allows us to isolate predicted motivations for each actor. We look at costs and benefits incurred throughout the process, both in the development and deployment of the flag, seeking to isolate out as much as possible the effects of the BPDG proposal. Potential benefits or risked costs count towards the real benefits or costs, since their expected value can be computed as the product of their probability times their expected harm or benefit. We find that, in cases, where the benefits exceed the costs, many of the benefits are derived from exogenous factors not directly related to the question of the broadcast flag itself.

The following table summarizes the analysis and conclusions that follow in section four:

Agent	Supports/Opposes	Reasons for Support and/or Opposition
Content Owners MPAA	General Support	
	Support	•See threat analysis
	Support and Ambivalence	•FOX invented broadcast flag •Networks broadcast without broadcast flag
Major Networks		
	Support and Oppose	
Consumer Electronics Manufacturers		
5C	Support	•Licensing proceeds •Increased sales •Create barriers to entry
	Oppose	•Licensing fees •Increased sales
Non-5C	Oppose	•Costs of transition
Consumers	Oppose	•Costs of transition
Broadcasters	Support	•Heavy investment already •Quality content may help gain market share
	Support	•Increased market share due to high costs of DTV transition
Cable Companies		
Governmental Actors	Support and Oppose	
FCC	Supports	•Expand scope of authority •Possible faster adoption of DTV due to flag
Congress	Supports and Opposes	•Avoid offending industry •Avoid offending consumers •Possible delay in adoption of DTV and delay in return of spectrum

4.1. Content Owners

The following subsection examines the costs and benefits of content owners (namely the MPAA member companies and major networks) with respect to the broadcast flag. The analysis finds that MPAA member companies have an incentive to support the flag for reasons mentioned in the threat analysis and that major networks will be ambivalent to the broadcast flag, because it does not directly impact their distribution chain.

The premium content industry—most notably represented by the MPAA—has been the principal driver behind the broadcast flag, providing the original impetus for its creation. As discussed above, their strongest case for the flag centers on protecting their premium content over unencrypted terrestrial broadcast. However, a strong threat model analysis suggests that the flag is not a highly robust protection against the dissemination

of content over the internet, and highly robust it would have to be to keep a small number of users from distributing content to many others using peer-to-peer systems and other hard-to-monitor channels. The question then stands: what does the MPAA stand to gain from the flag?

4.1.1. MPAA

The Association has spent some resources on the creation of the broadcast flag system. As a chief sponsor of the CPTWG and the BPDG, the MPAA expended enough energy to shift the development discussion on matters from backwards compatibility to the language of Robustness Requirements in the final BPDG Report²⁴. On top of that, the trade association has spent considerable efforts on lobbying various actors in Washington for the general promotion of the flag. Finally, the member companies of the MPAA would be responsible for maintaining and updating permissions on the content they license to broadcasters for distribution, a small but real expense. The MPAA, and by proxy its member companies, have not expended a huge sum on the flag, nor do they stand to lose any of their current market share under a broadcast flag implementation. That is, any shift in their business model will be purely endogenous with the wide-spread acceptance of the flag, rather than caused by the flag itself.

The alleged primary benefit of the flag is that MPAA members will release their massive libraries of premium content once the broadcast channels are protected against the threat of unauthorized distribution. The threat of unauthorized distribution is discussed above; what about the idea of newer, better content on the airwaves? The authors of this paper do not claim expertise in the entertainment industry, but it is not altogether clear where in the current distribution chain the free (advertiser-sponsored) distribution of premium HDTV content will occur. Hollywood movies are currently broadcast over NTSC television standards,²⁵ but these occur at the very end of the distribution chain. Movies are released to different media to extract the maximum value from them, going from the theatres to VHS/DVD sale and rental to pay-per-view, through the premium movie channels before finally being made available on network TV.²⁶ Until this last stage, the consumer is willing to pay a premium to access the movie; in order for the market to shift, content-owners must believe they can extract greater rents from the advertising-sponsored broadcasts than they can from other sources. While this may be possible due to the fantastic image quality of HDTV, it is not assured. If the MPAA does not stand to gain a new market, at least they will preserve an old one.

What else does the content industry get? As discussed in the threat analysis above, shaping the debate can be a very powerful force. Indeed, further reflection may bring one

²⁴ “-----”. “Final Report of the Co-Chairs of the Broadcast Protection Discussion Subgroup to the Copy Protection Technical Working Group, June 3, 2002.” Retrieved December 9, 2002, from <http://www.cptwg.org/Assets/BPDG/BPDG%20Report.DOC>.

²⁵ See, e.g. TV Guide Nov. 16-22 2002, p.82: Local Boston ABC affiliate broadcasts *The Sixth Sense* (1999)

²⁶ “-----”. “The anatomy of a monster” from Frontline, The Monster that Ate Hollywood. Retrieved December 9, 2002, from <http://www.pbs.org/wgbh/pages/frontline/shows/hollywood/business/windows.html>.

to wonder why such a small part of the current broadcast television market²⁷ is setting such a large part of the current agenda. The MPAA benefits greatly from precisely that agenda-setting role. As technology threatens the traditional content-owner's business model, the MPAA is devoted to ensuring that new technological and regulatory advances take into account their member companies. By establishing the precedent of privileging their own interests, and framing the debate around those interests as being common interests, the MPAA can have a lasting impact on the long-run debate over digital copyright. By defining fair-use technically, rather than legally, the content-owners can edge around sticky issues of fair use, for example, by simply asserting that their own rights should be protected in the system. The MPAA gains a huge benefit, simply by defining the debate.

Comparing the costs and the benefits, we see that the Motion Picture Association pays fairly little for the benefits of securing its distribution channels, and the large benefit of controlling the discussion over digital copyright. We see that the issue here is not directly related to the broadcast flag, but to the long-term solvency of an entire industry. The MPAA is using the flag as a tool to assert its role as a primary actor in defining digital copyright issues.

4.1.2. Major Networks

The major networks can be seen as content providers as well, since they primarily create and disseminate broadcasting content to their affiliates. They do not, however, have the same interests as the MPAA. The primary output for their content is advertiser-sponsored open broadcast, and the value of that is the first release as a primetime broadcast, as well as resale for syndication. Those broadcasts differentiate their network from others, and allow them to control the costs. Under a broadcast flag regime, much more content would be available, claims the MPAA, and the market may well demand its broadcast. The networks would have to pay for these movies, but would not retain the rights for syndication and resale. Furthermore, the occasional hit TV show offers opportunities for external marketing and licensing, such as *The Simpson's* Happy Meals, or the *Touched by an Angel* Christmas Album. By spending resources on Hollywood's movies, rather than their own productions, networks may miss these synergistic marketing opportunities. Finally, networks derive a fair amount of prestige for creating their own programming, and competing for awards like the Emmys; this too would diminish with a rise in Hollywood movies on network TV.

On the other hand, one could question just how large the separation is between Hollywood and the networks. Mergers and acquisitions have left Disney owning ABC. Fox produces movies as well as television shows. Revenue would be lost by one division, but gained by another in a parent company. Still, the primary benefit for the networks would be the same as the stated claims of the MPAA, namely to protect broadcast content.

Yet the networks do not seem to fear lost digital content as they currently broadcast primetime content. Television shows do not have as long a distribution chain, and thus can not extract as much value from an episode of a hit TV show as a studio can

²⁷ Major network affiliates do not typically broadcast an incredible amount of Hollywood movie content.

from a hit movie. Conversely, a 21 minute TV show is much easier to disseminate across the net with reasonable quality than a 100 minute feature-length movie. Since the MPAA counts each instance of unauthorized viewing as lost revenue, why don't the networks? It comes down to a business model, where after the first prime-time viewing of a TV show, its value for syndication does not diminish with multiple digital copies around the Internet. While the networks have not actively campaigned against the flag, they have not actively supported it either. In fact, 17 of CBS's 21 weekly prime time programming hours are currently simulcast in HDTV where available²⁸. Eight prime time hours are digital for ABC²⁹. Seven of 21 prime time programming hours are in digital for NBC³⁰. Major networks are currently broadcasting their content today without any sort of copy protection, as evidence that they do not think the broadcast flag is necessary. These actions validate the conclusions of the analysis that the major networks are ambivalent toward the broadcast flag.

4.2. Consumer Electronics Manufacturers

The following subsection examines the costs and benefits of 5C and non-5C corporations with respect to the broadcast flag. The analysis finds that 5C firms have an incentive to support the flag due to licensing proceeds, increased sales of DTV related equipment and to create a barrier to entry for other consumer electronic manufacturers. Our analysis also finds that non-5C firms will oppose the broadcast flag due to licensing costs imposed by the 5C firms, but will be interested in DTV rollout in hopes of increased sales of related equipment.

4.2.1. 5C Corporations

The consumer electronics industry has a large role in the broadcast flag debate since all consumption of broadcast content will involve manufactured electronics. The 5C corporations (discussed extensively in the Appendix) bear considerable costs in the actual development of the flag-compliant devices. The rather complex standard discussed above requires the cooperation and coordination of 5 disparate firms, and the legal costs alone of securing an equitable intellectual property mechanism must have been quite substantial. While the full costs of the standard creation are not known, going from protocol design to baked silicone entails an extensive procedure. The BPDG set the required level of robustness rather high; in order to be compliant a device must "effectively frustrate" attempts to circumvent it. This efficacy requirement is a high barrier that represents a high cost of compliance. The added expense of broadcast flag compatibility will raise the price of the product, and result in a corresponding decrease in the amount purchased. Moreover, the increased cost of manufacturing could affect the revenue streams of an industry where cheap electronics have already dramatically shrunk

²⁸ "-----". "Primetime Schedule with HDTV." Retrieved November 20, 2002, from <http://www.cbs.com/info/hdtv/>.

²⁹ "-----". "Fall 2002." Retrieved November 26, 2002, from <http://www.abc.abcnews.go.com/primetime/schedule/index.html>. Information was calculated by looking at the web site of each individual show that is linked from this site to see if it is broadcast in HDTV where available.

³⁰ "-----". "Frequently Asked Questions." Retrieved November 20, 2002, from <http://www.nbc.com/nbc/footer/FAQ.shtml>.

profit margins to razor-thin levels³¹. 5C corporations face the costs of development, together with threats to their current profitability. Finally, if home recording is going to be substantially more difficult, we can envision a similar substantial reduction in the number of VCRs bought.

Despite the costs, these corporations stand to gain two large benefits. First, as commented on above, consumers will have to update their entire home-theatre system, which gives the CE manufacturers a vast new market. The leading edge is already under way, and current digital televisions, although not necessarily flag-compliant, sell at large mark-ups for gadget-hungry early-adopters. Soon, every household that wishes to watch broadcast television will be forced to upgrade its television, as well as any peripherals that go with it. This portends millions of dollars in sales in consumer electronics. Yet with the advent of digital and high-definition television, many consumers would voluntarily upgrade, at least purchasing a set-top box tuner when the standard analog channels go dark. Much of the added benefit does not require the implementation of the broadcast flag *per se*. Rather, the flag affords a second, less obvious benefit to 5C corporations. The consortium collectively owns the standard necessary for compliance, and thus all other consumer manufacturers will be forced to license this standard to compete in the television market. At best, this offers the 5C firms a chance to extract rents from their intellectual property. At worst, it erects a barrier of entry into the market of DTV sets and peripherals, and creates the potential for a cartel to maintain artificially high prices.

The 5C firms stand to make a significant profit from their investment in the 5C standards, a profit that comes at the expense of their competitors and the consumers. Again, we see that this net benefit comes with the broadcast flag but in no way relates to the initial idea driving the public policy. This analysis is affirmed by the general support of the 5C industry in furthering the broadcast flag, as evidenced by their commitment to make 5C chips for compliant devices.

4.2.2. Non 5C CE Firms

Those CE firms not party to the 5C standard do not, of course, have to directly worry about paying for the standard development, but they must pay to license the flag-compliance technology should they wish to continue selling televisions. These fees could be rather high, and offset the benefits of a larger market, since that market might now be dominated by 5C firms. If non-5C firms expect to lose market share due to the added expenses they would face, we would expect them to be speaking out against the strict flag regime. In fact, they are doing just that, which helps lend credence to our theories about discriminatory licensing of 5C technology. While supporting Digital Television in general, non-5C consumer electronic manufacturers have no incentive to support the broadcast flag itself.

The consumer electronics manufacturers can be represented by the Consumer Electronics Association (CEA), a group that represents companies involved in the design

³¹ Ether, Thomas and Friel, Thomas. Executive Strategy Reports. Retrieved December 9, 2002, from http://www-1.ibm.com/services/strategy/e_strategy/strat_sucs2.html.

and manufacture of electronics for consumers. The CEA has a close relationship with the Home Recording Rights Coalition (HRRC) and consequently shares many views with that organization that seeks to protect the ability of consumers to make recordings in their homes for noncommercial uses. The more than 1000 members of the CEA account for more than \$80 billion in sales of consumer electronics each year³². Since consumers will have to buy some form of electronics in order to watch television in the future, these consumer electronics companies, which hold a large share of the market, are a major factor in the broadcast flag debate.

As predicted in the analysis, the CEA has taken a firm stance in favor of the consumer's right to record in their home. They say, "Copyright owners must resist the temptation to restrict technology. If successful, restrictions will deprive the public of equal and fair access to information, entertainment and education"³³. This opinion places them firmly in opposition to the implementation of the broadcast flag. However, as also predicted by the analysis, the CEA does support digital television in general, as evidenced by the creation of "Digital Television Zones" throughout the United States³⁴. These DTV Zones are designed to educate the American public about digital television and expose them to its better picture and sound quality, in the hopes that this will motivate them to transition to a digital television set. We see that the quotes of non-5C CEs support the above cost-benefit analysis in predicting that non-5C CE firms will not support the broadcast flag, but will be interested in DTV rollout in hopes of increased sales.

4.3. Consumers

The following subsection examines the costs and benefits of consumers (and indirectly consumer advocacy groups) with respect to the broadcast flag. The analysis finds that consumers and consumer advocacy groups will oppose the broadcast flag due to the flag imposing additional costs on the DTV transition.

It is the consumers, in theory, for whom the broadcast flag is being set up. They are, by definition, the ones who will consume the content broadcast under the digital television regime. Yet they bear considerable costs. For one, everyone watching digital television will have to buy a new television. This is an enormous expense, to be borne across a huge range of incomes, interests, etc, and must be tempered with a few caveats. First, we must separate the cost of the digital receiver from the high-definition screen, itself a very large expense. This leaves the question of where the receiver must live. In order for the broadcast flag to have a hope of working, an implementation must close the analog hole. This means that every digital tuner must live inside a 5C compliant device

³² Joseph, Jeff and Miller, Jenny. "CEA Reports Record-Setting October DTV Sales." Retrieved November 26, 2002, from http://www.ce.org/press_room/press_release_detail.asp?id=10106.

³³ "-----". "Consumer Home Recording Rights/Copyright Protection." Retrieved November 26, 2002, from http://www.ce.org/about_cea/cea_initiatives/viewInitiativesOverview.asp?title=Consumer%20Home%20Recording%20Rights/Copyright%20Protection&name=253.

³⁴ "-----". "All About Digital TV Zone." Retrieved November 26, 2002, from http://www.digitaltvzone.com/info/about_dtvzone.html.

which, of course, must be purchased new, since there are no legacy 5C devices. This eliminates the possibility of a cheap set-top-box connecting to one's current television set, because those sets take an un-secured input. So the actual cost to the consumer would be the cost of a new, 5C-compliant television, less the cost of the STB that consumer would otherwise have to buy to use un-flagged DTV with his or her existing set. These STBs³⁵ would essentially be a mass-produced handful of decoders and decrypters, and would thus cost much less than a full television set. This still represents a considerable expense. The consumer must not only have a compliant television, however. All peripheries that touch the content, including home recorders and projectors, must be upgraded. There is no reason why the price of these compliant devices would go down from their non-compliant brethren, so at a bare minimum, a consumer would have to pay the current retail price of each component he or she wishes to continue using.

Beyond the immediate fiscal cost, all consumers face an encroachment on fair use, as is much discussed on consumer and copyright activist forums such as Electronic Frontier Foundation (EFF) and DigitalConsumer.org. The authors of this paper do not wish to wade into that debate, often filled with hyperbole, but do wish to note that a regime designed to protect fair use would not include a 'copy-never' flag at the broadcast level.³⁶ We would further note the fair-use concerns of the Consumer Group Copyright Project, notably the question of who will determine what acceptable fair use is.³⁷ Consumers face considerable real fiscal costs and a threat of diminished rights over what they can do with publicly broadcast content; what benefits do they derive?

At first blush, consumers can claim to get more content and better content over broadcast television. A closer look at where people get their content from shows a different story. Almost 70% of American households subscribe to cable, with another 15% getting extra content from satellite services such as DirecTV³⁸. Assume that very few have both cable and satellite leaves only 15% of American households that will directly benefit from the increase in network-carried, advertiser-sponsored movies. Putting aside the previous discussion of where content is likely to be released, we can see that most TV viewers already have access to some premium content. The subscription-based services use their own encryption, and thus have no need for the broadcast flag. Thus, if we assume that the current must-carry rules forcing cable companies to transmit the local television stations will at least be voluntarily enforced to carry the new Hollywood content broadcast under the DTV regime, the flag will affect a very small segment of the viewing audience. The rest can still view movies over other subscription-based services, even if the absence of the flag would force the MPAA members to withhold their movies over DTV. Without exact figures on the demographics to non-cable subscribers, we can still surmise that they are either towards the lower end of the economic spectrum or are individuals who simply do not wish to spend heavily on TV

³⁵ Set-top-box

³⁶ "-----". "Cablevision in New York City," San Jose Mercury News, September 18, 2002.

³⁷ "-----". "Consumer Policy Questions and Issues Regarding the BPDG Proposal for Protecting DTV Content" by Center for Democracy & Technology, Consumers Union and Public Knowledge. Retrieved December 9, 2002, from <http://www.cdt.org/copyright/020719bpdg.pdf>.

³⁸ "-----". "Cable TV extends its reach" Lansing State Journal, July 17, 2002. Retrieved on December 9, 2002, from http://www.lsj.com/things/hughes/020717_cable_1d.html.

content. From a social perspective, these are not people who should bear the cost of the broadcast flag.

All consumers will have to bear the costs of compliance, however. Even if cable subscribers do not need to immediately rush out to replace their equipment, legislated compliance will raise the price of all TV-related components. Thus, for minimal benefits, consumers across the board will face considerable costs, both real and potential. The 15% who do rely on broadcast television will face considerable upgrade costs when they could be quite minimal for a STB (Set Top Box), and may not get that much content in exchange.

Not surprisingly, no consumer group supports the broadcast flag. Consumer advocacy groups such as the Electronic Frontier Foundation (EFF) and DigitalConsumer.org cite reasons like, “the biggest problem with the BPDG [who created the standard] is that it strips citizens of their fair use rights”³⁹ In reference to recent Congressional legislation attempting to expedite the broadcast flag process, consumer groups state that the legislature “asserts that fair-use will be protected while at the same time providing content providers with bulletproof piracy protection. But no such technology exists to meet both of these goals”⁴⁰.

4.4. Broadcasters

The following subsection examines the costs and benefits of broadcasters with respect to the broadcast flag. The analysis finds that broadcasters will support the flag because of sunk costs related to the DTV transition, and in hopes of gaining increased market share after the DTV transition.

The broadcasters are a key actor, understandably, since they will broadcast the signal carrying the flag itself. They bear the head-end costs of inserting the flag, but much of that is arranged by the content owner. Since they have invested considerable expense in upgrading their traditional NTSC broadcast arrays to handle the new DTV standards, any compliance costs of the flag is fairly small in comparison. Since broadcasters are required by FCC mandate to upgrade their facilities to be capable of digital broadcast, the stations are primarily interested in having consumers ready as soon as possible. In the event that the broadcast flag regime slows consumers in their adoption of DTV-capable hardware, the DTV market grows more slowly and thus any added advertising revenue would grow more slowly as well. Broadcasters need this revenue to recompense their DTV expenses. Thus the principle cost borne by broadcasters from the broadcast flag would be a delay in DTV diffusion. To minimize their costs, the broadcasters have no interest in blocking the flag itself, merely in preventing the flag from becoming a stumbling block for DTV rollout. According to Michael Fiorile, the Television Chair of the National Association of Broadcasters, “Broadcasters have

³⁹ “-----“. “Frequently Asked Questions.” Retrieved November 26, 2002, from <http://www.digitalconsumer.org/faq4.html>.

⁴⁰ Walia, Melissa. “DigitalConsumer.org Statement on Tauzin Bill Draft.” Retrieved November 26, 2002, from <http://www.digitalconsumer.org/press-release-2002-09-19.html>.

invested billions of dollars to bring digital television to all American consumers.”⁴¹ As evidence of the progress of the transition, 621 stations are currently broadcasting in digital in addition to their normal analog transmissions⁴². In addition, 94% of homes in America are in a market with at least one station broadcasting in digital, and 62% of American households are in a market with at least five digital stations⁴³. Because of this, NAB president Edward O. Fritts says, regarding the digital transition, that “there is no turning back”^{44[48]}.

Since the National Association of Broadcasters has not fought the FCC in planning the new Digital Television regime (indeed, it has lobbied hard for it) we can assume they believe that the broadcasters will benefit from it. What is the added marginal benefit of the broadcast flag for NAB constituents? If the MPAA members do indeed release more content for broadcast television, this will increase the desirability of the broadcasters’ content, helping them gain back some of the market share lost to cable over the past 25 years. This market share translates into advertising revenue. Discussion above takes some wind out of the argument that Hollywood content will flood the airwaves under a flag regime. The broadcasters merely want DTV out quick and, just as important, they need to appear as cooperative players to the FCC and other regulators. Why are appearances important? The broadcasters currently control two large chunks of electromagnetic spectrum used for broadcasting: the old analog bands and the newly licensed bandwidth for DTV. They were given the DTV spectrum as a loan, under an arrangement that would involve them handing over the old spectrum once the full digital transition is completed. Yet recent developments show that the broadcasters have more to gain as spectrum controllers. The FCC recently agreed to allow 21 broadcasting companies to sell off their old UHF spectrum to wireless electronics interests, and keep the full proceeds, “to clear the band for use by the booming wireless industry.”⁴⁵ One firm, Paxson Communications Corp., is likely to receive \$1 billion for 17 stations. It is very likely that NAB members feel they will be in a good position to reap similar rewards. Hence, there is a general reluctance in the broadcasting community to in any way obfuscate the DTV transition, including attacking the flag. The broadcasters seek a fast diffusion of digital television, and thus will support the broadcast flag, and they do as shown through their statements above, despite the cost-benefit analysis having little to do with the merits of the broadcast flag.

⁴¹ Fiorile, Michael J. “Testimony of Michael J. Fiorile, President & CEO, Dispatch Broadcast Group, National Association of Broadcasters, Before the House Subcommittee on Telecommunications, September 25, 2002.” Retrieved November 26, 2002, from <http://www.nab.org/Newsroom/PressRel/testimonies/Fiorile092502.pdf>.

⁴² “-----”. “DTV Stations in Operation.” Retrieved November 26, 2002, from <http://www.nab.org/Newsroom/issues/digitaltv/DTVStations.asp>.

⁴³ Wharton, Dennis. “44 New Stations make DTV Transition.” Retrieved November 26, 2002, from <http://www.nab.org/Newsroom/PressRel/Releases/dtvlatest.htm>.

⁴⁴ Fritts, Edward. “Broadcasters Moving Forward on DTV.” Retrieved November 26, 2002, from <http://www.nab.org/Newsroom/PressRel/speeches/051502.htm>.

⁴⁵ Ornstein, Norman and Calabrese, Michael. “While Nation Distracted by Sept. 11th, FCC Chairman Announces Corporate Giveaway of UHF Channel Revenues.” Washington Post, October 14, 2001. Retrieved December 9, 2002 from, <http://www.webcom.com/hrin/magazine/fcc.html>.

4.5. Cable Companies

The following subsection examines the costs and benefits of cable companies with respect to the broadcast flag. The analysis finds that cable companies will support the broadcast flag in hopes of gaining market share from current terrestrial TV viewers who will not want to make the heavy investment in the DTV transition.

The chief cost of the cable industry, apart from flag development costs they shared, is the threat of lost market. The broadcast industry, after all, hopes that the DTV upgrades will draw more viewers, some of whom might be drawn from cable content viewers. At the very least, it would mean that more viewers would return to the network stations, rather than the cable content stations. As discussed above, users will have to invest significantly to watch this DTV new content. According to the NCTA, the National Cable and Telecommunications Association, a trade association of the cable industries that provides service to over 90% of the households in America with cable television⁴⁶, and represents many cable programming networks as well as equipment suppliers and service providers⁴⁷, the average consumer will have to spend between \$1,000 and \$3,000 purchasing new digital equipment for the DTV transition.⁴⁸ As we mentioned in our discussion on consumers, a great deal of this expense comes from the compliance requirements of the broadcast flag. Having invested this expense, some consumers might feel that the new HDTV content and Hollywood content meets their needs, and cancel their cable subscription.

This high cost of transition applies to those who want to receive DTV content from the on-air broadcast, however. Thus, cable companies might see the DTV switch as a chance to improve their market share. There are 35 million households in America without a cable or satellite subscription⁴⁹. An average digital cable package from AT&T costs between \$50 and \$90 month, and analog cable is significantly less.⁵⁰ Switching from broadcast to digital cable may be a way for consumers to lower the costs of the digital transition in the short term. They will still be able to receive any content sent over the relevant broadcast frequencies, since one expects the must-carry rule to be at least voluntarily enforced to access the new Hollywood content. Instead of making the large investment to stay with broadcast television, consumers may switch to digital cable, resulting in increased revenue for cable providers. The flag raises the expense of the transition, which in turn makes the cable transition more attractive.

⁴⁶ “-----.” About the Industry. Retrieved December 7, 2002, from http://www.ncta.com/industry_overview/aboutIND.cfm?indOverviewID=1.

⁴⁷ *Ibid.*

⁴⁸ *Ibid.*

⁴⁹ *Ibid.*

⁵⁰ “-----.” “AT&T Digital Cable: Packages and Pricing.” Retrieved December 7, 2002, from http://www.attbroadband.com/services/pricing/PricingDigitalVideo.jhtml?_requestid=119113.

Cable companies have no direct gain from copy protection schemes that apply almost exclusively to broadcast content, and in fact could lose market share, at least in terms of which station viewers tune to. However, the fashion in which the broadcast flag will shift the cost structure of the upgrade makes cable television an attractive option for non-subscribers looking for the least expensive way to make the DTV transition.

In actuality, the Cable Companies are taking a position in favor of the broadcast flag. Robert Sachs, President and CEO of the NCTA has said that his organization is working hard to “assure that broadcast flag or watermarking mechanisms work seamlessly with cable technology.”⁵¹ As a technical solution, the NCTA has said that, “The cable industry supports the proposed 5C technology as an effective way to provide copy protection”⁵² In fact, they participated in the CPTWG development process, with a special eye on cable integration. They have also supported simply including the set top box inside the DTV set, thus eliminating an output that can be used to steal content. However, cable companies are currently providing programming in HDTV without copy protection on the output from the set top box. For example, “Time Warner is providing HD programming to subscribers in 35 markets.”⁵³ Other providers are following suit by beginning to provide HDTV programming in other markets. Our analysis indicates that the cable companies’ support of the flag could signal that they do not see it as a threat to market share, and that they, in fact, anticipate an increased market share from current terrestrial television watchers who will find cable subscription a smaller investment than digital terrestrial television.

4.6. Governmental Actors

The following subsection examines the costs and benefits of government actors (namely the FCC and Congress) with respect to the broadcast flag. The analysis finds that the FCC will support the broadcast flag due to increased authority and expedited adoption rate of DTV. The analysis also finds that Congress will both support and oppose the broadcast flag because it will seek to appease both supporters and opponents of the broadcast flag debate.

4.6.1. FCC

The FCC will be responsible for overseeing the multiple regulatory issues under the broadcast flag regime. They have pressed strongly for the entire Digital television rollout. In the event that consumer reluctance to purchase new technology slows DTV adoption, the FCC would fail to achieve its stated goals. Given the rapid transition schedule, the FCC would suffer an image failure as a regulatory agency if it failed to produce a successful and timely transition. The flag could expose the Commission to risk here, if consumers are reluctant to quickly upgrade their home entertainment systems

⁵¹ Sachs, Robert. “Samuel Morse Did Not Invent the Telegraph.” Retrieved December 7, 2002, from <http://www.ncta.com/press/press.cfm?prID=243&showArticles=ok>.

⁵² Willner, Michael. “Digital Television: A Private Sector Perspective on the Transition.” Retrieved December 7, 2002, from <http://www.ncta.com/press/press.cfm?prID=103&showArticles=ok>.

⁵³ “-----.” “The Transition to Digital Television.” Retrieved December 7, 2002 from <http://www.ncta.com/legislative/legAffairs.cfm?legRegID=15>.

because of the specific increased expenses of the flag. Moreover, as the oversight body for the broadcast flag regime, it would be the focal point for both internal and external conflicts. Resources would have to be stretched to evaluate competing claims, such as complaints about compliance or improper usage. Both the public and Congress would look to the FCC to solve these issues and hold the body responsible for failures. Members of Congress often have favored industries, and would pressure the Commission to rule in their favor, threatening funding or legislative delay should the ruling be averse to their interests. In sum, the broadcast has a potential to embroil the FCC in a mess that it might not want.

The flag does offer several benefits, however. The risk of delayed rollout is offset by the hope of faster adoption due to more premium content. Moreover, what might be lumped as a “headache” under costs, would be considered a benefit by many political scientists. William Niskanen describes bureaucracies that constantly seek to expand their mission, jurisdiction and funding, and certainly the FCC could be seen as belonging in this category.⁵⁴ Commissioners can increase their power and influence by touching on this very *au courante* subject of digital copyright, lending their expertise to the debate and acquiring a larger role. By vocally supporting the claims of the MPAA and the content industry, the FCC gains an ally in future fights and the support of a key player that might help reign in many of its regulatees, the broadcasters. Thus, the FCC derives a *net benefit* from supporting the broadcast flag regime, despite the fact that its expected benefits have little to do with the flag itself. This analysis is verified through the general support of the broadcast flag in documents commenting on the concept and architecture⁵⁵. In addition, statements that the FCC has made that indicate that the FCC is concerned about the DTV switch rather than the merits of the broadcast flag. For example:

“the current lack of digital broadcast copy protection may be a key impediment to the DTV transition is progress. Without a digital copy protection scheme that prevents the unauthorized copying and redistribution of digital media, programming content providers assert that they will not permit the digital broadcast of high quality programming. Without such programming, consumers may be reluctant to buy DTV receivers and equipment, thereby delaying the DTV transition.”

These statements show that the analysis is correct in predicting that the FCC has motives other than copy protection in supporting the broadcast flag.

4.6.2. Congress

Congress faces similar costs and benefits as the FCC. If we put aside speculation about whether Congress will ultimately get spectrum auction revenue, a delay in DTV adoption will result in a delay in congress getting the auction proceeds (likewise, faster adoption means faster money). Congress must also handle the ultimate legislative assignments, and must avoid offending any industry, and the representatives that defend

⁵⁴ Niskanen, W. "Bureaucrats and Politicians," *Journal of Law and Economics* 18 (1975), 617-643.

⁵⁵ “-----.” “April 25, 2002 CONTENT PROTECTION STATUS REPORT.” Retrieved November 15, 2002, from http://judiciary.senate.gov/special/content_protection.pdf

those industries. Finally, as the closest and most direct link to consumers, individual members are the lightning-rods for constituent discontent about unpopular policies. Congressmen thus risk being assigned responsibility for a bungled transition, and being punished at the ballot box. Television may be important enough in daily lives to be a voting issue.

Like the FCC, Congress as a whole might be interested in the support of the MPAA, particularly in the realm of funding. More important than \$3.4 million in MPAA PAC money,⁵⁶ is the idea of avoiding future copyright battles. While political conflict often produces the best policies, major players can benefit from producing policy outside the limelight of active congressional debate and in the shadows of precedent and natural expansion.⁵⁷ By establishing a firm grounding on how IT and copyright interface in the realm of digital TV, Congress has a precedent to refer to when addressing other questions of digital rights management. This allows the legislature to address key issues and yet not be forced to line up against the same interest groups that can seek to alter the issues for the next round of debate.

As predicted by the analysis, Congress is currently entertaining proposed bills that support both sides of the issue. Some bills align themselves with what the broadcast flag supporters are currently saying, while others echo the concerns of those opposed to use of the broadcast flag. These bills are not being actively debated in Congress now, and it is unclear which ones will actually reach Congress and which ones will be passed.

An example of a proposed bill that supports the broadcast flag is the one that has been proposed by Senate Commerce Committee Chairman Fritz Hollings, as described in the Appendix. This bill would prohibit the sale of any technology that does not adhere to copy protection standards to be determined by the government⁵⁸. Another bill that supports implementation of the broadcast flag is the one by Representative Billy Tauzin, which would require that consumer electronics react to the broadcast flag in some way. It may also eliminate analog output from devices.⁵⁹ Both of these bills, if passed, would force consumers to abide by the broadcast flag and only use compliant devices. They would consequently prevent consumers from practicing the fair use to which they are accustomed.

An example of a bill that tries to negate the effects of the broadcast flag is the one by Representatives Boucher and Doolittle, which is called the Digital Media Consumer Rights Act. This bill would codify certain fair uses as affirmative rights, and it would

⁵⁶[60] Ju, Anne. "Who's buying into copy controls?" PC World, June 18, 2002. Retrieved December 9, 2002, from <http://www.pcworld.com/resource/printable/article/0,aid,101988,00.asp>.

⁵⁷[61] See, e.g. C. Howard, *The Hidden Welfare State*. Princeton: Princeton University Press, 1999

⁵⁸[62] McCullagh, Declan. "What Hollings' Bill Would Do." Retrieved November 26, 2002, from <http://www.wired.com/news/politics/0,1283,51275,00.html>.

⁵⁹[63] Schoen, Seth. "Draft Tauzin Bill Has Broadcast Flag Mandate." Retrieved November 26, 2002, from <http://bpdg.blogs.eff.org/archives/000169.html>.

also allow for the circumvention of copy protection measures for non-infringing uses⁶⁰. If this bill passed, it would still allow consumers to record in the manner that they are accustomed to now, whether or not the content they are trying to record is flagged. A very similar bill has been proposed by Representative Zoe Lofgren. These comments affirm the analysis by showing that Congress both supports and opposes the broadcast flag, although the motivation does not clearly revolve around copy protection.

4.7 Cost-Benefit Analysis Conclusion

By isolating each actor, and then further isolating specific costs and benefits the broadcast flag would impose on that actor, we can get a better picture of who is shaping this policy and why. By then comparing the projected actions of each actor with the actual actions and statements of that actor regarding the broadcast flag, we can reaffirm the correctness of our analysis. The costs to consumers overwhelm the projected benefits, and they thus stand against it. The TV networks analysis shows to be a wash, and they thus have been relatively silent on the topic while broadcasting their digital content unprotected. The remaining actors have all pegged their support of the flag onto the MPAA's claims that the flag will enable Hollywood content to be broadcast without fear of unauthorized content distribution, yet earlier analysis shows this to be an unrealistic claim. Yet each of the remaining actors continues to support the broadcast flag?

Probing further into the benefits show that each actor may extract considerable gain from issues not directly related the flag or DTV content protection. Content owners gain the intangible benefits of being able to control the digital copyright debate overwhelm their costs. The 5C manufacturers can leverage their market position as owners of compliance technology. Broadcasters get a stronger claim over controlling how their current spectrum holdings are sold. The FCC gets a larger mission statement and more power, while congress can dispose of a sticky political question.

The debate over the broadcast flag, then, is shaped by actors all party to the question of content protection over the airwaves, but few of them are acting based on concerns directly related to this matter. Since the flag is nominally aimed at DTV, the deciding factors of policy questions are not inspired by the policy problem it is designed to solve.

5. Conclusion

The broadcast flag is a mechanism designed to prevent the illegal redistribution of copyrighted content over the Internet. The MPAA has stated that this is its major reason for supporting the broadcast flag. There are also other ulterior goals of the MPAA, outlined in section three, that are further reasons for their support. However, the threat analysis of that section shows that the broadcast flag will not be successful in protecting content from Internet redistribution. On the other hand, it may help to achieve the other smaller, more incidental, goals of the MPAA, including restricting consumer 'fair use' copying of broadcast television.

⁶⁰ Grebb, Michael. "Bill: Copyright Power to People." Retrieved November 26, 2002, from <http://www.wired.com/news/politics/0,1283,55569,00.html>.

Many of the influential actors in the situation explicitly support the broadcast flag, saying that it will properly protect copyrighted content, even though section three showed this is not the case. We then take a closer look at each of these key players, including the MPAA, consumer electronics companies, broadcasters, the major television networks, consumer groups, cable providers, the FCC, and Congress. We examine each in turn and explore the answer to four issues: what they say about the flag, what they have done with respect to the flag, what they would gain and what they would lose under a broadcast flag regime.

This cost-benefit analysis shows that the motivations of each of the broadcast flag proponents may not be entirely pure. In other words, their reasons for supporting the broadcast flag do not center on concerns for digital copyright or content protection. Instead, their support of the broadcast flag often rests on some ancillary benefit, often gleaned from another party's reaction to the flag.

When deciding about mandating adoption of the broadcast flag, one must be careful to separate these issues. Decisions must be made in light of the fact that, according to the analysis presented in this paper, the broadcast flag does not achieve its major stated goal of protecting copyrighted content from redistribution on the Internet. At the same time, it results in great costs to consumers, by both forcing them to buy much new equipment and by eliminating the 'fair uses' to which they have grown accustomed. Therefore, the broadcast flag, if implemented, will not serve its intended purpose, while at the same time costing consumers and some consumer electronics companies greatly. The decision on whether or not to mandate the broadcast flag must be based on reasons directly related to the flag. The question of policy should be decided on its merits. In other words, the active players should seek direct methods of achieving their goals rather than realizing them indirectly through the broadcast flag. Digital content protection is a large problem, and requires innovative solutions. It should not come at an inordinate and inescapable expense to consumers, however, and should not be used as a vehicle for content owners to accrue side benefits completely tangential to the policy at hand.

It is reasonable to expect that, prior to the widespread adoption of a policy, some motivation should be offered to the public. We show in this paper that the stated motivations by many of the players involved in pushing the broadcast flag are of doubtful veracity at best, and outright insincerity at worst. Before moving forward and threatening greater expense to both themselves and consumers, the key players should re-evaluate their goals in the broadcast flag. Since it is usually difficult to hide underlying motivations, especially in a market like this, let them come clean and make their case. The problems of unauthorized distribution can be very real, and if those at risk want the cooperation of other players and the general public, let them be honest and make their case directly. Public policy based on subterfuge and misdirection is poor policy.

Appendices

Appendix 1 – Standards

The broadcast flag was suggested following the emergence of digital television. Although, digital television has only recently begun to obtain subscribers, its roots go back to 1984. At that time, digital equipment was already available, but arguments regarding how digital television could best serve the interests of the public hindered its advancement. The argument hinged around whether to adopt a system compatible with the then current analog standard (NTSC) or to adopt a simulcast system requiring additional spectrum.⁶¹

NTSC stands for the National Television Standards Committee and is the video standard in North America and other parts of the world for broadcasting video into the home and recording the video on tape. NTSC broadcasts 30 interlaced frames per second (60 half frames per second). The signals include an audio FM frequency and an MTS signal for stereo. The signal is a composite of red, green and blue. NTSC is used throughout outside of the United States in countries such as Canada, Japan, South Korea and several Central and South American countries⁶².

The European standard for video is PAL, or Phase Alternating Line. PAL was a color standard developed in Germany and broadcasts 25 interlaced frames per second (50 half frames per second) at 625 lines of resolution. Brazil uses PAL M, which broadcasts 30 frames per second. Because PAL's color signals are maintained automatically, the TV set does not have a user-adjustable hue control. Europe, China as well as various African, South American and Middle Eastern Countries use PAL. France and Russia and many African, Eastern European and Middle Eastern countries use a color TV standard called SECAM, or Systeme En Couleaur Avec Memoire. It broadcasts 25 interlaced frames per second (50 half frames per second) at 625 lines of resolution⁶³.

⁶¹ Whittaker, Jerry. "Broadcast History: Milestones in the Evolution of Technology ." Retrieved November 22, 2002, from <http://www.tvhandbook.com/History/History.htm>.

⁶² "-----". "DTV/HDTV/Flatscreen Specifications." Retrieved November 22, 2002, from <http://www.dtvcity.com/resources/tv5.html>.

⁶³ "-----". "DTV/HDTV/Flatscreen Specifications." Retrieved November 22, 2002, from <http://www.dtvcity.com/resources/tv5.html>.

Appendix 2 – History of DTV

A2.1. ACATS

Concrete plans for digital television began in 1987 with FCC establishment of the Advisory Committee on Advanced Television Service (ACATS), an organization whose responsibility would include recommending a broadcasting standard. At the time of the inception of the ACATS, it was generally believed that digital could not be broadcast using the 6 MHz standard of analog terrestrial television. Initial reports filed in 1988 suggested several standards, ranging from enhancing the current standard to full quality high definition digital television, using 6 MHz, 9 MHz and 12 MHz. Proponents of the 12 MHz standard suggested a simulcast option, with one 6 MHz channel utilized to transmit analog terrestrial television, and the other channel containing a high definition television (HDTV) signal. However, the report also stated that “based on current bandwidth-compression techniques, it appears that full HDTV will require greater spectrum than 6 MHz”³.

A2.2. Simulcast

A frenzy of research began in developing a digital broadcast. As a consequence of the research proposals, experts assumed that consumers would be able to purchase HDTV for home use as early as 1992⁶⁴. However, the divergent system proponents and hardware development delays made meeting such a stringent deadline impossible. A serious setback was the adjacent channel interference problem present in VHF and UHF-TV bands, which required one non-broadcasting channel interspersed between two active channels. Initial testing began in 1990, using an FCC favored approach employing a simulcast broadcast of one 6 MHz channel for conventional (NTSC) transmission, and another 6 MHz channel for high definition programs to be broadcast on existing VHF and UHF channels, but requiring compressing due to the 6 MHz bandwidth requirement.

A2.2.1. Analogy to Britain’s Switch to Color Television

The simulcast policy resembled a policy similarly employed during Great Britain’s transition to color television. Such a policy required monochrome transmission for 20 years after 625-line PAL color transmission began. Monochrome receiver owners benefited, as they were not required to invest in new color receivers, while industry began developing a color transmission standard. Eventually, Great Britain reallocated the spectrum used for monochrome transmission, as all television is now on UHF, reassigning VHF channels to other radio services. The FCC desired to similarly not inconvenience viewers with NTSC receivers who would be able to receive the 525-line standard without having to purchase new HDTV receivers. Although not explicitly stated,

⁶⁴ Whittaker, Jerry. “Broadcast History: Milestones in the Evolution of Technology .” Retrieved November 22, 2002, from <http://www.tvhandbook.com/History/History.htm>.

the FCC presumed the must-carry provision⁶⁵ stating that broadcasters transmitting the HDTV standard would carry programs offered on the NTSC standard.

A2.2.2.First Digital Simulcast

Despite FCC announcements regarding the feasibility of HDTV transmission, most consumers considered the technology to be in the early stages of development. However, in 1990, General Instrument was the first company to announce an all-digital system. MIT, Philips-Thomson-Sarnoff consortium and Zenith-AT&T followed suit shortly thereafter. After and ACATS recommendation of surround sound audio and adaptive data-allocation capability, proposals were limited to only those by the four initial developers. Although all systems exhibited impressive results, the Advisory Committee strove to unify these proposals under a “best system”. Such was the reason behind the formation of the Digital HDTV Grand Alliance. By 1994, final HDTV proposals were placed on the table with such features as digital video compression, packetized data, audio, modulation and scanning formats. The proposal included the following features:

- Support of two fundamental arrays of pixels (picture elements): 1920 x 1080 and 1280 x 720. Each of these pixel formats supported a wide-screen 16:9 aspect ratio and square pixels, important for computer interoperability. Frame rates of 60, 30, and 24 Hz were supported, yielding a total of six different possible scanning formats—two different pixel arrays, each having three frame rates. The 60 and 30 Hz frame rates were important for video source material and 24 Hz for film. A key feature of the system was the Grand Alliance’s commitment to using progressive scanning, also widely used in computer displays. Entertainment television traditionally had used interlaced scanning, which was efficient but subject to various unwanted artifacts. Of the six video formats, progressive scanning was used in all three 720-line formats and in the 30 and 24 Hz 1080-line formats. The sixth video format was a 60 Hz 1080-line scheme. It was neither technically or economically feasible to initially provide this as a progressive format, although it was a longer-term goal for the Grand Alliance. The 1080-line, 60-Hz format was handled in the initial standard by using interlaced rather than progressive scanning.
- Video compression: Utilizing the MPEG-2 (Moving Picture Experts Group)-proposed international standard allowed HDTV receivers to interoperate with MPEG-2 and MPEG-1 computer, multimedia, and other media applications.
- Packetized data transport: Also based on MPEG-2, this feature provided for the flexible transmission of virtually any combination of video, audio, and data.
- Compact-disc-quality digital audio: This feature was provided in the form of the 5.1-channel Dolby AC-3 surround sound system.

⁶⁵ The must-carry provision contained in the Cable Television Consumer Protection and Competition Act of 1992 was upheld by the Supreme Court on March 31, 1997 in *Turner Broadcasting System, Inc. v. FCC*. With this decision, the Court emphasized the benefits of free, over-the-air broadcast television and the importance of widespread dissemination of information from multiple sources. This case did not specifically address the issue of must –carry of digital television signals.

- 8-VSB (8-level vestigial sideband): The modulation system selected for transmission provided maximum coverage area for terrestrial digital broadcasting.

Source: HDTV History⁶⁶

A2.3. ATSC

Field and laboratory testing of the Grand Alliance standard indicated that the digital transmission standard would provide better performance than the current analog system. The ACATS recommended the new standard to the FCC in 1995. Due to objections from the motion picture industry regarding the wide-screen aspect ratio and the computer industry's objections regarding interlaced scanning, the 60 Hz scan rate and square pixels, the FCC adopted a standard without a single digital television video format. This lack of format was expected to encourage competition between personal computer manufacturers whose products would compete within the sharp picture and consumer-feature specific arena. Later that year, the FCC created the Advanced Television Systems Committee of the DTV standard. This group was composed of 160 member corporations, standards bodies, educational institutions, research laboratories, and industry associations. This group would develop voluntary standards for the entire range of advanced television systems, including computers, television sets and consumer video devices, in cooperation with the Consumer Electronics Manufacturers Association.

A2.4. Timetable for Implementation

With the standard set, broadcasters were faced with a timetable for implementation. By late 1998, the 26 TV stations in the country's most populous cities would begin broadcasting using the Grand Alliance DTV system. This initial broadcast would reach 30% of U.S. television households. By 1999, that number would expand to 40 and by 2000, that number would reach 120 stations. By 2006, every station would be expected to transmit all content digitally for fear of losing the FCC license. The first digital broadcast occurred on October 29, 1998 with the launch of John Glenn back into space, with transmission by ABC, CBS, Fox, NBC and PBS affiliates.⁶⁷ Broadcasting cities included Washington, D.C., New York, Atlanta, Chicago, Los Angeles, and transmission was free to any broadcaster who could receive the signal. The launch was filmed using HD cameras, but on occasion, the director would switch between standard-definition and high-definition, allowing viewers to witness the difference in the image. By January of 2001, there were 177 stations broadcasting DTV signals to 61 markets covering 67% of U.S. TV households, according to an NAB survey.⁶⁸

⁶⁶ "-----". "DTV/HDTV/Flatscreen Specifications." Retrieved November 22, 2002, from <http://www.dtvcity.com/resources/tv5.html>.

⁶⁷ "-----". "DTV/HDTV/Flatscreen Specifications." Retrieved November 22, 2002, from <http://www.dtvcity.com/resources/tv5.html>.

⁶⁸ "-----". "TV Today". Retrieved November 15, 2002, from <http://www.nab.org>.

A2.5. HDTV vs. SDTV

There are two different standards for digital television. Although during the simulcast period the FCC did not mandate a standard on to a broadcaster, it did mandate that the resolution of the free broadcasting be better than what is currently available via analog. The FCC allowed the broadcaster to use his discretion regarding whether to provide high definition television or to simulcast the NTSC stream on DTV. In addition, the FCC did not mandate what and how many ancillary and supplemental services to provide⁶⁹. The ancillary and supplemental services could include subscription television programming, computer software distribution, data transmissions, teletext, interactive services, audio signals, and any other services that do not interfere with the required free service. By allowing broadcasters the flexibility to decide the format of services and the services to provide, the FCC felt that the broadcasters will provide services and best suit consumer demand, increasing broadcasters' profits, and will promote consumer acceptance of digital television.

A2.5.1.FCC 4th and 5th Orders Regarding SDTV and HDTV

In addition, the fourth Report and Order by the FCC allowed broadcasters to offer several digital programs by multicasting. Multicasting allows a content provider to offer up to seven SDTV programs in the space occupied by one HDTV program on DTV. In its fifth Report and Order, the FCC stated that the standard also allowed broadcast of CD-quality audio and transmission of voice video and data simultaneously. The switching between these venues can be done dynamically, allowing a broadcaster to transmit a “news program consisting of four separate SDTV programs for local news, national news, weather and sports; while interrupting that programming with a single high definition television commercial with embedded data about the product; or transmit a motion picture in a high definition format, while simultaneously using the excess capacity for transmission of data unrelated to the movie”⁷⁰.

A2.5.2.HDTV and SDTV Standards Defined

Digital televisions refers to any television containing a receiver device that can accept and display DTV broadcasts. Such DTV-ready televisions require a set-top decoder box to decode the incoming digital broadcast. The broadcast can either be SDTV, standard definition TV, or HDTV, high definition TV. An SDTV compatible television allows the viewer to connect the component video inputs to the unit for viewing standard broadcasts in either 480i or 480p formats. This set-up requires a DTV set top box and possibly an air antenna. High definition television refers to those devices that can display the highest resolution as defined by the ATSC standard. This resolution translates to 1,080 vertical lines and 1,920 horizontal pixels, or 720 vertical lines and 1,280 horizontal pixels. This device has a wide screen with a 16:9 aspect ratio. Like SDTV, this set-up requires a set-top box and possibly an antenna. An HDTV device may be compatible with the cable system in the future.

⁶⁹ “-----” 1997 FCC 5th Report and Order (FCC 97-16). Adopted April 3, 1997.

⁷⁰ “-----” 1997 FCC 5th Report and Order (FCC 97-16). Adopted April 3, 1997.

A2.5.3.DTV Savings over Analog

Digital offers an enormous amount of compression compared to what is possible in the analog domain. Tremendously better picture, sound and quality are possible in the original 6 MHz bandwidth per channel than what is possible with analog signals in 9 MHz⁷¹. Even greater savings comes from the elimination of a blank channel between every active channel on the air, as needed with analog. Seeing the tremendous reductions, the government would like to encourage investment in digital television. They would like to regain and resell the original NTSC spectrum granted to FCC licensed broadcasters in exchange for DTV spectrum with the same bandwidth.

A2.6 FCC Timeline for Adoption

The FCC has set up a stringent timeline for adoption of DTV, and released the implementation schedule in April of 1997. The following timeline was obtained from the original FCC docket entitled the FCC 5th Report and Order.

DTV Simulcast Schedule

The following information was derived, in part, from the FCC 5th Report & Order

Year	Percentage of Content Simulcast	Simulcast Deadlines
6	50%	April 3, 2003
7	75%	April 3, 2004
8	100%	April 3, 2005

Source: Analysis provided by Fedele & Associates – A technical advisory group

After the 100% of content is broadcast in digital, the FCC will terminate and reallocate the analog spectrum. The FCC has targeted 2006 for the cessation of the analog service. However, the 1996 Act requires that the commission allow licenses to those who offer ancillary or supplementary services on a subscription basis and with a fee⁷².

A2.7. Slow Adoption of DTV

By 2001, adoption of digital television had been slow. The Consumer Electronics Association stated that after more than two years of availability, HDTV shipments totaled only 625,000 in 2000 compared with 25 million TVs overall. Networks attempted to

⁷¹ Kane, Joe, and Gary Reber. "Implementing HDTV." Retrieved November 21, 2002, from <http://www.widescreenreview.com/attractions/insdhdtv.html>.

⁷² "-----." 1997 FCC 5th Report and Order (FCC 97-16). Adopted April 3, 1997.

encourage HDTV subscriptions through new hit series such as “The Sopranos” in high definition format. However, the lackluster adoption gave broadcasters little reason to broadcast in HDTV format, and gave consumers little reason to invest thousands of dollars for digital television sets⁷³.

⁷³ Goroch, Antonette. “HD in the Clouds? DBS seek to stay ahead, despite slow growth in HDTV.” January 22, 2001. Retrieved November 21, 2002, from http://www.broadbandweek.com/news/010122/010122_wireless_hdtv.htm.

Appendix 3 – The MPAA and the Broadcast Flag

Congress attributed the slow adoption of digital television to the lack of quality content on terrestrial television, and looked to the MPAA (Movie Picture Association of America) to provide that content on digital television. However, the MPAA had stated that it would not release content without copyright protection enforcement. Unlike DVDs and cable, which are delivered encrypted to the viewer, digital broadcasting must be delivered unencrypted. In fact, the FCC requires that this terrestrial broadcast television be sent “in the clear”. The MPAA fears delivering high-quality, unencrypted content digitally, because viewers could record shows and later make them available on the Internet. The MPAA feels that their refusal to deliver content without protection is justified, and that such protection should be supported via the DMCA (Digital Millennium Copyright Act) that made circumventing copy protection measures illegal and that provided corporations with a legal tool to protect their intellectual property.

The Motion Picture Association of America is the trade association of the American film industry. They represent many major producers and distributors of motion picture and television programs in the United States, including Walt Disney Company, Sony Pictures Entertainment, Metro-Goldwyn-Mayer, Paramount Pictures Corporation, Twentieth Century Fox Film Corp., Universal Studios, and Warner Bros⁷⁴. The MPAA represents the interests of its members by lobbying in Washington D.C. The members of the MPAA grossed over \$8.4 billion in box office sales in 2001⁷⁵. The sheer economic size of the MPAA makes it a very powerful lobbying group. The MPAA is also an influential member of the CPTWG and the BPDG, which were described above.

⁷⁴ “-----“. “About MPA, MPAA.” Retrieved November 26, 2002, from <http://www.mpaa.org/about/index.htm>.

⁷⁵ MPAA Research Department. “2001 U.S. Economic Review.” Retrieved November 26, 2002, from <http://www.mpaa.org/useconomicreview/2001Economic/sld002.htm>.

Appendix 4 – Compliant Devices

A4.1. DTCP and HDCP

Compliant devices are needed to mandate adherence to broadcast flag proposals. Copy-control schemes for digital audio, called DTCP (Digital Transmission Content Protection), have been devised by five companies, including Sony, Hitachi, Intel, Matsushita, and Toshiba called the 5C consortium. This scheme encrypts video transmitted over a digital cuss called IEEE 1394, or FireWire. A similar copy control scheme called HDCP, High-bandwidth Digital Content Protection, encrypts video transmitted over a video-specific bus called DVI, Digital Video Interface. This was designed by the 4C companies, which are IBM, Intel, Matsushita and Toshiba. The HDCP process consists of authentication, encryption and renewal. Authentication occurs when a source device and a display device authenticate each other. Once the party establishes a sense of trust for the other, the source encrypts the content and transports the content to the display. The display then decrypts the content. Renewal occurs every two to three seconds during HDCP. While the high definition stream is playing, the device re-authenticates every two to three seconds. Should either party fail during renewal, the session is abandoned and the stream ceases playing. The Digital Content Protection LLC can send source devices messages regarding a list of devices that are no longer authorized to play HD content. If such a device attempts to interact with a compliant device, encryption of content will be prevented from occurring.

The HDCP and DVI combination does not allow for recording, only transmission. However, the 5C consortium through the DTCP, the leading candidate to enable this functionality through a FireWire interface. This interface permits recording in addition to bi-directional flow and networking capabilities. 1394 does not have the bandwidth to transport uncompressed high definition content⁷⁶, as does DVI, and must compress content before transmission. Compression would occur with algorithms such as MPEG-2 whose impact on picture quality is negligible.⁷⁷ Once installed a 1394 device will interact with a TV or a set-top box automatically, unlike the current TV/VCR interaction.

Without the DTCP standard, the 1394 protocol does not address security. In fact, the protocol increases to risk of theft above that of DVI, simply because the transmission is more difficult to protect. However, DTCP performs authentication, encryption and renewal (similar to HDCP) to protect the content from piracy. The major difference between the two protocols is DTCP's functionality to conduct two authentication modes, a restricted mode and a full mode. Full authentication occurs when the protocol prevents recording in compliant devices such as set-top boxes. However, this symmetric authentication mechanism requires extensive processing and memory, and restricted authentication is used when copying is permitted or when content is being transferred from one device to another. This method of authentication is less robust than the former.⁷⁸ Like HDMI, DTCP allows for System Renewability Messages (SRMs) to be

⁷⁶ 1394 can only transmit up to 400 Mbps.

⁷⁷ deCarmo, Linden. "Changing of the Guard." Retrieved Nov 15, 2002, from http://www.emedialive.com/r5/2002/decarmo11_02.html.

⁷⁸ *Ibid.*

sent to compliant devices warning them of unauthorized devices authenticating as compliant. However, because the 5C devices can be networked, they have the ability to pass on the list to other compliant devices on the network.

A4.2. Types of Copying Allowed under DTCP

Both these mechanisms are activated only when a copy protection is requested, via insertion of a Copy Control Information flag into the MPEG-2 stream. Settings for the Flag are Copy Free, Copy Once, Copy No More and Copy Never. If the content's flag is set to copy free, the content owner places no restriction on copying of the content displayed by compliant devices. On the contrary, a Copy Never CCI setting requires full authentication and no copies are permitted of the stream. Copy Once permits a user to make one backup copy. The mechanism first attempts full authentication, and if that fails due to limited memory, it reverts back to restricted authentication. However, the analog component of the content is down-sampled. A Copy No More prevents other devices on the network from making further copies of the original broadcast. The functionality of Copy No More is similar to Copy Never, with the exception that Copy No More content may be played back on devices that support full or restricted authentication whereas copy never content only operates on devices requiring full authentication.

A4.3. 5C and Broadcast Flag Interaction

In the realm of digital television, the digital broadcast flag functions as the CCI flag. It is placed in the basic MPEG transport stream, when the stream is first created. However, adoption of new compliant devices and mandating that only those compliant devices will be able to receive quality programming obsoletes millions of current devices, states the CEA. The Consumer Electronics Association worries that the 30 million DVD players sold will not be able to play DVD's that contain broadcast flag protected digital programs. Hollywood has stated that it does wish to exclude the current tens of millions of existing products from adhering to broadcast flag protection, by enacting grandfather clauses in legislation. Hollywood fears this type of Internet distribution by current electronics.

Appendix 5 – Congressional Legislation

A5.1. Tauzin Bill

The support of the broadcast flag by certain members of congress is evident through recent legislation that has come up on the congressional floor. Republican Billy Tauzin has proposed a measure for broadcast flag adoption and the ending on analog television capability, and increased cable interoperability. Tauzin sees the need for the latter due to "the lack of progress in private, inter-industry negotiations and the number of outstanding FCC rulemakings [which] has led to uncertainty in the marketplace, and makes it very difficult for businesses to make solid plans for the future".⁷⁹ Mandating that no analog ports be added to digital devices would make VCR's and other analog media obsolete. In addition, Tauzin's bill states the "television broadcasters would be required to cease analog television service by December 21, 2006" and that devices would have to recognize the broadcast flag by January 1, 2006 in order to prevent unauthorized distribution of content over the Internet.

A5.2. Hollings Bill and Letter

In another congressional proposal, Senator Hollings, chairman of the senate commerce committee, urged Chairman Powell to move quickly to implement the broadcast flag mandate, without additional legislation in a letter to the Chairman. In his letter, Hollings suggested that 47 USC 336(b)(4) and (b)(5) already give Powell the authority to impose such regulations. Hollings states that it is "beyond dispute that the public interest would be served" by this mandate. In addition, Hollings also proposed the Security System Standards and Certification Act (SSCA), which makes production or sale of devices without "certified security technologies" a civil offense. This legislation has not yet been formerly introduced, however, it is known that it would impose criminal penalties to persons altering or disabling current copy protection schemes.

A5.3 Lofgren Bill

In October 2002 Congresswoman Zoe Lofgren (D-CA) introduced the "Digital Choice and Freedom Act of 2002." The bill, which has not yet been passed, clarifies that the principles of fair use as outlined in Section 107 of the Copyright Act do apply to digital transmissions, and protects the rights of consumers to make copies of digital works for personal use, as has been allowed with analog works for years.

Lofgren's bill, which has the backing of the EFF and numerous other consumer advocacy groups, limits the extent to which copyright holders can dictate how their content is used. According to the bill, consumers will be able to reformat copies of digital works to play on devices of their choice, and will be able to sell or give away their digital copy of a work. Lofgren's bill also changes the law as amended by the DMCA to allow consumers to circumvent technological restrictions on copying for the purpose of making fair use of a legally acquired work.

⁷⁹ King, Brad. "New Bill: More Digital TV Limits." Retrieved November 15, 2002, from <http://www.wired.com/news/print/0,1294,55276,00.html>.

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