Brigham Young University

BYU ScholarsArchive

2007-03-20

Evaluating the Feasibility of a Performance Improvement Initiative at BYU Broadcasting

Brandon L. Smith
Brigham Young University - Provo

www.manaraa.com

EVALUATING THE FEASIBILITY OF A PERFORMANCE

IMPROVEMENT INITIATIVE AT

BYU BROADCASTING

by

Brandon L. Smith

A selected project submitted to the faculty of

Brigham Young University

in partial fulfillment of the requirements for the degree of

Master of Science

Department of Instructional Psychology and Technology

Brigham Young University

April 2007

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a selected project submitted by

Brandon L. Smith

This selected project has been read by each member of the following graduate

committee and by majority vote has been found to be satisfactory.

_____   _____
Date   Charles R. Graham, Chair

_____   _____
Date   Stephanie Allen

_____   _____
Date   Paul F. Merrill

BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the selected project of Brandon L. Smith in its final form and have found that (1) its format, citations and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

_____   _____
Date   Charles R. Graham
                                            Chair, Graduate Committee

Accepted for the Department

_____   _____
Date   Andy S. Gibbons
                                            Department Chair

Accepted for the College

_____   _____
Date   K. Richard Young
                                            Dean, David O. McKay School of Education

ABSTRACT

EVALUATING THE FEASIBILITY OF A PERFORMANCE

IMPROVEMENT INITIATIVE AT

BYU BROADCASTING

Brandon L. Smith

Department of Instructional Psychology and Technology

Master of Science

The purpose of this project was to evaluate the feasibility of bridging performance gaps in the program stream between BYU Broadcasting's post production and master control environments by implementing a technical infrastructure that supports a file-based workflow. The system that was evaluated was an Apple Xsan running specialized software, called FORK.

Performance gaps were identified and a technical evaluation of the system was conducted. Figuring out how the change initiative would affect and be affected by non-technical factors, such as human nature and social and cultural concerns, was integral to the evaluation process.

The evaluation concluded that the System was technically capable of supporting the ideal workflow; however a number of organizational interventions would need to be put in place in order for the change initiative to have success. The recommendations were (a) consolidating all operations employees under a Chief Operations Officer, (b) consolidating all engineering functions under a Manager of Engineering, (c) tasking the Chief Operations Officer and Manager of Engineering with encouraging participant support and organizational responsibility, (d) temporarily localizing the system's implementation, and (e) crafting an official media management policy. Included in the stakeholder report was an implementation design for the system.

It was beyond the scope of this evaluation to measure for post-implementation improvement. Completing such an evaluation would require a significant amount of time; however, it is recommended that it be conducted subsequently and separately from this project.

ACKNOWLEDGMENTS

Heartfelt thanks are extended to the members of my graduate committee: Dr. Charles R. Graham, Stephanie Allen, and Paul Merrill. Their mentoring influence both in and out of the class will continue to guide my professional course for years to come.

Special thanks to BYU Broadcasting for commissioning this evaluation and providing an opportunity for me to have this valuable experience.

Many thanks to Rich Bisignano. His careful attention to the unique mission of BYU Broadcasting, and his mentoring hand helped ensure that this project was a meaningful success.

Thanks also to my parents: my dad for frequently taking me to work with him at the TV station; my mother for her consistent "you'll do just fine" that always gave me the confidence to try new things.

Most of all, thanks to my wife, Heather, for providing the motivation to complete this project. Her unfailing support continues to encourage me in all aspects of life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Purpose

The purpose of this project was to evaluate the feasibility of bridging performance gaps in the program stream between BYU Broadcasting's post production and master control environments by implementing a technical infrastructure that supports an electronic file-based workflow. The purpose was to conduct a technical evaluation of the new infrastructure (the System), provide an implementation design for the System and an accompanying list of recommendations to assist the initiative's success. The evaluation was also concerned with how the change initiative would affect and be affected by non-technical factors, such as human nature and social and cultural concerns.

The System that was evaluated is a combination of a hardware system called an Xsan, which is made by Apple Computers Inc., and a specialized software system called FORK, which is made by a company by the name of Building 4 Media (B4M). On the surface this may seem like a rather routine project in which one system is being replaced by another – something that happens periodically at broadcasting companies like BYUB. This particular project is much more involved than that. For that reason, I will explain in lengthy detail the history surrounding this change and set the stage for why this evaluation was conducted.

It was beyond the scope of this evaluation to measure for post-implementation improvement, primarily because of the lack of control over how the recommendations of the evaluation would actually be implemented. Completing such an evaluation would require a significant amount of time. It is recommended that an evaluation like that be conducted subsequently and separately from this project.

A brief history about BYU Broadcasting and the field of broadcast engineering follows. This information will help lay the groundwork for the purpose of this project.

Background

BYU Broadcasting (BYUB) is a department of the College of Fine Arts and Communications at Brigham Young University (BYU), which is owned by the Church of Jesus Christ of Latter-day Saints (LDS Church). As an arm of BYU, BYUB provides an outlet to over 60 million homes across the world for the wealth of educational opportunities and spiritually inspiring encounters that are commonly part of what is often referred to as the BYU experience. BYUB's ability to provide education, foster lifelong learning, and present uplifting entertainment and instruction to the world is unprecedented among other university-owned broadcasting entities across the world. The opportunities for improving BYUB's ability to fulfill its unique mission to export the BYU experience are frequently under consideration by the highest levels of BYU administration, particularly as of late.

BYUB currently operates four television stations and two radio stations. Three of the television stations are Public Broadcasting Service (PBS) affiliate stations, KBYU-TV, PBS Create, and KBYU-TV HD. These television stations are broadcast over the air throughout Utah and Southeastern Idaho. Content for these channels is provided by various PBS producers, BYUB production staff, and the LDS Church's audiovisual department. All content that is supplied by external producers must be previewed and where necessary edited at BYUB to ensure that it complies with BYU standards before airing.   The fourth station, BYU Television, is distributed over satellite and cable

systems across the world. The content for this station is primarily provided by BYUB production resources and the Audiovisual Department of the LDS Church.

The original radio station at BYUB, KBYU-FM, is locally broadcast to many areas in Utah. Its emphasis is on providing classical music and glimpses into current affairs at BYU to its audience. The newer radio station, BYU Radio, is available on cable and satellite around the globe, and features a variety of programming from live commentating of BYU sporting events, to a number of musical selections created by BYU and LDS artists. The signal streams for BYU Television, KBYU-FM, and BYU Radio are also available over the Internet.

The signals for all BYUB stations originate from the Harris Fine Arts Center (HFAC) on the BYU campus. Most of the content is produced by BYUB employees at a facility located four miles south of campus, known as the KBYU Media Center (KMC).

The logistics of acquiring, packaging, and airing content from two diverse facilities presents a number of challenges for BYUB. This evaluation is part of a mandate by BYUB management to explore ways that these challenges could be mitigated, thus improving efficiency in the organization. The following paragraphs explain more of BYUB's history leading up to the reasons for conducting this evaluation.

For many years, BYUB was known as *KBYU*, primarily because the two properties that were owned and operated by the organization at the time were KBYU-TV and KBYU-FM. Virtually all of the content on these stations was created by external producers, with a very small production unit housed within KBYU. Over time, generous donations and innovative initiative led to the creation of more television and radio stations. The addition of BYU Television and BYU Radio necessitated a more

encompassing name for the organization, BYU Broadcasting, and promulgated a revised mission that charged the organization to "inform and enrich audiences worldwide by acquiring, creating, and distributing engaging educational programs that reveal the values and character of Brigham Young University" (BYU Broadcasting Mission Statement, n.d.).

BYU Television and BYU Radio brought this fledgling organization into the worldwide market and significantly increased the amount of content required to sustain additional broadcast properties. The mandate to "reveal the values and character of Brigham Young University [to the world]" could not be accomplished by relying on external producers who had little connection to the campus community, so BYUB began producing much more content on its own to fulfill its new mission.

Even though the organization was burgeoning with additional workload and expectations, the processes for producing television shows remained essentially the same throughout these stages of tremendous growth. Ad hoc organizational structures, processes, and technical infrastructures cropped up over time as workload mounted. Opportunities for collaboration and unified processes were not taken advantage of, and a resulting labyrinth of sometimes competing and redundant departments, processes, and technical kingdoms were cobbled together into a system that has somehow remained afloat and has accomplished remarkable things throughout its short history. The incredible skills that BYUB employees have are much of the reason for the organization's success.

Recent developments have mandated further expansion, and prompted BYUB to reflect on its ability to better achieve its unique mission. In June 2006, the Board of

Trustees of BYU approved the launch of a Spanish and Portuguese channel, BYU Television International (BYUTVI), adding one more name to the ever growing lineup of properties that are owned and operated by BYUB. The channel was approved to be distributed to Central and South America, the Iberian Peninsula, areas of the Caribbean, and selected areas of the United States.

With the advent of this new channel, BYUB management quickly reviewed the challenges that growth has previously presented to the organization. They made a determined decision to evaluate numerous work practices and find strategies for placing BYUB in a better position to handle this new growth, as well as the looming potential for growth in the future. The forthcoming launch of BYUTVI is providing BYUB with a clean operational slate where a more ideal way of providing a program stream can be implemented.

One of the areas identified for improvement was the workflow for handling the management and transfer of video content between the post production and master control environments. The Dean of the College of Fine Arts and Communications, Stephen Jones, commissioned a study of possible workflow alternatives for the new program stream early in 2006. That study resulted in findings that a file-based workflow would be the most efficient way of providing the program stream. The Dean subsequently mandated that a file-based workflow be implemented to support the new program stream. He commissioned another evaluation to determine the feasibility of implementing a particular technological infrastructure (the System) at BYUB in order to support the new workflow. This evaluation is described in this paper.

The following two outcomes were expected from this evaluation: first, a verification of the System's technical capability of supporting the file-based workflow and second, recommendations for an implementation plan for the System. The implementation plan needed to address the technical design of the System as well as the non-technical factors that would allow the initiative to achieve the original objective of providing program streams more efficiently (Chris Twitty, personal communication, April 2006).

Initiatives to implement file-based workflows have failed at BYUB in the past, so it was essential that a formal evaluation be conducted to determine how this particular mandate could be achieved. The initial study that was commissioned by the Dean found that many other broadcasters had been able to lessen the workload and cost of providing program streams by implementing file-based workflows. The following background will generally explain how this is achieved.

The broadcasting industry has been built upon the use of tape media in order to acquire, edit, archive, and broadcast television content. The workflow goes something like this: the first step is for production crews to record raw video footage onto tape media. The tapes are then brought into the post production editing facility where the footage is compiled together in the correct sequence onto a separate tape to create a final show. The final show is then played out of a tape machine in a master control facility (TOC), which is the place where the broadcast stream originates and is there distributed to various audiences. After airing, the tape is put into a library system of some kind, usually consisting of shelves in a large room, and then catalogued in a software database. Obviously, the logistics of moving the tape media around is manual and very time

consuming. BYUB still operates in this way. Since the production and master control facilities exist in two separate locations, a very labor intensive, time consuming, and expensive flow of work results. With four television channels operating 24 hours each day, every day of every week of every year, the amount of tape media that must be driven back and forth between the two facilities is enormous.

Recent advances in information technology are providing production folks and broadcasters with enough storage space and bandwidth capability to allow them to use computer technology, rather than tapes, to work with video content. The video footage resides as a file on a hard drive or optical disc, rather than on tape, and is able to be edited and broadcast from the same. There are obvious workload and time saving advantages to working with files over tapes. Tape media manipulation is all real-time, meaning that if you want to make a copy of a show that is 60 minutes long, it takes you at least 60 minutes to make the copy (in addition to the time to prepare the tape you will be copying to). File copies are much quicker to create and eventually transfer to a final destination. High speed fiber networks sprawling across the globe allow content to be quickly transported to previously disconnected locations. This rapid sharing ability allows multiple people in multiple locations to acquire, view, and edit content simultaneously. The opportunities for television production and broadcasting companies to implement simplified, more efficient workflows are therefore expanded.

Many companies have sprung up over the past few years, offering file-based solutions. Essentially, these solutions consist of a specially designed file server that is able to store massive amounts of data in the form of video files and play those files out at levels of quality that meet broadcast industry standards. This technology has previously

been available only through proprietary vendors. These servers have been created on what is called a closed architecture, which basically means that all maintenance on the system must be performed by someone from the company that made the server. The difficulties of being held hostage by such a situation are obvious. It is an expensive way to run an organization.

The software to operate these file servers is of a similar proprietary nature. It is usually created by the same company that made the hardware, and only works on their particular hardware system. The Application Programming Interface (API) for the software in these systems is also closed for manipulation by the end user. This means that any customizations to the software must be performed by the company itself. Again, the price of sustaining such a system can become quite high.

All around, making the switch to a file-based infrastructure is not an easy one for any organization to make, partly because of this fairly monopolous relationship that must be entered into with a vendor in order to maintain the system. Another large factor is the cost associated with the migration from one infrastructure to another. An infrastructure for a typical program stream will usually reach into the millions of dollars. Throwing away one infrastructure and putting in a new one is not something that can be done very often. A third reality that prevents many from making this switch is the human side of the equation. Asking those who have been in the industry their whole lives to change the way they have always done their jobs can sometimes be a challenge. BYUB has faced this difficulty in the past.

The ability to work in a file-based environment is advantageous for an organization like BYUB that produces and broadcasts its own content from separate

locations. BYUB has operated in a tape-based environment for the duration of its existence, and has yet to fully adopt a file-based workflow. Subsequently, numerous manual tasks are placed upon employees that could otherwise be automated.

Ironically, BYUB had already installed file-based systems in its post production and master control areas. Partly, because these two environments were engineered by completely separate departments at BYUB, the systems exist very much separately from one another. Because of the absence of a digital, operationally supported pipeline between the two systems, any content that goes between the two environments must still be exported to a tape and driven by car to its next location. This obliterates the whole reason for which the systems were purchased. The result is that the end users at each facility have all but abandoned the use of the file-based systems and reverted almost solely to using tape as a means of doing their work.

Since significant funding was allocated when the launch of BYUTVI was approved, some of the lead thinkers at BYUB wanted to explore the possibilities of using this opportunity to engineer a completely separate infrastructure for this service as a proof of concept that would thrust the organization into more efficient ways of doing the work. Many systems were identified early in 2006 as potential candidates, but the System described below was eventually chosen by BYUB management.

The System is actually two separate systems, a software system combined with a hardware system. The software is created by a company called Building 4 Media (B4M), and is named FORK. The core of the hardware solution is an Apple file server system called an Xsan. Attached to the Xsan are high-end server devices, also manufactured by Apple, that allow the large amounts of data stored on the Xsan to be utilized by the

broadcast organization. For simplicity in this report, the servers and the Xsan will simply be referred to as the Xsan, unless distinction necessitates otherwise. FORK is automation software that allows users to do work on the files residing on the Xsan. The Xsan simply stores the files and provides the hardware necessary to transfer content from the storage pool at significant data rates.

Until very recently, the Xsan has been used only as a file storage device, but its versatility has gained a fairly strong contingent of post production professionals who use it to digitally store and edit television content. A few companies like B4M have just barely begun to create software that allows video files to be streamed directly from an Xsan at broadcast quality, rounding out the hardware's ability to operate in both a post production and a master control environment.

Traditional broadcast engineers have been reluctant to adopt this particular System for a number of reasons. One is simply that they have fallen prey to smart marketing. Proprietary vendors have advertised their products in such a way that it has led many to believe that theirs is the only solution that is able to handle the massive streaming requirements that are required in a broadcast environment. Solutions like the proposed System are typically labeled by the perception that they were not specifically designed for the broadcast environment and therefore they cannot provide broadcast quality video streams. In reality, companies like Apple didn't design their servers to be broadcast file servers, so there is some truth to that argument. But also in reality, companies like B4M have been using the Xsan for quite a while now in many broadcast facilities outside of the United States to do just what proprietary solution providers claim that it can't do. The United States has been much slower than other countries to adopt

this System; however, it is creeping into the culture and seems to have a good chance of eventually penetrating it quite heavily.

The implementation of this completely new way of doing BYUB's core business functions is no small task. The changes necessary for a successful implementation do not happen overnight and require significant change management skills on the part of managers and employees. Thus, this evaluation was not merely a technical evaluation of the Fork/Xsan Infrastructure, but also an evaluation of the social and cultural implications of implementing the System.

The reader should note that this project was an actual performance improvement initiative at BYUB. This means that all of the frustrations to arriving at predictable, Petri-dish like conclusions in an uncontrolled environment were inherently a reality of this project. While the theoretical foundation upon which the evaluation was conducted was thoughtfully researched, a number of limitations towards applying some of those principles were met during the course of the evaluation. These limitations will all be described later in the report. It is unlikely that any real-world project of this nature will ever have the luxury of being conducted purely, without external perturbations to the established order of theoretical findings. No attempt was made to contrive a situation out of this experience that fits a perfectly shaped school project. This, I would assume, is as real as any experience that a performance consultant would have on the job.

Stakeholders

Members at the highest levels of BYUB management commissioned this project, and were the primary users of the information. This included Stephen Jones, Dean of the College of Fine Arts and Communications; Derek Marquis, then Acting Managing

Director of BYUB; and Chris Twitty, then General Manager of New Media at BYUB. Derek is now the official Managing Director of BYUB, and Chris is now the Chief Operating Officer at BYUB.

These stakeholders presented the following questions as the criteria by which they would judge the FORK/Xsan infrastructure to be capable of supporting the workflow they envisioned (Stephen Jones and Chris Twitty, personal communication, May 19, 2006). This list is interpreted from the original communication to help it fit more fluidly into this report:

1. Will the System more tightly integrate and/or consolidate the post production environment with the master control broadcast environment, creating a more streamlined workflow, and avoiding duplication of tasks, electronic files, and equipment? If yes, how should it be implemented?

2. Does the System allow digital content to be broadcast to air? What components are needed to do so (hardware and software)? What are the advantages/ disadvantages of doing so? Who are the credible, robust broadcast and production entities nationally/ internationally that utilize these approaches and what can we learn from them?

3. How can we implement the System to save costs and increase efficiency?

On the surface, these questions seem to be concerned only with the technical ability of the System, as well as the cost savings that might result from implementing it. However, parts of questions one and three indicate their concern with correctly integrating the System into the culture of BYUB as well. Through personal communication with these key stakeholders, it became apparent that one of their main

reasons for commissioning this evaluation was to determine what the social and cultural impact would be on the organization. It was clear that if the System was found to be technically capable of supporting the proposed workflow that they intended to implement it, but they wanted to make sure that they addressed any social/cultural issues so that the performance improvement initiative would have lasting success. What follows is a brief review of the literature that was helpful in conducting this evaluation.

Literature Review

Many people have researched how to effectively use technology as a driving force for performance improvement in organizations. In this section, I will attempt to outline some of the basic principles that have been gathered by researchers over time from a number of different disciplines, as they pertain to this project. I will first provide a short example that helps set the stage, and then briefly touch upon a few principles from the fields of action research, activity theory, socio-technical design, enterprise engineering, human performance technology, and evaluation. There exists an enormous supply of literature regarding each of these topics, so I've chosen to include just a few salient points that were particularly informative for this evaluation and solicit the readers who have further interest to find much amusement by searching out the documents listed in the reference section. Let's start with a brief example that helps set the stage for the overall topic at hand:

The short film "The Gods Must Be Crazy" helps illustrate a simple yet important point. The film is about the introduction of a new technology into a native African tribal unit that has existed for many years with little or no advancement in the tools that the members of the tribe use to perform their daily duties. One day, a glass soda pop bottle drops from a plane into the village. Members of the village very soon find that this new technology is able to help them perform some of their usual daily tasks more efficiently. Yet, even though the tool was so useful, it actually created quite a few problems within the social unit of the tribe. There was only one bottle, so people began to altercate one with another over who got to use the tool next. It became a very messy situation; so bad that the tribe decided that the gods who sent the tool to them must have been crazy.

Therefore, they ended up sending a man on a journey to throw the tool off the end of the earth to remove the problems it created in their society. We must note that it wasn't the bottle that had a problem; it performed its duties just fine. The troubles resulted from the way the bottle was integrated into the society, and from an apparent inability of the people to utilize the scarce resource without reckless abandon (Uys, 1980).

This same scenario plays itself out in all kinds of societies every day. Technology is ever more pervasive amongst organizations and social units today than it has ever been. But, the principles remain relatively the same whether in an African tribe, a classroom in Connecticut, or a university-owned television station in Utah. Simply plopping technology into a society does not automatically solve problems or improve performance. It must be intelligently integrated into society. And, as illustrated in the film described, there are usually plenty of encounters with the baser sides of human nature that will block your path on the way to a successful, technology-driven, change initiative. The following principles were helpful for this evaluation.

Enterprise Engineering

Enterprise Engineering's (EE) overall goal is the "improvement of enterprise performance" (Sarkis, Presley and Liles, 1995). Its practitioners have a term they call the enterprise architecture, which includes the activities, organization, business rules, human factors, and processes in which technology systems exist. A good enterprise engineer will ensure that the elements of the enterprise architecture are collectively in a position to support the technology's ability to enable performance improvement measures prior to implementing new technology (Sarkis et al., 1995).

To explain this concept further, consider a real example of an organization that tried to solve a performance problem contrary to this fundamental EE practice. A pervasive problem in the organization had been identified: not being able to finish projects in a timely manner. To solve the problem, they implemented a piece project management software that claimed to have the ability to allow project managers to track project information, which in turn could help them finish projects on time by managing expectations, encouraging accountability to project schedules, and communicating information to the projects' sponsors more easily. They used the software for a number of years, but never were able to regularly complete projects in a timely manner. Why didn't the technology solution work? In part, the initiative failed because of the following. Over the years, numerous consultants identified a number of barriers to the stated goal, such as un-navigable organizational structures, counteractive processes, and blatant employee apathy toward project schedules. They made recommendations for solving some of those problems, most of which would have been quite painful to adhere to. In spite of the recommendations, the organization chose not to address those problems and instead focused on implementing a technology that was advertised to solve the problem. The technology alone, as proven, was not able to solve this organization's problems.

EE seeks to eliminate these types of scenarios by ensuring that foundation structures are in place prior to implementing new technology into a social system. Some might be tempted to think that this approach only applies to the implementation of enterprise kinds of technology solutions, such as an organization-wide project management tool. The following statement from Sarkis et al. (1995) helps us see that

even localized technology implementations can in fact perpetuate enterprise-wide

efficiency problems:

> Technology has often been introduced through a bottom-up path with a focus on improvement of operations in a single department without consideration of the context of its relationship to the rest of the enterprise. This approach has usually led to islands of technological excellence focusing on locally optimal technological solutions. (p. 501)

EE stresses the need to consider the entire organization as one whole even during

single department technology implementations.

The situation BYUB is currently in exhibits the unhealthy symptoms just

described. The post production and master control areas were engineered quite

separately from one another, without consultation of the flow of work throughout the

entire organization. Each area functions quite handily on its own, much to the designing

engineers' credit. However, the amount of effort required to transfer content between the

two areas work is evident of a need for the application of enterprise engineering

principles at BYUB.

EE also emphasizes the need for strong support from upper management and

stresses the need for the "presence of a 'champion' of the technology" (Sarkis et al.,

1995, p. 504). All EE endeavors, no matter how worthy, have the chance of meeting with

much opposition. Unless properly supported, failure of the system is found to be likely

without proper support structures in place.

Human Performance Technology

Though stated differently, Enterprise Engineering (EE) and Human Performance

Technology (HPT) are concerned with similar outcomes and are rooted in practices that

are heavily related to one another. Compare the purpose of EE stated previously with this

definition of HPT from the American Society for Training and Development (1992): "A

systematic approach to analyzing, improving, and managing performance in the

workplace through the use of appropriate and varied interventions." Robinson and

Robinson (1996) explain this concept further by stating that,

> [Human Performance Technology] acknowledges that human performance is a
> function of many influences: feedback, accountability, rewards or incentives, and
> motivation, to name just a few… Another concept associated with human
> performance technology is the idea that these influences are interdependent; it is
> the combination of these factors that results in the desired performance…
> Performance consultants operate from the basic assumption that performance is a
> function of a system and not of any one element. Therefore, solutions to
> performance problems will be systemic in nature and not unidimensional. (pp. 14-
> 15)

In short, both HPT and EE try to engage performance improvement by taking a

systemic (i.e. encompassing, global, entire) approach to solving performance problems.

Not only is the underlying theory the same, but both disciplines focus on using similar

approaches as well. After identifying that the current level of performance is insufficient

and subsequently identifying what the performance goal is, the next step is to identify the

factors that contribute to the gap. Clark and Estes (2002) indicate that these steps can be

achieved, in large part, by answering four simple questions. These questions are

paraphrased below in a way that relates to this particular evaluation:

1. Stakeholder Reactions: what are stakeholders' reactions to the System?

2. System Functionality: does the System effectively perform all necessary
   functions?

3. Robustness: does the System continue to be effective after it is
   implemented?

4.   Effectiveness: will the System contribute to the achievement of the

organization's performance goals?

The process of finding answers to these questions helps the performance

consultant(s) to understand where the barriers to performance reside. Questions 2 – 4

identify whether the system has the technical ability to support a more efficient

workflow. Question 1 helps the facilitator identify the problems that are related to false

perceptions or negative attitudes toward a change initiative.

Action Research

Action Research (AR) has helped performance technologists to understand the

importance of involving people at various levels in a work organization, particularly the

doers of the work, during all phases of performance improvement initiatives. Carr and

Kemmis (1986) stated, quite simply, the purpose of action research by saying, "There are

two essential aims of all action research, to *improve*, and to *involve*" (p. 162). And

further:

> Action research is simply a form of reflective enquiry undertaken by participants
> in social situations in order to improve… the situations in which the practices are
> carried out. (p. 162)

To propose to someone that they need to improve their work practices can be

quite difficult to do without offending them. Action research claims that the discomfort

can be eased by involving those responsible for the daily work throughout the process.

Activity Theory

Activity Theory (AT) is closely associated with action research; however, it

focuses more on the theoretical underpinnings regarding work and the people who do

work. Because of its hefty emphasis on theory, many HPT practitioners don't naturally

place it in their toolkit of HPT wizardry. James A. Marken (2006) attempted to bridge that gap by providing a down-to-earth explanation of AT, as well as providing a practical application of its principles. Marken does a fabulous job of laying out the history of AT in his 2006 case study report. Here, I will mention only the aspects that were relevant to this particular study.

Activity theory states that there are seven elements that make up all human activity: Subject, Object, Outcome, Instruments, Community, Rules, and Division of Labor. Put succinctly, the Subject is the doer of the action, the Object is the motive behind the action, the Outcome is the goal or objective of the action, Instruments are the tools used to perform the action, Community represents the stakeholders, Rules are what constrain and justify the action, and Division of Labor describes which Subject(s) is either able or expected to perform each action in an activity system.

Activity theory further states that "Disruption—or as Engeström (1987) calls it, contradiction—is in some ways the heart of Activity Theory. Disruption is what drives the system; it is the key to change" (Marken, 2006, p. 33). There are four levels of contradiction: Primary, Secondary, Tertiary, and Quaternary Contradiction (Levels 1-4 respectively).

Primary contradiction occurs when a Subject is placed in a situation where there is conflict between the actions it performs. A Subject who fills two simultaneous roles can easily find itself experiencing primary contradiction. To illustrate, Marken (2006) uses the example of a person who fills the roles of researcher and participant-observer on a research project. As the researcher is participating in the activity, there would naturally

be resulting contradictions between the activity of doing research and the activity of participating in the research.

Secondary contradiction comes because of conflict between two or more elements in an activity. "Going against the grain" is an expression that effectively describes this type of contradiction. Those Subjects who are not afraid to conform to socially acceptable norms in an effort to reach the Object are the ones who will experience this form of contradiction most often. They are often the individuals who will champion change and create the disruption necessary for change to happen.

Tertiary contradiction is difficult to understand, but it basically means that there is a difference between what one element sees as the Object and what another element sees as the Object. It comes when there is a difference in the underlying motives behind doing an activity. It is a hard contradiction to identify.

Quaternary contradiction comes when changes in one activity system affect the activities of another system. This particular contradiction was not viewed as relevant to this project (Mumford, 2006).

Thus, activity theory implies that in order for significant change to take place effectively, it is necessary to have some contradiction in place. The evaluation presented in this paper identified which levels of contradiction would naturally be in attendance by implementing the System and made recommendations for instigating further contradiction as part of the System implementation to help foster a desirable change.

Socio-Technical Systems Design

Socio-Technical Systems Design (STS) was first developed after World War II, and was seen as "a means for optimizing the intelligence and skills of human beings and

associating these with new technologies that would revolutionize the way we live and work" (Mumford, 2006). The creators of STS placed strong emphasis on the need to de-emphasize bureaucratic structures and instead foster the ability of workers to organize themselves as needed in order to achieve certain goals. Work structures, then, should be designed by the actual doers of the work. All too often, technology has been interjected into cultures to the end of increasing performance and solving problems, without first consulting with those who will eventually be using the technology.

With socio-technical principles in practice, the entire organization is brought into the process of redesigning the work structure, which more easily enables a global view of the entire organization's work process. Identifying gaps in workflow efficiency is simpler when the entire flow of work is seen as one process rather than as individual, unrelated pieces (Mumford, 2006). Researchers have seen this participant involvement approach as helpful for quite some time.

In the 1950s and 1960s, many socio-technologists contrasted the robust levels of productivity in America with the fairly pitiful industry in Europe and accredited American success to their adoption of the more democratized socio-technical approach. Scandinavians are credited with being the principle initiators of socio-technical design, with many others such as Italy, France, Germany, and the United States also finding success up until the early 1980s with STS.

Cost and time constraints limited the perpetuation of STS approaches in the 1980's. As the desire for expediency and control gradually crept into social systems, management started to place more regulation on the work practices of their employees. Workers began to have less ability to choose how they accomplished their job objectives.

The latter portion of the 1990s saw an awakening of some of the old socio-technical principles, yet with more emphasis on technology and business results.

The Netherlands later began to adopt an approach called modern socio-technical theory. As an interesting side note, B4M, the makers of the software solution being evaluated, is based in the Netherlands. Basically stated, this approach declares that "most production systems are overcomplex and cannot be easily controlled, and need to be simplified" (Mumford, 2006, p. 332). Mumford also implies that one of the big questions on people's minds now is whether technology should be used as a major driving force for change, or whether it is simply something to be used to facilitate increased output and decrease the number of employees needed. Obviously, BYUB management intended to use technology as a driving force for change in this evaluation.

Those who plan to use technology in this way must realize the implications of such change initiatives. A piece of the foundation of socio-technical design is that the every day employees should be allowed to participate in the decision making process and design of new technology systems. Likelihood of success increases as the doers of the work are involved in the technology selection process. Regardless of the process followed, there is always the chance that a major change will be so hard for some people to deal with that it can lead to the breakdown of social systems (Mumford, 2006).

Albert Cherns (1976) is one of the principle pioneers of socio-technical design. He initially crafted a list of nine core principles of socio-technical design, and later revised the list ending up with ten core principles that he recommends adhering to when performing a socio-technical design (Cherns, 1987). The following four principles are relevant to this evaluation.

1.   Principle 1: Compatibility. In essence, this principle states that if the technical system is going to help a group of people, those people must be involved in its design.

2.   Principle 7: The Multifunctional Principle. Effective designs require the implementation of new roles in an organization. These roles can be filled in one of two ways. An external professional "consultant" can be hired as a facilitator to the evaluation, or employees can fill the role. Whichever option is chosen, the facilitator must be able to become an expert in the subject domain, if s/he is not one already.

3.   Principle 9: Transitional Organization. The design team and its process must be seen by the organization as a "vehicle of transition" (p. 159).

4.   Principle 10: Incompletion or the Forth Bridge Principle. Eventually, the design team must take a back seat while the organizational units themselves take over the responsibility to act as the team that will redesign the system and continue to perpetuate its usefulness into the future.

Evaluation

One of the difficulties any good evaluator will face is ensuring that conclusions are based upon truth, or something close to it. Particularly in a purely qualitative evaluation, such as the one described in this paper, one must take careful measure of the information that is being gathered to increase the likelihood of making correct assumptions. There are a number of ways to do this. Webb, Campbell, Schwartz and Sechrest (2000) encourage the evaluator to collect data from different sources so that it can be compared prior to making assumptions. This is commonly known as source

triangulation. The methods for gathering data do not have to be complicated. In fact, Clark and Estes (2002) say that the most effective way to gather data is to simply ask questions. Webb et al. (2000) recommend that one of the best settings for asking these questions is in the natural environment of the situation you are gathering information about. Most evaluators will recognize this approach by its common name, naturalistic inquiry. Ensuring accurate data can be enhanced by not only collecting data from many sources, but also by using more than one person to gather the data. One person may bring certain history and assumptions to the research that will color the results. If more than one person gathers data, their individual preconceived notions can be washed out to some degree as they compare information prior to making final conclusions.

Summary

Principles from each of these disciplines were gathered at various stages of the project as more information became necessary to guide the evaluation. The key principles were distilled and placed into a list that eventually became the criteria by which the feasibility of the change initiative was measured.

During the preparatory stages of the project, principles from Enterprise Engineering, Human Performance Technology, and Socio-Technical Systems Design were used to architect the overall structure of the evaluation. Specifically, these principles provided a realization that the evaluation needed to be systemic in nature, concerned with all elements in the organization that could impact the improvement initiative's success. This broadened the scope of the project past the point of being a simple technical evaluation, and turned it into a complete socio-technical evaluation.

Principles from Action Research and Activity Theory were introduced well into the project's lifecycle. In general, these principles were supportive of the direction already chosen for conducting the evaluation; however, the principle of contradiction, or disruption, from Activity Theory stood by itself and provided another criterion by which to judge the initiative's feasibility.

The field of evaluation provided the underlying methodology by which the project should be conducted. Ensuring that a goal was clearly defined, that stakeholders were integral to the process, and that source triangulation was used to gather and analyze data were all a part of this project because of the principles learned from this discipline. Basic evaluation principles are essential to the core of the Instructional Psychology and Technology learning experience at BYU, so they were readily available at the onset of the project to help guide its development and execution.

The disciplines that address this project's objective go beyond those described above. Only those disciplines that held the most relevance to this particular project were included in the review.

I could not find any literature that specifically deals with the type of environment that this evaluation takes place in. Conducting such a study at a broadcasting entity as part of an academic endeavor is therefore somewhat unique.

Methods

The evaluation was conducted in two phases: a technical evaluation and what I am calling a feasibility study. The technical evaluation's purpose was to verify the System's functionality. The feasibility study's purpose was to determine the non-technical factors that could affect the System's implementation success, and to make recommendations for addressing those factors.

The core evaluation team consisted of three people: I filled the role of facilitator and project manager, and two students were hired specifically for this project to serve as assistants in any way needed. I have worked in various capacities in the industry for the past 13 years. One student had previous experience editing video using Xsan technology; the other had prior experience building and maintaining an Xsan. Together, the team possessed enough knowledge and experience by which to successfully conduct the evaluation. However, in accordance with principles in the literature review, many other people inside and outside of the organization were invited to be active participants in the evaluation process.

Technical Evaluation

A technical evaluation was necessary for two reasons. This System is relatively infantile in its lifecycle. While many broadcasters have switched to file-based workflows, very few broadcasters in the United States have adopted this particular System. We needed to ensure that B4M's advertised claims of its functionality were sufficient for the desired workflow. Secondly, Clark and Estes (2002) strongly recommend validating a system's technical ability prior to evaluating the feasibility of implementing the system.

First, we laid the groundwork for the evaluation by creating a complete list of technical requirements, while simultaneously identifying the workflow goal that the System must support. We started by obtaining a requirements list that the engineers had previously used for this purpose. The list was insufficient for our purposes, considering the drastically different workflow that needed to be implemented. Hence, we set out to complete the list. As recommended in the literature, we had to find a way of looking at the technical aspects of the system from a holistic standpoint, including the enterprise workflow into the evaluation. So, our first task was to map out the entire workflow, detailing the technical requirements of the System along the way.

Drawing the workflow proved to be one of the most useful exercises of the entire evaluation. Our review of the literature helped us understand that it was important to involve as many people in the evaluation process as possible, and that we should take every opportunity to gather information from as many sources as we could. So, even though the evaluation team possessed enough collective experience to draw the workflow as a group, we decided to conduct naturalistic inquiry sessions and focus groups with those involved in the workflow. We felt this would help us create a more accurate workflow map, but the real significance was in the opportunity it would provide us to gather information unobtrusively. Everyone we involved in the process had been told by management what the evaluation team's objective was, so nobody was wondering what the purpose of our work was, nor were they unaware as to what we were gathering information for. But, approaching them under the cloak of a technical evaluation seemed to provide a venue where many felt comfortable sharing their opinions with us regarding the change initiative.

Naturalistic inquiry. The inquiry sessions were performed rather casually, as the individual being interviewed performed their daily work. Nine people were observed. Each person was told that the purpose of our visit was to find out what the requirements for the System should be, in order to inform our evaluation of it. We asked them to show us what they do, particularly as it relates to the workflow that would be affected by the System. We asked them a number of questions regarding their jobs, and regarding their feelings on the new System. Two members of the evaluation team conducted the naturalistic inquiry sessions. Both members were present at four of the sessions. We split up for the remaining five sessions, so that only one of us attended each of them. A set of guidelines were prepared prior to the inquiry sessions. These guidelines are detailed in Appendix H.

The information we gathered from the inquiry sessions was helpful in bringing the technical requirements closer to completion, and aided in drawing a straw man workflow map that was later used during focus group sessions, where the workflow map was actually created.

Focus groups. To involve as many people as possible, we conducted a series of focus groups to continue drawing the current workflow. Everyone at BYUB that is involved in the process of acquiring, editing, managing, archiving, and broadcasting video content was invited to participate in constructing a map of the current workflow. Twenty-one people were invited to participate. Seventeen responded to the invitation, and only seven continued with us through the end of the mapping process. The seven continuous participants were representative of each area of work (acquisition, editing, engineering, management, and master control operations), so we felt that it was a fairly

good sampling of the worker pool. The straw man workflow map that was created

previously consisted of a very basic block diagram of the production process from

acquisition to broadcast and archive. This map is included in Appendix A. Every person

around the table was asked to participate as we went through the workflow, step by step,

and edited the workflow map so that it accurately reflected BYUB's current workflow,

from start to finish. See Appendix B for the accurate workflow map.

After this workflow map was completed, we sought to determine what the ideal,

file-based workflow would look like. Again, a straw man workflow was created to

represent a typical file-based workflow, and the same people were gathered to finalize it

according to their view of the ideal workflow. This map also incorporated some of the

ideas for efficiency that were discussed as the original workflow map was created. At

this point, we invited the BYUTVI project team to participate to ensure that the workflow

and subsequent technical requirements encapsulated all of the needs for the new channel.

Because the ideal workflow was very subjective in nature (not everyone had the

same idea of what the ideal workflow should be), it was not possible to finalize the map

in the focus group sessions. Fortunately, management had previously dictated certain

elements of the ideal workflow, according to their previous study. They did not

document the results of their study, so we conducted personal interviews with two of

them to gather these requirements. See Appendix H for the guidelines we used to

conduct the interviews with management.

To ensure that our ideal workflow map was complete, a site visit was conducted

to Current TV in San Francisco. They had implemented a file-based workflow in 2005,

using Xsan technology. A guided technical tour of their facility allowed us to identify the

elements of their workflow and compare our ideal flow against it. One member of management and I participated in the site visit. The workflow map for Current TV was deemed private, and therefore is not included in this report.

From all of the information gathered thus far, we constructed what we thought should be the ideal workflow for the organization and obtained management's approval of it. This ideal workflow map is included in Appendix C. In accordance with STS principles, this was shown to the other participants and presented as the goal of this workflow change initiative. Participants were allowed to comment freely on this new goal in yet another focus group meeting. Notes from the meeting were kept and reviewed later to inform the feasibility study.

While comparing the ideal workflow map with the current workflow map, it became apparent to us that the current workflow map was much too detailed. It was difficult to identify the differences between the two maps because of the intricate detail of the current workflow map. Thus, we created a simplified version of the current workflow that was more accessible for comparison with the ideal. The simplified workflow map is included in Appendix D.

Through this process we were able to complete the list of technical requirements, which was then reviewed by the remaining participants and management. A few changes were made, after which time the list was ready for use in the technical evaluation. Appendix E contains the finalized list of technical requirements. Throughout the remainder of the evaluation, we found that the list of requirements occasionally needed revision, but we felt that we had done sufficient due diligence up to this point that we could officially begin the technical evaluation.

It should be noted that at least one of the two student assistants was present during each of the focus groups and some of the interviews. They took notes and made observations, which were compared with mine to help ensure that the conclusions reached were not simply based on one person's view of the situation. Where possible, everything was reviewed by as many other participants as was prudent to further reduce bias.

Prior to beginning the evaluation, the team realized that we had somewhat blindly taken management's word that a file-based workflow would help the organization be more efficient. We also realized that unless we knew exactly how it would help the organization be more efficient, we could easily fail at successfully conducting the evaluation. We felt that it would be important for us to know exactly how the new workflow would help the organization, so we did a quick comparison of the ideal and simplified current workflow maps to verify management's assertion. The comparison revealed that, for a 60-minute program, a file-based workflow results in nearly four hours of employee time savings. Table 1 shows the details of this comparison. This is admittedly a narrow view of the entire list of ramifications that a file-based workflow has upon the workload of the resources involved in the entire production and broadcasting process. There are many other factors that need to be considered in the overall cost savings, but it provided us with enough confirmation of the validity of what we were doing that we felt comfortable proceeding.

Table 1

Employee Time Savings, File-Based Workflow

Task	Resources	Time Savings (min)
Ingest Tape into ProTools	Audio editor, tape machine, room	65
Create Master Tape	Video editor, tape machines (2), room	65
Create Air Copy	Video editor, tape machines (2), room	65
Drive tape to TOC	Courier, Car	20
Tape cueing	Master control operator, tape machine	15

Feeling comfortable that we were doing a worthwhile project, the next step was to verify the System's functionality against the requirements list. To be completely thorough, we reviewed the System three different ways: by sending the list of software requirements to B4M and having them respond to each item in the list, installing a demonstration version of the System and conducting usability tests, and finally by conducting an on-site visit to an organization that had already implemented the System.

Vendor response. We sent the technical requirements list to B4M and asked them to verify FORK's functionality accordingly. Their responses were noted on the requirements list for review later. Any requirements that FORK did not meet were discussed with B4M, and a suitable plan by which the critical requirements could be met was agreed upon.

Demo system. BYUB had previously purchased an Xsan, which for reasons described earlier was not in use. This equipment was used to create a demonstration version of the System for further technical evaluation. The student assistants setup the

Xsan and installed a demo version of FORK on it. The students tested the software for functionality, according to the list of requirements. Notes were made next to the vendor responses for comparison.

After the students' verified the System's technical functionality, we conducted usability tests with eventual users of the system. The usability studies served a twofold purpose: to further verify the System's functionality and usability, and as a means to better understand the likelihood that the current employee base would accept the new technology. All full-time eventual users were invited to participate, however only two out of seven accepted the invitation. The demo system was setup in an actual station where the users currently do their work. Each participant was asked to go through a normal sequence of activities (according to their individual job function) using the software. We had each of them practice the familiar talk-aloud usability testing protocol while we made notes of their comments and any other observations that were relevant to the study. This approach is fairly standard amongst usability engineers (Nielsen, 1993).

We intentionally familiarized participants with the software prior to the usability test. Because automation software like this is controlling a live television signal, there is little room for error. All operators will always be trained extensively on the software prior to using it to do the job. The usability test therefore needed to reflect this reality. The notes were later reviewed and compared against the other aspects of the technical evaluation for consistency.

Because so few people elected to participate in the usability study, we arranged for a presentation to be made to the organization by the president of B4M. He used screenshots for the entire system, and a limited demo on a laptop, to walk eventual users

through the software's features. The purpose of the presentation was simply to show users the system's functionality and help them catch the overall picture of how the system could technically help the organization achieve its ideal workflow. During his presentation, everyone was given the chance to ask any question at any time. After the presentation, users were asked to make any observations they had regarding the System. Twelve people attended the presentation. We considered this to be good practice to provide eventual users with another chance to be involved in the evaluation. Appendix F contains the responses from participants in the usability study.

On-site visits. Two on-site visits were conducted at Digital Latin America (DLA) in Coral Springs, Florida in June and July 2006. The list of technical requirements was brought to the site visit, and functionality of the System was observed. The chief engineer at BYUB accompanied a member of management and me to the first of these visits, to ensure that we did not overlook any technical aspects of the way that the System was being used. We wanted him there to ensure that their infrastructure was similar enough to BYUB's to make the comparison valid. Three people participated in the second visit: a consultant who will be introduced later, one of the student assistants, and me.

DLA provided an excellent seedbed of knowledge for the feasibility portion of the evaluation. They too had recently expanded the number of television stations that they operate and had switched to using the System when they added the last three stations to their list of properties. We made extensive notes on their perceived successes and failures and gathered as many recommendations as we could from them to further inform our conclusions.

Now that we knew that the System had the technical ability to support the ideal workflow, we created the technical design document. The design was compared with that of DLA, and reviewed by B4M to ensure its technical accuracy. We also had an Xsan certified expert who has experience implementing FORK review it for accuracy. Adjustments were made as necessary and the design finalized. The design was not approved for public viewing by BYUB management, and is therefore not able to be published in this document. Those interested in viewing the design are welcome to request case by case exceptions from BYUB.

Feasibility Study

With the technical evaluation complete, we needed to determine whether the organization would likely adopt the System to allow the workflow goal to be achieved. Though this may seem like a simple thing to do, in reality it is typically more difficult to gather this kind of information than to verify technical functionality. There are very few absolutes because of the human element involved, and the steps for obtaining this information vary amongst practitioners. However, the underlying principles are fairly well researched, and the literature reveals a number of ways to identify the likelihood of success.

We decided that a simple, yet effective way to carry out the feasibility study was to judge the likelihood of success according to a list of criteria. Table 2 contains the list of feasibility criteria, which were distilled from the disciplines described earlier in this paper.

Table 2

Feasibility Study Criteria

Discipline	Principle
*EE/**STS/***HPT	System designed to fit within the enterprise-wide workflow
EE	Strong support from upper management exists
EE/†AR/††AT	All elements within the enterprise workflow are considered
EE/AT/STS	A champion of the technology in place to support the System
EE/AR/HPT/STS/†††EV	A goal is identified and clearly stated
HPT/EE	System functionality is verified
HPT/EV	Stakeholder reactions are reflected in the design
AR/EE/STS	Workers were involved in the design
AT	Sufficient levels of disruption are present
STS	Organizational units promptly take over System maintenance
EV	Triangulation is used to gather information/make conclusions

*EE = Enterprise Engineering, **STS = Socio-Technical Systems Design, ***HPT = Human Performance Technology, †AR = Action Research, ††AT = Activity Theory, †††EV = Evaluation

We were pleased to realize that after the technical evaluation we were already in a position to identify the extent to which this initiative presently adhered to these criteria. We found that conducting the technical evaluation according to the principles in the literature review allowed the evaluator to be exposed to the realities of each of the above criteria quite heavily through the evaluation process. So, the information to address the above criteria was gathered throughout the course of the technical evaluation. This was

not entirely by surprise. We knew that we would need this information, so we were sure to gather it along the way. Gathering the information during the course of the technical evaluation was a deliberate attempt to obtain more accurate information in regards to this feasibility study. The guidelines for conducting the naturalistic inquiries, focus groups, and interviews were constructed specifically for this purpose. The guidelines are included in Appendix H.

To complete the feasibility study, we reviewed all of the notes we had gathered thus far to ensure that our judgment of the criteria was more accurate than our memories would be. We documented our responses to each of the criteria and then identified recommendations to management for causing the other criteria to be met. Appendix G outlines our responses to each of the criteria in Table 2. A compilation of the observations that were consistent across each evaluation team member is contained within the response list.

Consultant

While the work of the evaluation team was appreciated and trusted by management, they felt it would be best if there was an opportunity for a professional consultant to vet the evaluation conclusions. The enormous cost of the new System, along with the significance of the changes required to support it, were of sufficient stature to merit a second measurement prior to making the final cuts, so to speak.

Stephen Jones chose Rich Bisignano and Associates as the consulting company, by recommendation of Lyle Shamo, then head of the Audiovisual Department of the LDS Church. Rich Bisignano himself provided the principle consultation, along with help from an associate, Suzanne Donino. Each of them has provided consulting work for

major organizations, such as Turner Broadcasting, CBS, the LDS Church, and others throughout their careers. They were very thorough in their consultation. Their contracted scope of work extended far beyond the evaluation described in this paper, indicating the wide extent to which management sought to implement change into this organization.

Due to the sensitive and proprietary nature of Rich's work, his methods and findings are not detailed in this report. The impact of his work on the final recommendations is discussed later however, and is a contributing factor to the final results of this evaluation.

Analysis

The information regarding the technical evaluation was rather simple to analyze. All we had to do was review the list of technical requirements, and the corresponding notes made next to each requirement during the evaluation, to ensure that the System was technically capable. We used a variety of methods to gather this information, so we were very confident in the information that we used to draw conclusions from. Appendix E is a condensed form of all of the information gathered on each technical requirement.

Drawing conclusions from the feasibility study was not as straightforward. We had gathered information from multiple sources, using multiple methods; and we used multiple evaluators to gather information. This gave us reasonable assurance that we had properly gathered information, giving us a fairly high level of comfort in our ability to draw appropriate conclusions. We felt it was necessary to apply these principles to the analysis of the information as well as the gathering of it, so the entire evaluation team was involved in analyzing the information. Discussing the information as a group, we

felt, would further lessen the potential biases of any particular individual. We gathered

all of the information that each team member had documented and reviewed it as a group.

After that, we recorded our conclusions next to each item on our list of criteria. Our

conclusions are outlined in Appendix G. To further verify our assumptions, we

compared our results with those of Rich Bisignano and Associates after their work was

complete.

Report

I presented the initial findings of the evaluation to one member of management

prior to the completion of the consultant's work. After the consultant finished his work,

we gathered together all of our findings and created a final list of recommendations to

present to the entire management support group. The presentation was given to

management on August 17, 2006. The group consisted of members of the Dean's office

from the College of Fine Arts and Communications, and the executive management

group at BYUB. This final report was presented by Rich Bisignano. Rich's consultation

report is on file at BYUB, but is not publicly accessible.

Subsequent to this presentation, the bulk of the report was made available to all

interested BYUB employees for review. Since that time, work has begun to implement

many of the recommendations.

Results and Recommendations

The results of this project can easily be summarized in two sentences. First, the System is technically capable of supporting the ideal workflow, with one minor software improvement. Second, successfully implementing the System will be difficult, and will require some interventions to be made as part of the performance improvement initiative. This section will provide an explanation of our conclusions and accompanying recommendations. For a more detailed explanation on the reasoning behind the recommendations, please refer to the Discussion section.

The technical evaluation confirmed that the System provided all of the functionality necessary to implement the ideal workflow, except the ability to playback six audio tracks embedded on a single video stream. B4M verified that they could provide a software modification, prior to the launch of BYUTVI that would allow the System to meet the audio requirements. All other functionality requirements were positively verified through the means described in the Methods section. Appendix E shows the detailed findings of the technical evaluation.

While the results of the technical evaluation were quite simple to draw conclusions from, making inferences from the feasibility study data was not as straightforward, simply because of the subjective nature of such analysis. After documenting our responses to the feasibility criteria in the table that is contained in Appendix G, it was apparent to us that the change initiative had very little chance of success unless further intervention was made. The primary factors being the lack of a technology champion who was in a position of authority, apparent antagonism towards the System, the organizational units were not in a position to take over the maintenance

of the System after implementation, and a perceived unwillingness from those in the organizational units to participate in the evaluation. These factors gave us significant reason to believe that implementing this change initiative would not be as simple as installing the System and training people on how to use it.

In addition to our conclusions regarding each feasibility criteria, we gathered information to help us understand why the previous attempt to migrate to an electronic file-based workflow had failed. From talking to a number of the participants in the evaluation, we concluded that the reasons for failure were two-fold.

First, some people deliberately failed to implement the system because it would hamper a couple of personal agendas that were mostly unrelated to the initiative. For reasons of confidentiality, it would not be prudent to include the details of these circumstances in a document of this nature.

Secondly, some of the key performers in the organization simply could not understand how the new workflow would help them become more efficient. In every case, we noted that these individuals were the most expert and efficient at performing in their job functions of any others in the organization. They were accustomed to a certain way of doing things and had become very efficient at doing things that way. Using the demo system that we installed, we observed them trying to do their jobs in a file-based workflow, but because of unfamiliarity with the new way of doing things, they encountered a number of errors in performance which naturally frustrated them. Hence, their negative perception towards the initiative became reality for them as they dealt with the frustrations of working on an unfamiliar system. They candidly mentioned to us that the frustrations we observed as they used the demo system were among the primary

reasons that they did not help the original initiative to succeed. This argument did not carry very much weight with management, obviously since the initiative was commissioned a second time. The previous studies conducted by management showed that many other people at other organizations were able to perform those same tasks in a file-based workflow much more quickly than those working in a tape-based workflow, after they had become expert in the file-based environment.

The false perceptions and fear of change were issues that we felt could be addressed by implementing the recommendations described below. The blatant failure on the part of some workers to support the original initiative showed that there would need to be a restructuring of authority in the organization to ensure that such an attack would not submarine the initiative during this second attempt.

We compared all of these observations and assumptions with those of Rich Bisignano after he was finished with his study. It was comforting to find that his conclusions were quite similar. In fact, the differences were very slight, involving specific people rather than general issues. This gave us very strong assurance that the conclusions we had reached were valid enough to begin constructing recommendations to management.

In spite of the imminent difficulty that would surely be encountered by implementing the System, specifically as a means to alter the current workflow at BYUB, we recommended to management that the System be implemented. With the launch of a new channel coming soon, and appropriate support from upper management and key donors, we felt confident that this was the appropriate time to initiate this significant change at BYUB. We created a block diagram of the System's technological design and

presented that to management. We were careful to clarify to management that the design would support the ideal workflow, but that we had concluded from our evaluation that a number of other interventions needed to be made in order for it to succeed at BYUB. The recommended interventions are described below.

Technology Champion and Consolidation of Operations Department

First, a champion of the System had to be installed in a position of authority. Practically, we recommended that a new position be created in the organization, that of Chief Operations Officer (COO), and that the following departments be realigned to report to that position: Production, IT, Web, Engineering, and Master Control Operations. BYU limits the number of full time employees (FTE) that a department can have. Since BYUB had already reached its FTE capacity, this position would either need to be filled by someone in the organization, or another position in the organization would need to be vacated to allow someone else to be brought in. Fortunately, we had identified a number of potential candidates within the organization to fill this role, so our recommendation to management was to utilize one of those people.

Encourage Participant Support

After the placement of the COO, the pervasive negative attitude toward the initiative had to be dealt with. The COO would be responsible for bringing as many people on board with the change initiative as possible, within a month or so after his appointment. After that time, it would be necessary to encourage those who were not supporting of the new initiative to vacate their positions at BYUB so that new individuals could be brought in to support this new direction. While it was apparent to the evaluation team who the malcontents were, no recommendations were made to management on

which individual's needed attention from the COO. However, management was encouraged to have the COO consult with our findings, in person, after he had an opportunity to meet with each of his employees.

Organizational Responsibility

Since it was apparent that the individual organizational units were not naturally preparing themselves to take over the maintenance of the System after implementation, we recommended to management that the organizational units bear the responsibility of implementing the System. This would ensure that they had sufficient knowledge by which to maintain the System. Since the evaluation team was temporarily assigned to this project, and would eventually return to their normal duties at BYUB, it was important to have the organizational units prepared to take over the System very soon.

Temporarily Localized Implementation

Because the new System would introduce the organization to a completely different way of doing work, we felt that it would be wise to implement it only on the new channel, BYUTVI. In the event of a catastrophic societal breakdown as a result of the System being introduced, BYUB would still be able to maintain its current properties using the conventional systems. After a six-month period after the launch of BYUTVI, we recommended that an evaluation of the System's effectiveness take place. If the evaluation turns up positive results, we recommend that the System be implemented across the workflow for the other properties as well. Implementing the System essentially as an island at first would also allow them to draw a distinct line between the conventional way of doing things and the new way. The System would have to be completely separate from the conventional system, preventing users from using old

technology to support the new channel's program stream. Considering the already proven tendency in the organization to revert back to old technologies, we agreed that this approach would yield greater success.

After consulting with Rich Bisignano, the following recommendations were added prior to the final presentation to management. These recommendations were in addition to the recommendations that planned to make.

Consolidate Engineering Department

Rich aptly pointed out that the bulk of the work for maintaining the System would fall upon the engineering groups. This would necessitate that these three disparate groups be reorganized under a single manager. That manager would function as the primary champion of the System. The COO's role would then shift from being the primary champion of the technology to being the person responsible for fostering a common goal amongst all users of the System (primarily the Production and Master Control Operations groups). The manager of engineering would be responsible for ensuring that the engineering group was properly trained to support the System.

Media Management Policy

Rich also recommended that a media management policy be put into place prior to the System's implementation. This serves two purposes for the organization. First, it ensures that the organization's most precious asset, its media content, is properly managed. Second, it ensures that the expensive storage space on the Xsan is utilized to its maximum potential.

Report

These recommendations, along with an accompanying system design, were presented to management on August 17, 2006. Management formally accepted the results of the evaluation and is moving forward with the implementation of the System. Many of the recommendations have been implemented, some in modified form from the original evaluation results.

Meta-Evaluation

A meta-evaluation of this evaluation was conducted, in accordance with the Program Evaluation Standards listed in the following website: http://www.eval.org/EvaluationDocuments/progeval.html. Overall, the evaluation received a rating of "Good," and seemed to adhere quite well to these standards. It received a rating of "Poor" in only two areas. For the detailed meta-evaluation report, see Appendix K.

Discussion

Leading this evaluation was a valuable learning experience. It was interesting to see how the theoretical base on which the evaluation was conducted had to be interpreted and adjusted fluidly throughout the project. It seemed impossible to conduct the evaluation purely, exactly according to any set of rote procedures. The dynamics of human nature in this particular workplace at this time required the ability to quickly change course and interpret unexpected results later on.

As mentioned earlier, some of the primary stakeholders had indicated that their decision to implement the System, or not, would be based on the answers to three questions. For convenience, these are listed again below:

1. Will the System more tightly integrate and/or consolidate the post production environment with the master control broadcast environment, creating a more streamlined workflow, and avoiding duplication of tasks, electronic files, and equipment? If yes, how should it be implemented?

2. Does the System allow digital content to be broadcast to air? What components are needed to do so (hardware and software)? What are the advantages/ disadvantages of doing so? Who are the credible, robust broadcast and production entities nationally/ internationally that utilize these approaches and what can we learn from them?

3. How can we implement the System to save costs and increase efficiency?

We felt that the evaluation sufficiently answered these questions, and the stakeholders indicated during the report that we had provided them with the information they needed to make decisions. Specifically, we found the answers to all of the questions

to be generally positive, affirming that the System should be implemented. We saw firsthand, through onsite visits, that many people were using the System to integrate their post production and master control environments with a workflow that surpasses the efficiency of BYU Broadcasting's. We also witnessed digital content being broadcast to air from the System, and learned of some of the advantages and disadvantages of doing so. All of the organizations we visited reported significant overall cost savings, both in efficiency and in infrastructure costs by implementing this kind of workflow.

Among the advantages we saw were the elimination of the time consuming process of transferring tape media throughout the organization, the ease by which content could be browsed and retrieved, the reduction of costly equipment to play the tapes, and the freeing up of valuable building space that would otherwise be used to store tapes.

One of the main disadvantages we saw was the need to abandon the costly traditional infrastructure at BYU Broadcasting while it was still in good operational condition. The other main disadvantage was the difficulty by which the change would happen. Using this System would be drastically different from what the operators are accustomed to and would require a considerable amount of effort and patience to help the initiative succeed.

We felt that the three questions listed by the stakeholders did not sufficiently address the non-technical factors that could impede the initiative's success. However, during interviews, the stakeholders expressed great desire to understand these non-technical factors. We, therefore, added the following question to be answered by the evaluation: What non-technical factors led to the failure of the previous attempt to

migrate to a file-based workflow? What aspects of the organization must change in order for the initiative to have success this time?

We felt that our observations provided adequate information to answer this question. We found two primary factors that led to the previous initiative's failure, as discussed in the Results section. Our conclusions led to recommendations for changing aspects of the organization that needed to be modified in order for this initiative to have success. It is entirely probable that we overlooked some of the non-technical factors that would affect the initiative's success, but we do feel that our judgments were based on a solid list of criteria and that our recommendations were valid and useful.

Even though the evaluation met with much opposition from the organization, many people were very open with us and willing to share information. We found very quickly that almost everyone involved felt that they were working at BYUB for a higher purpose than to simply make a paycheck. They truly felt that it was a pleasure to be involved in bringing to pass the mission of BYUB. It was interesting to us that everyone could be motivated by this common goal, yet be so distant from one another in their approach to achieving it. This is one shining aspect of the people at BYUB; they are motivated by a higher purpose, as it were, that naturally compels each one of them to sacrifice time and energy for the good of the organization's mission. Yet, even in an environment as ideal as this seems, it was apparent that change was still a very hard change for many people in the group. That was a major task of this evaluation – to find out how to encourage the people to embrace the change.

We noticed very early on that it was difficult for many to step outside of their individual duties and look at the enterprise architecture as a whole. As we were

constructing the ideal workflow map together, the main challenge was helping people to see how their ways of doing things would impact other parts of the workflow. We found in many instances that what worked well for one person, did not always serve the entire process very well. We found that many individuals had worked very hard to refine their individual processes to be as efficient as they could, without regarding how it affected anyone else. So, in an effort to do their best to help the organization fulfill its mission, they actually caused a bit of damage to enterprise performance by not consulting with others to ensure that their processes were contributing to the overall flow of work.

Many things went very well during this evaluation; however, a number of things could have been conducted more effectively. For example, we would have preferred that management had not selected a particular System to evaluate prior to commissioning the evaluation. According to the principles in the literature review, it is usually best to involve the doers of the work in the technology selection process. We felt that the participants in the evaluation would have felt much better about the initiative if they were involved from the beginning. Many participants candidly noted that they were disappointed in management's lack of trust in them by not involving them upfront. On the other hand, management did attempt to involve many people upfront, which met with apparent opposition. So, it's difficult to pinpoint exactly what the best approach was. Those who theoretically should have been involved seemed unwilling to help conduct a fair evaluation, yet without them we felt that the change initiative would be more difficult to successfully implement.

In retrospect, we felt that it would have been better for management to fix the non-technical aspects of the previous initiative's failure prior to pushing the initiative

again. With those factors addressed, management could have had those people in the organizational units conduct the evaluation, rather than bringing in someone from another department to do it. According to the principles distilled from the literature, this would have allowed the evaluation to be conducted more effectively.

Our hope is that management will strongly consider commissioning an evaluation of the System after it has been implemented to measure for performance improvement. Even though all of the research up to this point indicates that it will have a very satisfactory impact on performance, we feel that it would be important to validate it with another evaluation.

Schedule and Budget Comparison

In general, the project stayed on schedule reasonably well, even though start and finish dates on individual tasks within the project fluctuated frequently. Appendix I compares the proposed schedule with the actual schedule. As is evident, the project started about three weeks earlier than was planned, and ended one week earlier than planned. The largest variable in the schedule was the installation and testing of the demonstration system. Scheduling conflicts with the vendor and installation setbacks on BYUB's side caused this phase of the project to take much longer than anticipated. Many other tasks within the project started earlier than planned, and took longer than planned to complete. However, the amount overlap between many of the tasks allowed the project to complete a bit earlier than planned.

Overall, the project came in $7,188 under budget. We had anticipated the need to purchase about $12,000 in hardware in order to install the test system. As explained earlier, parts from the dormant post production Xsan were used for the test system. That caused the hard costs for the project to be much smaller than budgeted, however since many of the tasks took longer than planned, the overall personnel cost was greater than expected. We did not figure the cost of the consultant's work into the budget, primarily because it is confidential. Appendix J contains a more detailed comparison of the actual vs. proposed budget for the project.

References

BYU Broadcasting. (n.d.). *BYU Broadcasting Mission Statement*. Provo, Utah.

Carr, W., & Kemmis, S. (1986). *Becoming critical: Education, knowledge, and action research.* Basingstoke, UK: Deakin University Press.

Cherns, Albert B. (1976). The Principles of Sociotechnical Design. *Human Relations,* 29 (8) 763-782.

Cherns, Albert B. (1987). Principles of Sociotechnical Design Revisited. *Human Relations*, 40 (3) 153-161.

Clark, R. E., & Estes, F. (2002). *Turning Research into Results.* Atlanta, GA: CEP Press

Engeström, Y. (1987). Learning by expanding: An activity-theoretical approach to developmental research. Helsinki: Orienta-Konsultit Oy.

Marken, James A. (2006). An Application of Activity Theory: A Case of Global Training. *Performance Improvement Quarterly,* 19 (2), 27-50.

Mumford, Enid (2006). The story of socio-technical design: reflections on its successes, failures and potential. *Information Systems Journal,* 16, 317-342.

Nielsen, Jakob (1993). *Usability Engineering.* Boston: Academic Press.

Robinson, D.G., & Robinson J.C. (1996). *Performance Consulting: Moving Beyond Training*. San Francisco, CA: Berrett–Koehler Publishers, Inc.

Sarkis, J., Presley, A., & Liles, D. (1995). The management of technology within an enterprise engineering framework. Computers and Industrial Engineering, 28 (3), 497-511.

Uys, J. (Producer and Director). (1980). *The Gods Must Be Crazy* [Motion Picture]. South Africa: Jensen Farley Pictures.

Webb, E.J., Campbell, D.T., Schwartz, R.D., & Sechrest, L. (1966). *Unobtrusive Measures*. Thousand Oaks: Sage Publications, Inc.

Appendix A

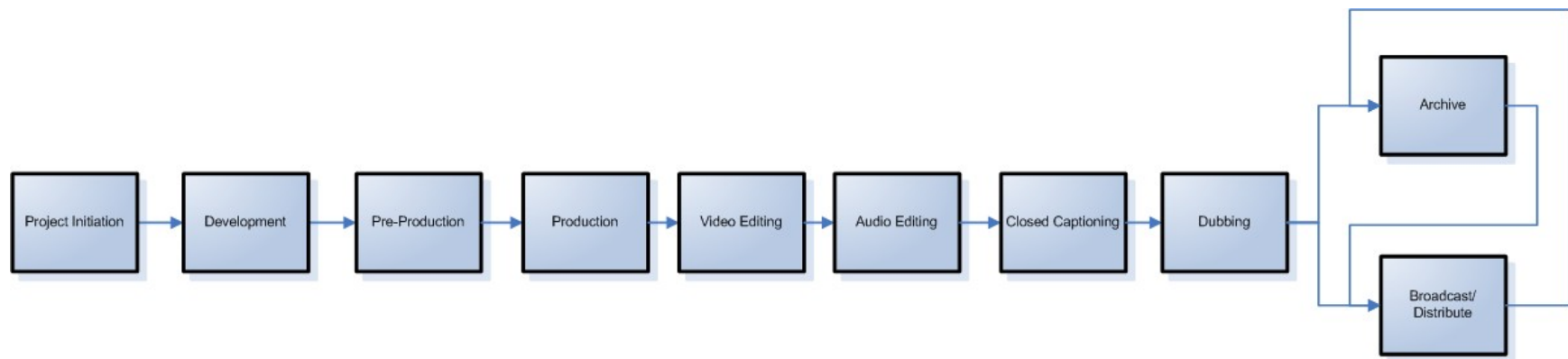Basic Television Production/Broadcasting Workflow, Revision: April 2006

Figure A1. Basic Television Production/Broadcasting Workflow

Appendix B

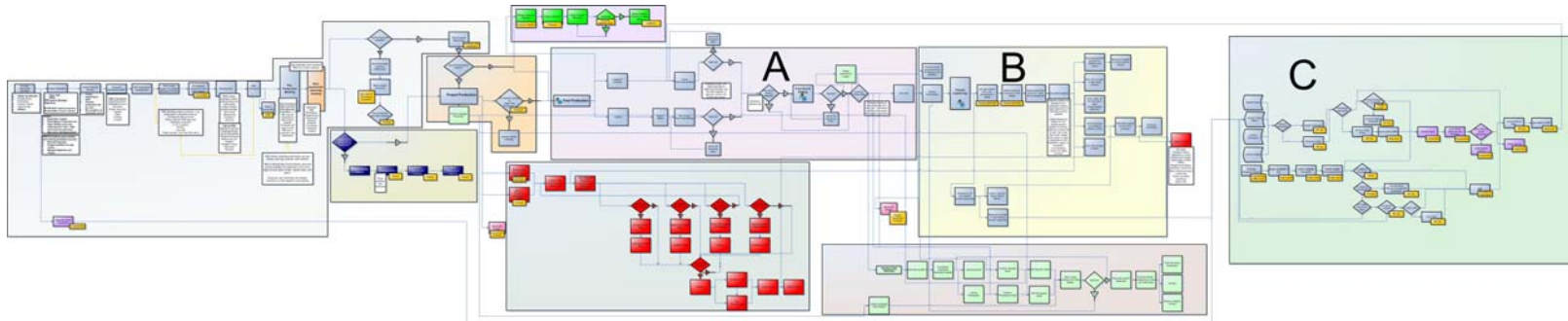Current BYUB Workflow, Revision: July 3, 2006

Figure B1.   Current BYUB Workflow

The above diagram represents the entire workflow for a television production at BYUB, from the initiation stages to the final broadcast and archival stages. Only sections A, B, and C (Post Production, Archival, and Broadcasting respectively) are relevant to this evaluation. Those sections are detailed below:
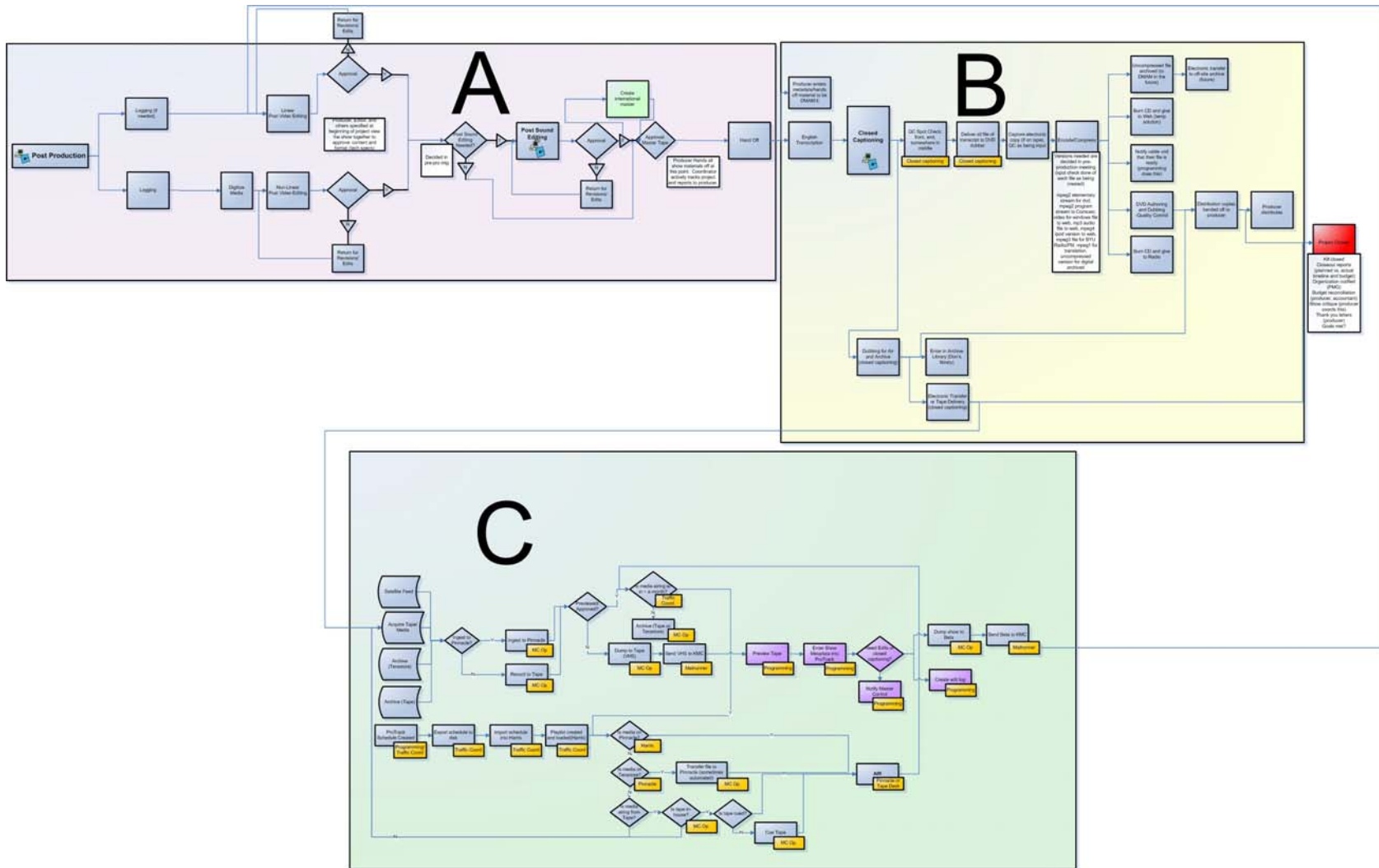
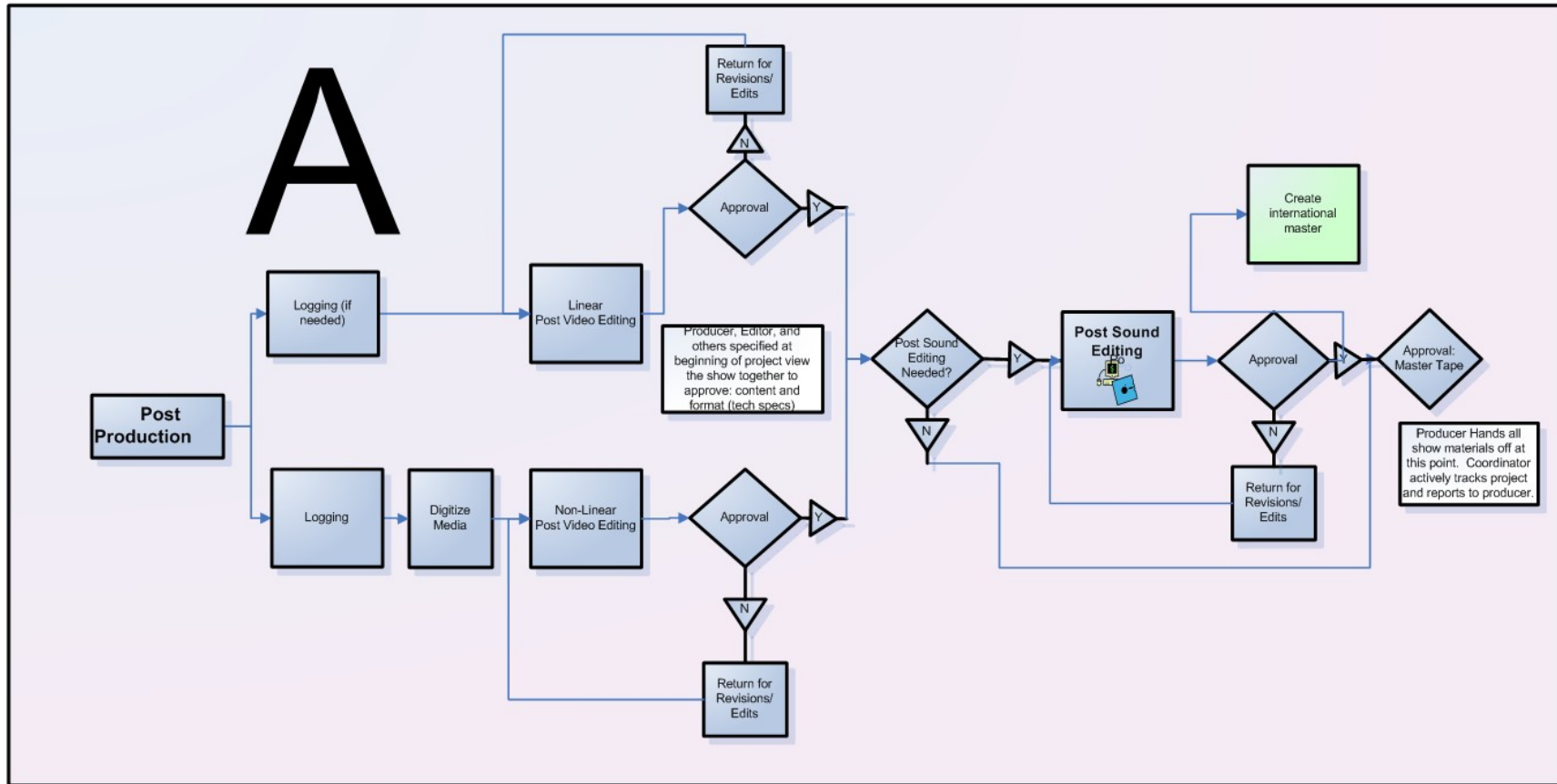Figure B2.   Current BYUB Workflow: Post Production to Broadcasting

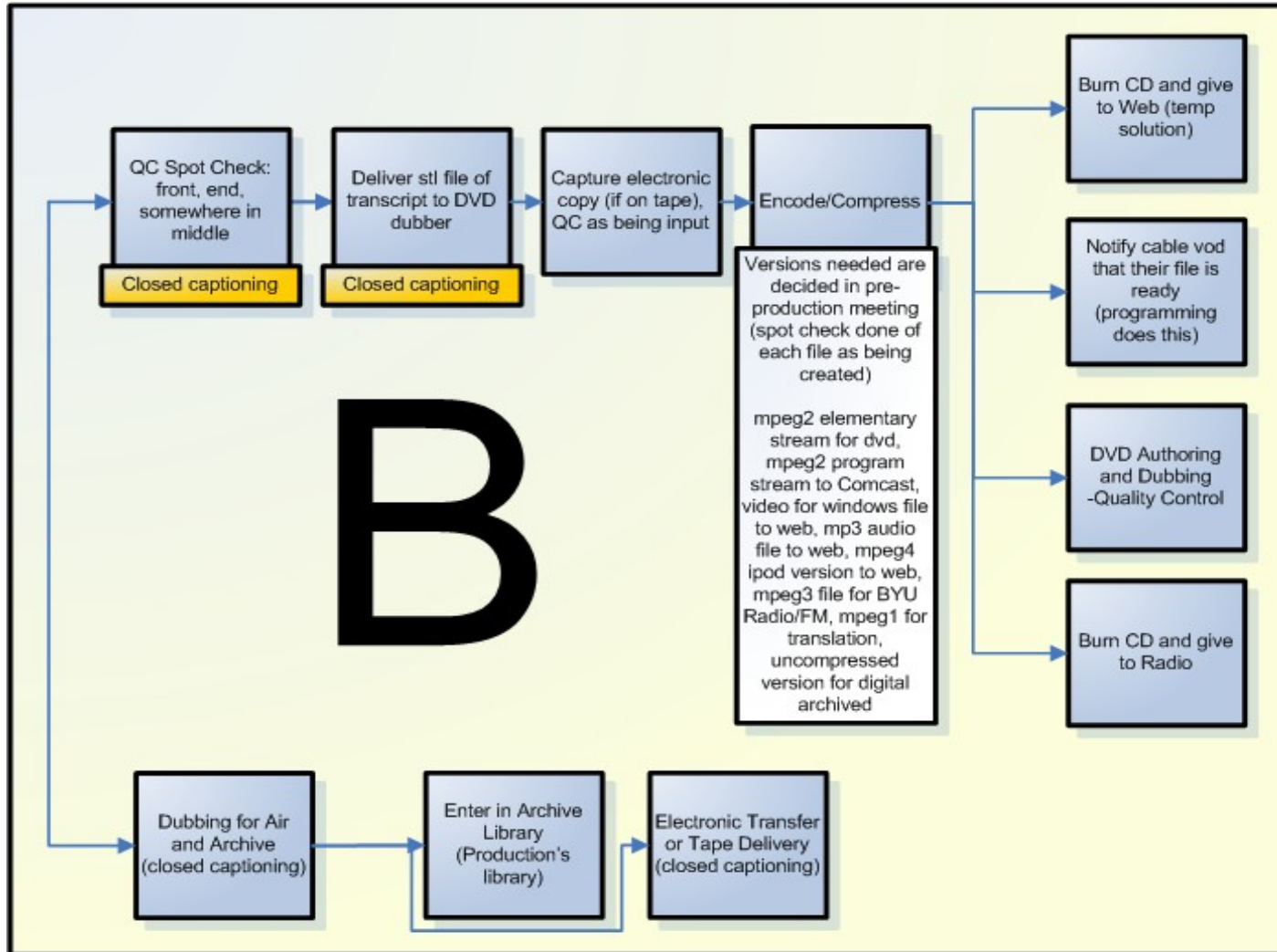Figure B3. Current BYUB Workflow: Post Production

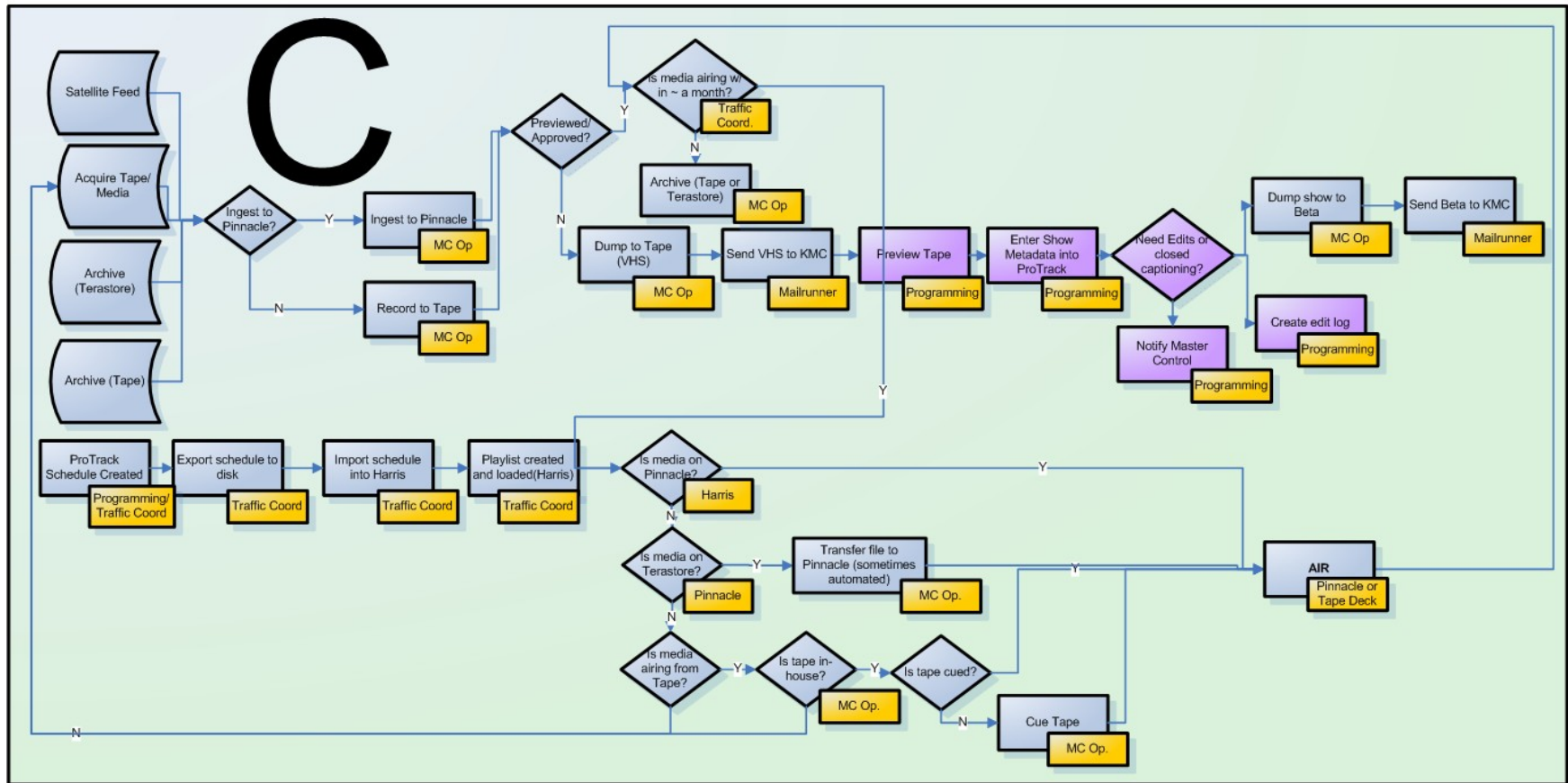Figure B4.   Current BYUB Workflow: Archival

Figure B5.   Current BYUB Workflow: Broadcasting

Appendix C

Ideal Workflow Map, Revision: July 13, 2006
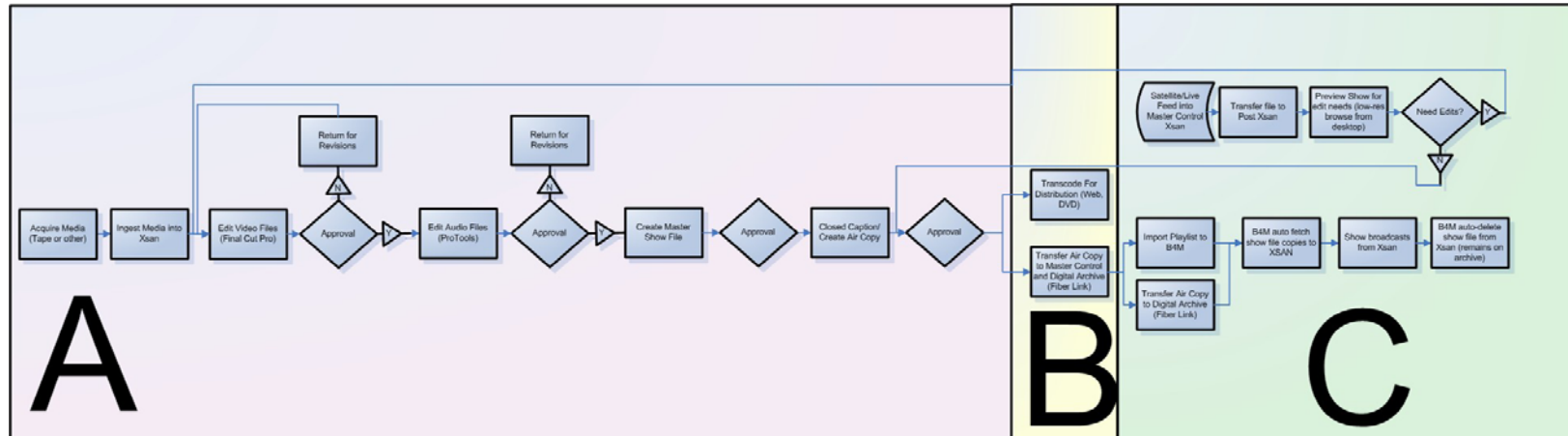
Figure C1.   Ideal Workflow

Once again, the size of the workflow map necessitates that sections A, B, and C (Post production, Archival, Broadcasting respectively) be detailed on separate pages below.

Figure C2.   Ideal Workflow: Post Production

Figure C3.   Ideal Workflow: Archival and Broadcasting

Appendix D

Current Workflow Map, Simplified, Last Revision: January 13, 2007

Figure D1.   Current Workflow: Simplified

Details for each section of this map are below.
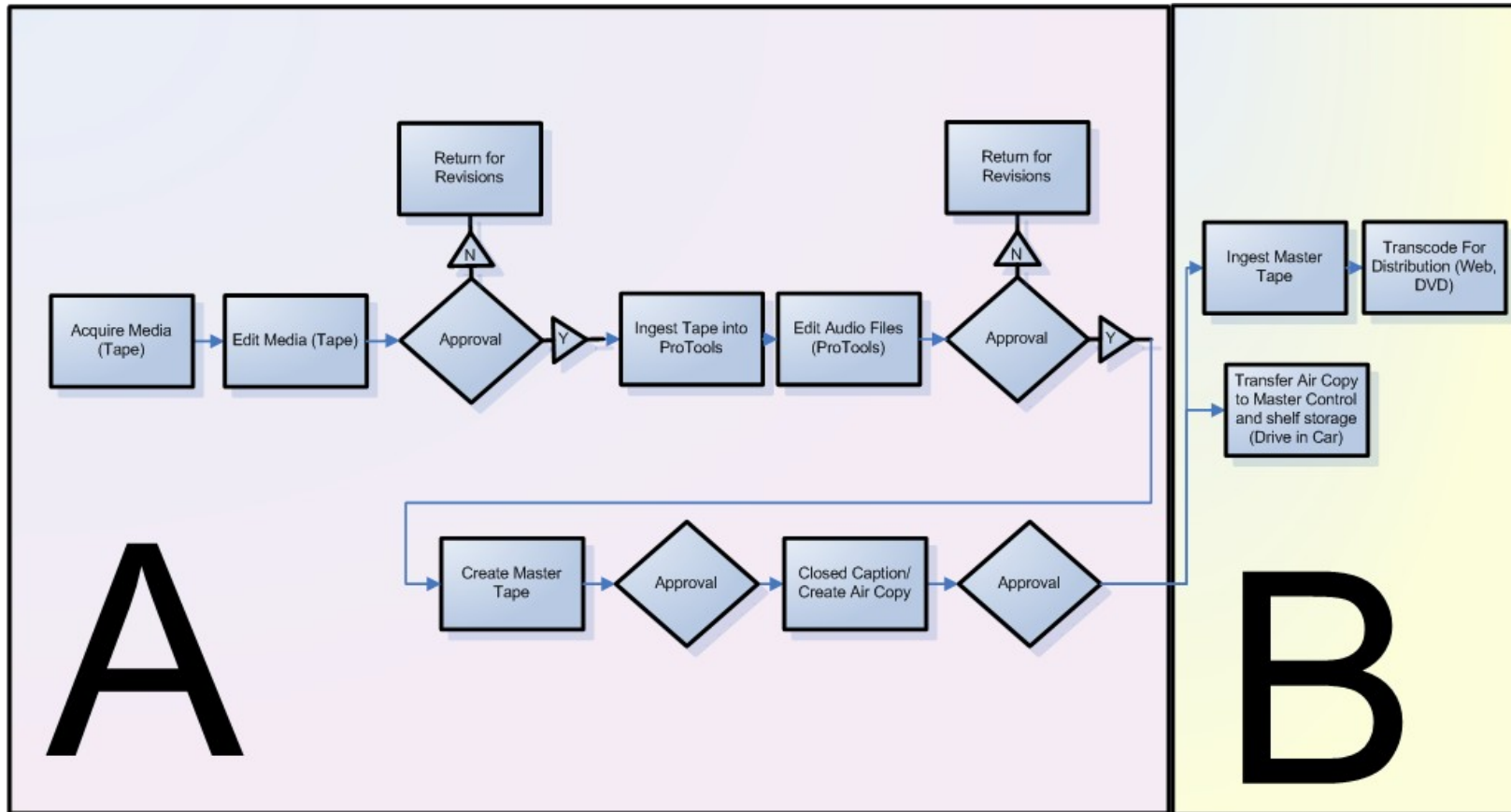
Figure D2.   Current Workflow: Simplified: Post Production and Archival
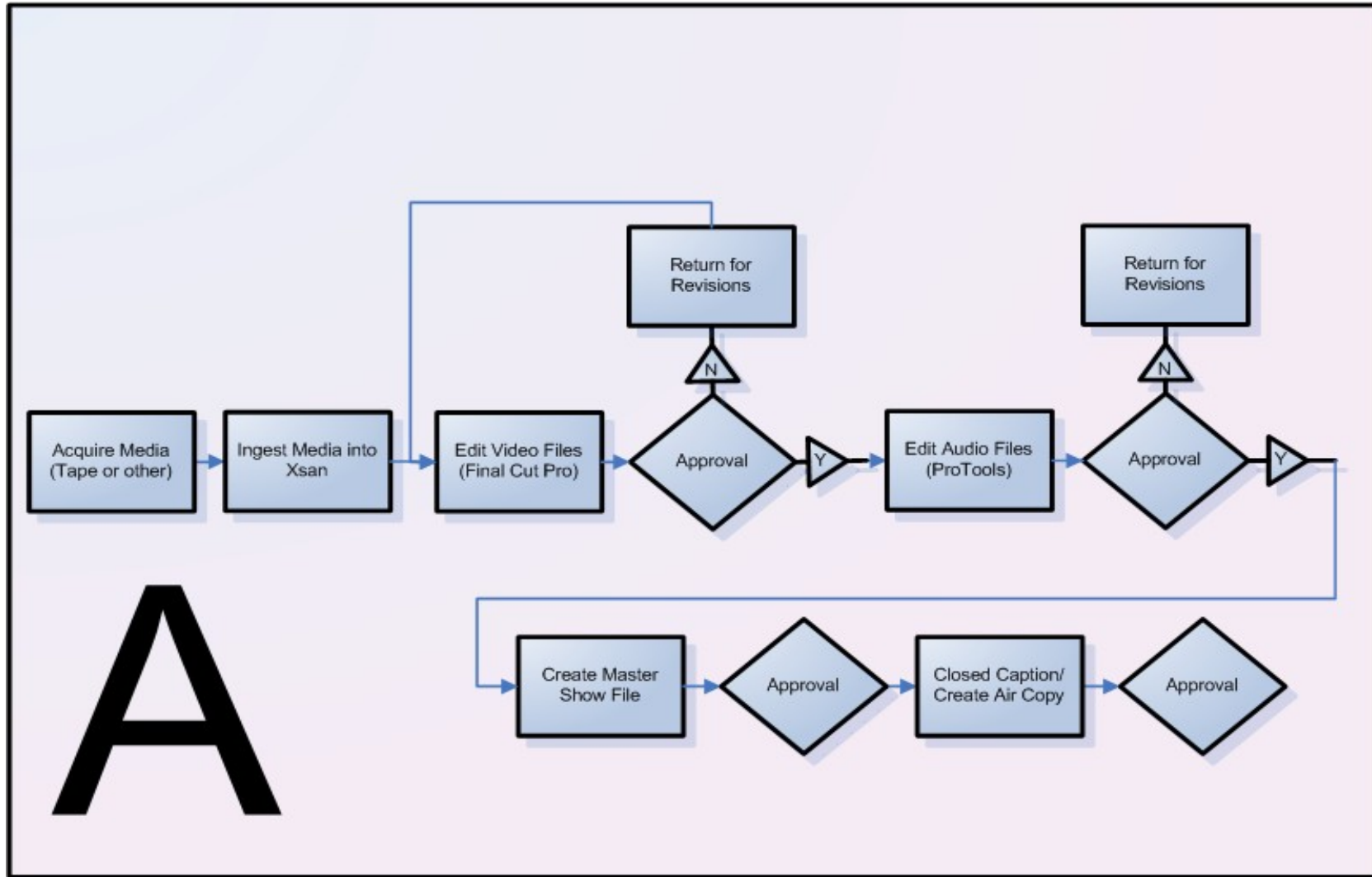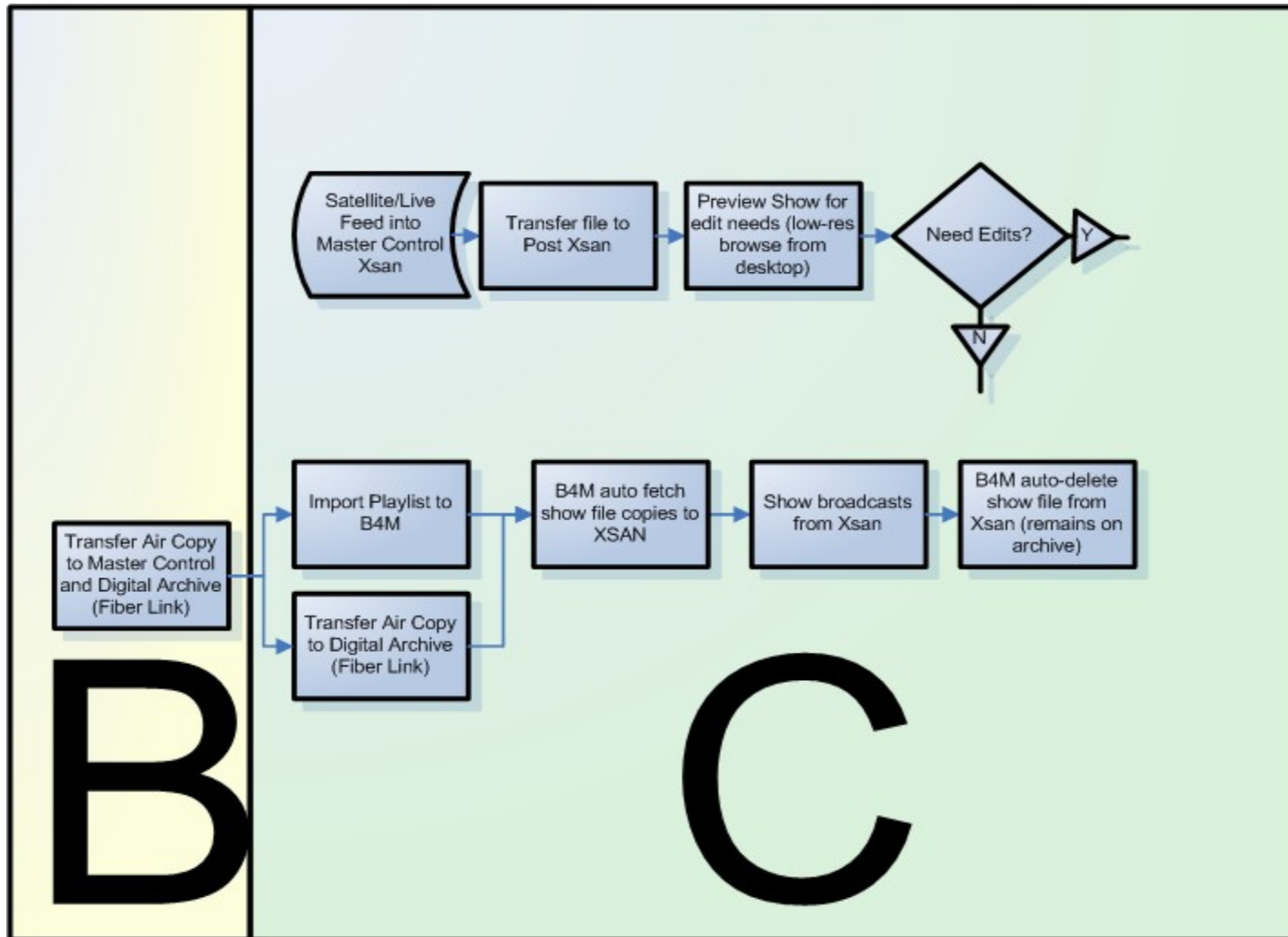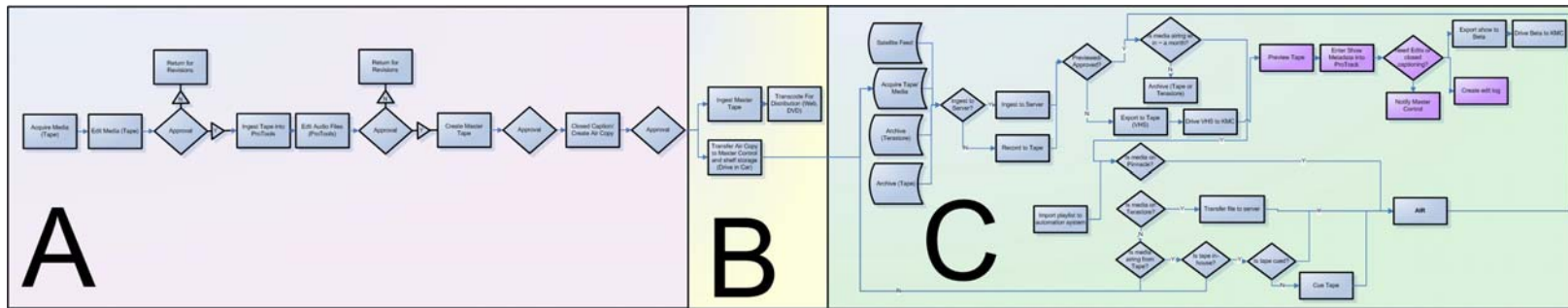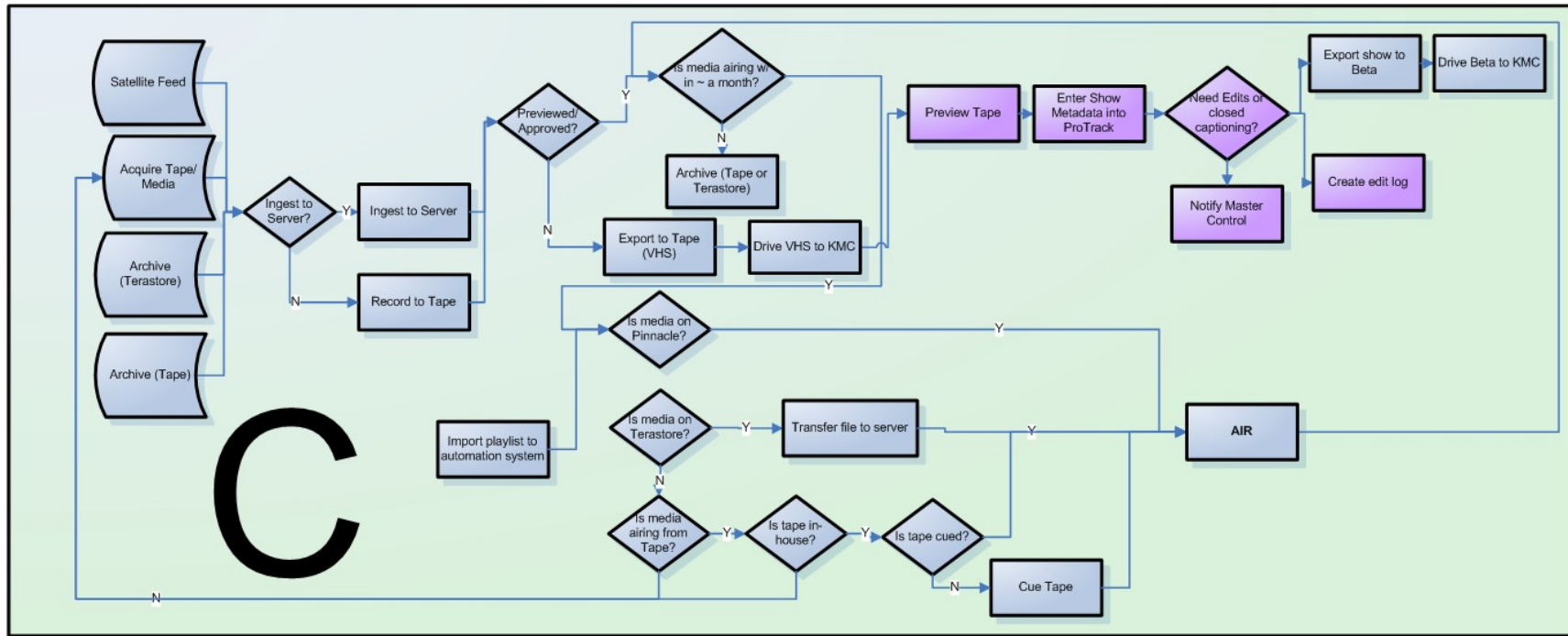
Figure D3.   Current Workflow: Simplified: Broadcasting

Appendix E

Technical Requirements

Table E1

Technical Requirements

Requirement	Resolution
Bandwidth per channel must be at least 25 Mbps	Can stream up to ~500 Mbps
At least 6 simultaneous playback channels	Virtually unlimited number of playback channels. Each Xserve handles 3 SD channels (or 1 HD), assuming Canopus converters are used on each server.
At least 5 simultaneous ingest streams	Yes. Add Xserves to increase number of ingest streams
Control Saturn Switcher	Yes, through Moxa RS 232
Control VTR decks	Yes, through Moxa RS 232
Air from VTR/Xsan/Live Feed	Yes, any source that can be routed.
Playlist import from ProTrack	Yes, with customized export feature from ProTrack.
Simultaneous operation with Harris automation	Yes, but each system must be kept separate on the router.

DekoCast control	Yes, with Graphics Server module
Customizable interface (fonts, colors)	Yes. Fonts, colors, and automated visual cues can be customized by user.
Capable of handling High Definition content	Yes. Only one HD stream per Xserve.
Interface with Asaca digital archive	Yes, as long as Asaca mounts as a fileserver. Confirmed with Asaca that it does.
Remote control of automation software via internet	Yes. The client software running from any computer that has a connection to the network can connect to the server and fully control it.
Remote control of hardware via internet	Yes, with latest Xserve release. Use ARD or Raritan system.
Playlist creation of clips that are yet to exist on the server	Yes. As long as the ID numbers match, FORK will recognize a clip from the playlist when it is placed on the server.
Automated/Scheduled Ingest from any router source	Yes. This is very standard functionality and is supported by FORK.

Playout of six audio tracks embedded in one video file	No. B4M commits to providing this customization prior to implementation. Will need to use KONA cards in order to playback six audio channels, which limits each Xserve to being able to playout multiple SD channels.
Interface with Proximity asset management	Yes, although they recommend using FORK asset management software.
24/7 technical support	Yes. Technical support crews based in the Netherlands, New York, Atlanta, Miami, and Australia. Phone or iChat support available. Extreme cases would require next day flight to remedy situation (travel costs covered by client).
Redundant power supply	Yes. Latest Xserve release has this feature.
Nvision router control	Yes. Standard Nvision protocol must be used. Verified that this protocol is in use at BYUB Master Control
Low resolution remain on Xsan after high resolution file archived?	Yes. Low resolution files can be browsed after high resolution files is removed from the server.

Able to handle standard compression rates (DV, SD, HD)	Yes.
Redundancy (complete hardware and software redundancy)	Yes. FORK supplies a redundant playback channel module that plays on the backup Xserve for each channel.
Dedicated bandwidth for playout (no other server activity can impede playout performance)	Yes. Playout is not impacted by other server activity.
Delayed/Live/Later playback	Yes. All standard playback scenarios supported.
Playout server bank up content in the event of nearline storage failure	Yes. FORK can copy playout content to the playout servers to protect against a SAN failure.
No minimum length spot prior to pre-roll on next show	FORK does not require a minimum length spot. Since the whole system only deals with files, there is no need to worry about how long each spot it.

Appendix F

Usability Study Responses

The participants of the usability study had very little to say about the functionality of the software. The entire set of responses can easily be summed up in the following three statements:

1. The font is too small on the interface

2. The colors are not the same as those of the current automation system

3. It looks like this software does everything our automation system does; it just looks different.

4. The following is a condensed list of notes made by the evaluation team during the usability study (actual names have been replaced with pronouns). Only those notes that seemed pervasive across each member of the team's notes are listed here.

5. He seems to easily be able to find where to click on the screen in order to perform certain functions. The interface seems fairly familiar to him.

6. He seems uninterested in finding out if the software functions the way he needs it to.

7. He has only made negative comments about the software, no positive comments.

8. He seems more interested in telling us why it won't work than trying to find out if it will do the job correctly.

9. They both seem to agree that the software has all of the functionality they need in order to do their jobs.

10. Neither of them seems interested in using this software.

11. It is apparent from their comments and body language that they have already made up their mind about the software, even before using it.

12. They keep using the same words and phrases that other people have previously used to belittle the System. There must be quite a bit of talk going on around the organization about this.

13. He seems frustrated that he is not the one management chose to evaluate the System.

14. They are obviously concerned about implementing this System, but can't seem to pinpoint why it is they think it isn't a good idea. They only give reasons that have little ground to stand on such as "We've talked to people who say Apple equipment doesn't work well" or "If you look at the company's website, it's obvious that their software won't work. There are too many typos on their website."

Appendix G

Evaluation Team's Responses to Feasibility Criteria

Table G1

Evaluation Team's Responses to Feasibility Criteria

Principle	Observations
System designed to fit within the enterprise-wide workflow	Both management and the evaluation team considered the enterprise-wide workflow in mind. Doers of the work tended towards defining the workflow in terms of their own area of work.
Strong support from upper management exists	This was definitely present, without the evaluation team needing to encourage it.
A champion of the technology is in place to support the System	There were three people who were obviously excited about the System. None of those people were in a position of authority, however. We recommend placing one of those people in a position of authority to ensure the System will have success.
A goal is identified and clearly stated	Management clearly indicated to everyone in the organization what the goal of the change initiative was. Not everyone agreed with the goal.
System functionality is verified	The technical evaluation was quite thorough.

Stakeholder reactions are reflected in the design	Stakeholders had varying opinions about the System. See Appendix H for their opinions. In general, there were a few people in support of the change initiative, but most were not in favor of it. The evaluation recommendations must reflect the need for changing the organizational structure such that there are more people who will support the System.
Workers were involved in the design	The three individuals who were chosen as champions were involved heavily in the design. Very few others elected to participate heavily. However, everyone took part in defining the technical requirements, which greatly aided in creating the final System design.
Sufficient levels of disruption are present	We did not find anything in the literature that defines what a "sufficient" level of disruption is. The following observations were made, which helped the team in crafting recommendations: Primary and secondary contradiction was present. However, those people within the organizational units that would be most heavily affected by the System's implementation were not the ones who were willing to stand out amongst the crowd and support the System. It was only people from other organizational units that provided this form of secondary contradiction that could help foster the intended changes.

	This further emphasizes the need to place someone in a position of authority within those organizational units that will provide a level of secondary contradiction that will help the change to happen.
Organizational units will promptly take over the maintenance of the System	The organizational units did not seem to be placing themselves in a situation to take over the System after implementation. The team's recommendation is to install the Chief Operating Officer and give him the charge to hold the organizational units accountable for implementing the System, with the evaluation team's help. This will provide the necessary impetus to ensure that the organizational units will become the long term owners of the System's success.
Triangulation	The evaluation team realizes that the qualitative nature of this evaluation could easily cause the conclusions to be quite subjective according to biases that are easily formed. We frequently found that each others observations differed from one another. This provided us with a chance to discuss our observations and we believe it helped us come to a more true understanding of the issues. Finally, our observations and conclusions were compared against those of a professional consultant. The similarity of his evaluation results gave us confidence in our own results and recommendations.

Appendix H

Naturalistic Inquiry and Interview Guidelines

Workflow/Technical Requirements (this is done on-site, in natural setting)

1. Explain:

    a. that you are learning what the individual does, in order to map out
       the path that a show takes as it moves through the post production
       and master control environments.

    b. that everyone is participating in this; it is not an analysis of how
       well they individually are doing their job. It is simply to gain a
       snapshot of the work that takes place..

2. Have them give a general description of what they do, ask specific
   questions until you feel you clearly understand the nature of their work
   and the general "flow" by which they accomplish it.

3. Have them actually show you what they do, and note any inconsistencies
   with what they have said they do. Ask questions to gain clarity on each
   inconsistency. Specifically find out what each piece of equipment does.

4. Make sure to ask questions about how their work connects to other
   individuals' or departments' work. (i.e At which points in the process do
   they interact with other people or systems? What is the nature of the
   interaction and how does it occur?"

5. Ask them the following questions, at whatever time seems appropriate
   (aimed at finding out what they feel the ideal workflow would be in their
   area):

a. Are there any tasks you do that are redundant? (point out any you may have already observed)

b. From your standpoint, what would be the most efficient way to get your job done? What tools, processes, rules, etc. would you need in order to accomplish that efficiency?

c. What tasks do you feel make your job most enjoyable? Which ones would you rather not have to deal with?

d. How much time (daily or weekly) do you spend on these redundant and menial tasks?)

6. For area managers: ask what the ideal workflow for their entire area would be. Find out what tools they would need in order to achieve that workflow.

7. For senior management: Show them the current workflow and ask them to explain what the most efficient workflow is, from their standpoint. What do you think is a realistic goal for the near future? What would be the next step after reaching that goal?

Stakeholder Reactions (for focus groups and interviews)

1. Explain the general objective of the project

2. Find out what their goals are for improving the performance their department's operational performance. Find out what plans they have in place for accomplishing that.

3. Ask them to explain:

a. What they think the System is supposed to accomplish

      b.   What they think their role is/should be

4.   Ask for positive comments they have about the project (e.g. "What positive outcomes do you see coming out of this project? How do you think its results can help you reach your performance and bottom line goals?)

5.   Ask for:

      a.   Their general feelings on the System

      b.   Specific concerns they have with implementing the System

      c.   Any other general concerns with the System

System Functionality

1.   What does the current system do? List all of its functions, and get specifications on how well it performs those functions (e.g. If the system is able to stream 5 SD channels, what is the minimum bandwidth needed to do that, what is the optimal bandwidth?)

2.   What functionality does the current system not have, but is needed?

3.   If a new system were implemented, what functionality would it need (above and beyond the current functionality)?

Robustness (These questions are asked during on-site visits)

1.   How long has your System been online?

2.   How many times have mission critical failures occurred?

3.   What was the nature of the failure?

4.   How long did it take to bring the system back online and what did it take to do that (hardware swap, vendor support, remote configurations, etc)?

5. What non-mission critical failures have you experienced (nature of failure, down time, steps to correct problem).

6. Who was impacted by these failures, and how? How much waste, in employee down time, did the failure result in?

Effectiveness (After all other interviews, focus groups, on-site visits, and subsequent documentation these questions will be asked. They will first be asked of the evaluation team, and then presented to stakeholders for their reactions.)

1. At what points in the workflow will employee performance be impacted by the new infrastructure? How is it impacted? Is it improved or degraded? If so how significant is the impact? How will the nature of their jobs change? How much time will that save the employee, if any time at all?

2. What have we learned from other stations about the impact on employee performance (system down time, maintenance, etc.)?

3. Compare the current workflow maps, "ideal" workflow maps, manufacturer "promises," and actual implementation workflow maps. Compare cost estimates, manufacturer estimates, and actual implementation costs.

4. How feasible is it that this System will have the desired impact on performance?

5. Will it truly save time and money?

6. How close to the ideal workflow will it bring the organization?

Appendix I

Proposed Schedule vs. Actual Schedule

Table I1

Proposed Schedule vs. Actual Schedule

Task	Proposed Start	Proposed Finish	Actual Start	Actual Finish
Create question list	6/15/2006	6/19/2006	5/22/2006	6/30/2006
Create current workflow map	6/9/2006	6/16/2006	5/22/2006	6/01/2006
Conduct focus groups	6/21/2006	6/23/2006	5/22/2006	6/23/2006
Conduct Interviews	6/21/2006	6/26/2006	5/01/2006	5/26/2006
Create "Ideal" Workflow maps	6/27/2006	6/30/2006	5/29/2006	6/09/2006
Onsite Visit #1 (Current TV)	5/16/2006	5/17/2006	5/16/2006	5/17/2006
Onsite Visit #2 (DLA)	6/1/2006	6/2/2006	6/1/2006	6/2/2006
Install Demo Systems	6/20/2006	7/10/2006	5/22/2006	6/12/2006
Test Demo Systems	7/11/2006	7/24/2006	6/12/2006	7/14/2006
Consultant Review and Recommendations	7/28/2006	8/3/2006	6/08/2006	8/17/2006
Analyze Results, ask final questions, revise data	8/4/2006	8/14/2006	7/28/2006	8/17/2006
Create Final Report	8/15/2006	8/18/2006	8/04/2006	8/17/2006
Present Recommendations	8/21/2006	8/21/2006	8/17/2006	8/17/2006

Appendix J

Proposed Budget vs. Actual Budget

Table J1

Proposed Budget vs. Actual Budget

Task Name	Proposed Cost	Actual Cost
Create question list	$958	$3,420
Create current workflow map	$663	$1,026
Conduct focus groups	$540	$2,850
Conduct Interviews	$440	$2,280
Create "Ideal" Workflow maps	$304	$1,620
Onsite Visit #1 (Current TV)	$2,910	$1,500
Onsite Visit #2 (DLA)	$2,910	$2,570
Install Demo Systems	$12,106	$768
Test Demo Systems	$2,960	$4,050
Analyze Results, ask final questions, revise data	$972	$2,430
Create Final Recommendation Report	$492	$1,620
Present Findings/Recommendations to Sponsor	$40	$114
Miscellaneous	$7,590	$1,450
Total	$32,886	$25,698

Appendix K

Meta-Evaluation Information

This meta-evaluation was conducted after the evaluation described in this paper was completed. Its purpose is to describe the areas where the evaluation performed well, and the areas where improvement is needed. The list of standards and their brief descriptions came directly from the following website: http://www.eval.org/EvaluationDocuments/progeval.html.

Ratings of "Good," "Fair" and "Poor" are given for each standard, followed by a reason for each rating. Concluding statements and suggestions for improving "Poor" ratings are given at the end of the meta-evaluation.

Utility Standards

The utility standards are intended to ensure that an evaluation will serve the information needs of intended users.

U1 Stakeholder Identification: Persons involved in or affected by the evaluation should be identified, so that their needs can be addressed.

Rating: Good

One of the key concerns of the evaluation team was to ensure that as many people as possible were involved in the evaluation.

U2 Evaluator Credibility: The persons conducting the evaluation should be both trustworthy and competent to perform the evaluation, so that the evaluation findings achieve maximum credibility and acceptance.

Rating: Good

As described earlier, each member of the evaluation team had significant experience in the broadcasting and information technology fields. Coupling that experience with the professional consultants helped ensure that the evaluation findings were credible.

U3 Information Scope and Selection: Information collected should be broadly selected to address pertinent questions about the program and be responsive to the needs and interests of clients and other specified stakeholders.

Rating: Good

Multiple methods were used to gather information about the technical viability of the System. Information was gathered from various sources to obtain the information as well. With the help of the professional consultant, we were able to gather viewpoints on the social and culture implications of the change initiative from more than one source as well.

U4 Values Identification: The perspectives, procedures, and rationale used to interpret the findings should be carefully described, so that the bases for value judgments are clear.

Rating: Good

We felt that through the naturalistic inquiry sessions, interviews, and focus group sessions, we were able to gather an accurate portrayal of the values held by each stakeholder. Comparing our observations with other members of the evaluation team helped to ensure that personal bias was minimized when interpreting these values.

U5 Report Clarity: Evaluation reports should clearly describe the program being evaluated, including its context, and the purposes, procedures, and findings of the evaluation, so that essential information is provided and easily understood.

Rating: Fair

Our personal report to the key stakeholders was not as adequate as we had planned, simply because we were only able to give it to one person from the key stakeholder pool. However, the conclusive report from Rich Bisignano was very good.

U6 Report Timeliness and Dissemination: Significant interim findings and evaluation reports should be disseminated to intended users, so that they can be used in a timely fashion.

Rating: Good

Interim reports were given to various members of management, and the final report was presented directly after conclusions were made by the evaluation team.

U7 Evaluation Impact: Evaluations should be planned, conducted, and reported in ways that encourage follow-through by stakeholders, so that the likelihood that the evaluation will be used is increased.

Rating: Good

The recommendations to management were effective in motivating stakeholders to action. The only basis by which I have to judge the evaluation's adherence to this particular standard is the fact that management has already begun to implement a number of the recommendations, mostly in a fashion that closely aligns with the original recommendations.

Feasibility Standards

The feasibility standards are intended to ensure that an evaluation will be realistic, prudent, diplomatic, and frugal.

F1 Practical Procedures: The evaluation procedures should be practical, to keep disruption to a minimum while needed information is obtained.

Rating: Fair

It was difficult to minimize disruption with this evaluation. The controversial nature of it effectively disrupted many people's normal work. The amount of participant involvement that we encouraged took a considerable amount of many people's time.

F2 Political Viability: The evaluation should be planned and conducted with anticipation of the different positions of various interest groups, so that their cooperation may be obtained, and so that possible attempts by any of these groups to curtail evaluation operations or to bias or misapply the results can be averted or counteracted.

Rating: Fair

We were very conscious of the political realities under which this evaluation was conducted. We were successful in obtaining cooperation from many people who had been overt in their objections to the proceedings of the evaluation. However, we felt that we were unsuccessful in fully utilizing some of the expertise of many of the professionals in the organization, mostly because it was hard to determine how to most effectively involve them in spite of an evident spirit of antagonism toward the evaluation.

F3 Cost Effectiveness: The evaluation should be efficient and produce information of sufficient value, so that the resources expended can be justified.

Rating: Fair

The technical evaluation was probably more extensive than it needed to be. We probably could have gathered sufficient information by making only one site survey, and by expediting the workflow mapping process.

Propriety Standards

The propriety standards are intended to ensure that an evaluation will be conducted legally, ethically, and with due regard for the welfare of those involved in the evaluation, as well as those affected by its results.

P1 Service Orientation: Evaluations should be designed to assist organizations to address and effectively serve the needs of the full range of targeted participants.

Rating: Fair

The evaluation was basically a mandate from upper management. It served their needs very well, but because of that strong upper hand it was difficult to involve stakeholders at lower levels in the organization. As indicated earlier, this is possibly the only guise under which this evaluation could have been conducted with any level of success.

P2 Formal Agreements: Obligations of the formal parties to an evaluation (what is to be done, how, by whom, when) should be agreed to in writing, so that these parties are obligated to adhere to all conditions of the agreement or formally to renegotiate it.

Rating: Fair

The obligations were only verbally communicated. We could have done a better job of formalizing the expectations in writing and tracking them more officially.

P3 Rights of Human Subjects: Evaluations should be designed and conducted to respect and protect the rights and welfare of human subjects.

Rating: Good

We were very conscious of the rights of those who would participate in and be effected by the evaluation. People were free to choose to participate or not, and were given clear instructions on the purpose of their involvement in the evaluation.

P4 Human Interactions: Evaluators should respect human dignity and worth in their interactions with other persons associated with an evaluation, so that participants are not threatened or harmed.

Rating: Fair

Nobody was harmed during the evaluation, but it was difficult to keep individuals from feeling threatened. We could have done a better job of helping people understand that even though we were evaluating a new way of doing things at BYUB, it did not mean that anyone was on the slate to be terminated from employment. The purpose of the evaluation was never to specifically eliminate malcontents, but many people felt that it was. We could have done better at communicating that to people.

P5 Complete and Fair Assessment: The evaluation should be complete and fair in its examination and recording of strengths and weaknesses of the program being evaluated, so that strengths can be built upon and problem areas addressed.

Rating: Fair

Even though the technical evaluation focused on strengths and weaknesses of the System, the feasibility study was more concerned with identifying strengths of implementing it. We could have done a better job at identifying the weaknesses of moving forward with the System's implementation.

P6 Disclosure of Findings: The formal parties to an evaluation should ensure that the full set of evaluation findings along with pertinent limitations are made accessible to the persons affected by the evaluation, and any others with expressed legal rights to receive the results.

Rating: Good

The final report from Rich Bisignano was made available to all people affected by the evaluation.

P7 Conflict of Interest: Conflict of interest should be dealt with openly and honestly, so that it does not compromise the evaluation processes and results.

Rating: Poor

A number of participants exhibited strong biases towards certain outcomes of the evaluation. These were not openly discussed. We as the evaluation team could have done a better job at fostering discussion about these conflicts and resolving them.

P8 Fiscal Responsibility: The evaluator's allocation and expenditure of resources should reflect sound accountability procedures and otherwise be prudent and ethically responsible, so that expenditures are accounted for and appropriate.

Rating: Fair

The project was commissioned and conducted quite rapidly. Even though we are able to look back and have what we feel is a fairly accurate picture of the project expenditures, we did not carefully track costs throughout the project's life.

Accuracy Standards

The accuracy standards are intended to ensure that an evaluation will reveal and convey technically adequate information about the features that determine worth or merit of the program being evaluated.

A1 Program Documentation: The program being evaluated should be described and documented clearly and accurately, so that the program is clearly identified.

Rating: Fair

As indicated earlier, the rapid nature of the evaluation was the cause of neglect on a number of details such as this one. We could have done a better job at documenting our procedures and findings more thoroughly.

A2 Context Analysis: The context in which the program exists should be examined in enough detail, so that its likely influences on the program can be identified.

Rating: Good

We feel that we took the entire context into account quite well. Utilizing principles from the enterprise engineering field, we were able to do this quite effectively.

A3 Described Purposes and Procedures: The purposes and procedures of the evaluation should be monitored and described in enough detail, so that they can be identified and assessed.

Rating: Fair

As stated earlier, we could have been more meticulous at detailing our procedures. We did fairly good at it, but could have paid more attention to this detail.

A4 Defensible Information Sources: The sources of information used in a program evaluation should be described in enough detail, so that the adequacy of the information can be assessed.

Rating: Good

We were careful to describe our information sources. We tried to describe this carefully to the stakeholders so that they would have a clear understanding of where the results and recommendations were drawn from.

A5 Valid Information: The information gathering procedures should be chosen or developed and then implemented so that they will assure that the interpretation arrived at is valid for the intended use.

Rating: Good

We gathered information from multiple sources, and compared it against more than one person's observations so as to ensure that our conclusions were as valid as possible.

A6 Reliable Information: The information gathering procedures should be chosen or developed and then implemented so that they will assure that the information obtained is sufficiently reliable for the intended use.

Rating: Good

We felt that we used the principle of triangulation quite well in this evaluation to ensure that information was reliable. Comparing our conclusions with that of the professional consultant was a particular strength to this evaluation.

A7 Systematic Information: The information collected, processed, and reported in an evaluation should be systematically reviewed and any errors found should be corrected.

Rating: Fair

We were fairly careful to identify and correct errors in information, but I felt that there was room for improvement. This is one of the areas that could have had more attention paid to it.

A8 Analysis of Quantitative Information: Quantitative information in an evaluation should be appropriately and systematically analyzed so that evaluation questions are effectively answered.

Rating: Poor

There was not any quantitative data gathered, to speak of, in this evaluation.

A9 Analysis of Qualitative Information: Qualitative information in an evaluation should be appropriately and systematically analyzed so that evaluation questions are effectively answered.

Rating: Fair

The rating on this item is almost "Good." We felt that our criteria list was crafted quite well, and provided a nice basis by which to analyze the information. However, we felt that more time could have been spent to ensure that the information specifically addressed the stakeholders' original list of questions.

A10 Justified Conclusions: The conclusions reached in an evaluation should be explicitly justified, so that stakeholders can assess them.

Rating: Good

The conclusions we arrived at were justified on a number of counts. First, they lined up quite well with those of the professional consultant. Second, they were consistent across members of the evaluation team. Third, management was not particularly surprised by any one of the conclusions, indicating that our interpretation of our observations was not heavily influenced by our personal biases.

A11 Impartial Reporting: Reporting procedures should guard against distortion caused by personal feelings and biases of any party to the evaluation, so that evaluation reports fairly reflect the evaluation findings.

Rating: Fair

Even though we double checked each others' interpretation of information quite thoroughly, I gained a fondness for the System we evaluated and probably let some of that enthusiasm show when reporting results.

A12 Meta-evaluation: The evaluation itself should be formatively and summatively evaluated against these and other pertinent standards, so that its conduct is appropriately guided and, on completion, stakeholders can closely examine its strengths and weaknesses.

Rating: Fair

Again, the quick nature of the evaluation prevented us from taking the time to stop and evaluate our progress against these standards during the course of the evaluation. Taking the time to conduct formative evaluations periodically could have helped us to avoid some of the Fair and Poor ratings in this summative meta-evaluation.

Conclusions

      This evaluation proposal seems to conform rather tightly to the Program Evaluation Standards, however there is room for improvement. As noted, there are a couple of areas where the evaluation adhered poorly to the standards. Conducting periodic formative meta-evaluations would have increased the evaluations adherence to the standards.