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CONTROLS ON DEVELOPING TECHNOLOGY: THE U.S. COMMERCIAL AIR TRANSPORTATION SYSTEM DURING THE INTERWAR PERIOD, 1919-1939

A DISSERTATION SUBMITTED TO THE

FACULTY OF THE DOCTORAL PROGRAM IN

CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPARTMENT OF HUMANITIES

BY

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DECEMBER 2000

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The dissertation of Eric J. Shaw titled "Controls on Developing Technology: The U.S. Air Transportation System, 1919-1939" submitted to the Humanities department in partial fulfillment of the requirements of the degree of Doctor of Philosophy in the Graduate School of Salve Regina University has been read and approved by the committee:

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ABSTRACT

This dissertation examines control of an emerging technology by investigating two contrasting views of technological progress. The pessimistic view asserts that technological development can advance beyond human ability to govern its growth. The optimistic view sees technology as neutral or positively valued; control over technological progress is a function of human activity or lack of it. At the core of the debate is the question of human freedom and the ability of human beings to exercise control over technology they create.

This work identifies successful and unsuccessful attempts at controlling developing aviation technology during the formative period of the U.S. air transportation system between the World Wars. These attempts are used to test tenets of the two interpretations of technological progress. The study identifies effective political, bureaucratic, business, and social controls that resulted in a manageable system of air transportation. The results apply to current technological policy questions. The study addresses these questions in the form of policy recommendations for U.S. civil and military leaders involved in technological decision making.

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CHAPTER 1

INTRODUCTION

Chapter Introduction

This chapter introduces the dissertation. It describes the interdisciplinary nature of the work as an historical and philosophical analysis addressing questions posed by exponents of different views concerning the relations between technology and humanity. This dissertation seeks to test both endpoints and several middle positions along a continuum of thought about human ability to control technology. In particular, the dissertation critically examines the autonomous technology argument which holds that technological development can reach a point beyond which humans can no longer control it. The dissertation demonstrates the need to recast the question of technological control not in terms of whether or not technology is autonomous, but in terms of the degrees and types of control possible. It seeks to understand the forces that inhibit or facilitate the development of a given technology during its creation, refinement, and maturation. This study maintains that technology is neither value-free, positively valued, nor autonomous. Technology is a human activity under human control. Decisions people choose to make or not make determine the path of technological development. Complex technologies require greater foresightedness and increased vigilance. With systems in place to provide objective

reviews of technological programs, people can maintain control over technological advances and their consequences, both intended and unintended.

Chapter 1 summarizes the history of recent philosophic thought concerning control of technology and introduces the general questions the dissertation examines within the context of that thought. It initiates the discussion the dissertation employs to answer questions concerning humanity's ability to control technology as it is developed, implemented, and assimilated.

The chapter also provides an overview of commercial aviation developments in the United States between World War I and World War II. It describes why the development of air transportation in the U.S. during the interwar period provides a case study for questions about controlling technology. The objective is to identify successful attempts by human agents in different political, military, and economic arenas to foster and control a newly emerging technology. This work demonstrates that the greatest contribution to shaping the advancement of U.S. interwar aviation was the complex interaction of individual human actors. These individuals participated in a variety of roles including those of aircraft pilots and designers, legislators, regulators, entrepreneurs, and industrialists. People who affected technology often operated within organizations that included political bodies, bureaucratic agencies and economic and business entities involved in shaping the nascent aviation industry. The activities of people within these organizations provided positive and negative forces on aircraft design, procurement, and

deployment which served to both foster and control the growth of the burgeoning commercial aviation enterprise.

The advancement of U.S. commercial aviation during the interwar period can be viewed as a technological "success story." It will be noted shortly that such interpretations are often associated with an optimistic view of technology. Literature covering aviation history often reflects this view in that it refrains from criticizing technology. Instead, much of this literature trumpets aviation progress as the success of individuals and groups in the face of difficult engineering, economic, and/or cultural trials.

However interpreted, aviation development during the interwar period marks one of the fastest progressions of a technology in the twentieth century. It grew from infancy to a fully deployed transportation system within twenty years. Yet, despite the overall record of advances, the history of U.S. aviation progress during the interwar period was also punctuated by notable failures.

Examining examples of both successes and failures provide corrections to the two extreme views of technological advancement that can be generally characterized as optimistic and pessimistic in regards to the possibility of technological control.

One critic of the optimistic view of technology, John M. Staudenmaier, calls this a "progress" model of technology. He believes this model is an ideology rather than an objective historical view. As such, it runs counter to a clear analysis of a history of technology (Staudenmaier 1985, 201).

The more strongly stated versions of technological optimism hold that technology is inherently good, and an important contributor to the continuing advancement of humankind. Accordingly, the pursuit of technology and the fruits of its application create a better human environment. In this view, most problems generated by technology are an intermediary step to a solution that will both alleviate the current side effect and produce a better world. Environmental issues like global warming, pollution, and nuclear waste storage may have technological origins, but they will have technological solutions. Once they are found, humanity's position improves. Other issues, such as computer-related privacy concerns, are unintended consequences that can be controlled by better policies governing their use.

Don Ihde describes this view as utopian and sees it as one that usually attempts to measure quantitatively the positive results associated with technology. Utopians use what they hold to be objective measures of technology's effects when defending technological approaches to human advancement. Utopian views usually conclude that the application of technology will at some point in the future solve most of humanity's problems (Ihde 1993, 60).

Related to this model of technological progress is a muted version of technological optimism that sees technology as being neutral. John Jalbert describes technology neutralists as believing that technological processes lack any internal motivation. Instead, good or bad consequences from the application of a technology are the result of the use or abuse of a given technology by human actors (Jalbert 1987, 85).

Regardless of how positively they view technology, optimistic approaches share the belief that technology is controllable and are therefore often couched in terms of human freedom.

Opposing the optimistic technological camp are the technological pessimists. Ihde ironically refers to adherents of the dystopian perspective as "negative progressivists." Using the same types of quantitative methods as the utopians, the dystopians argue the opposing, pessimistic view. They concede there may have been measurable progress in technology's capabilities. However, the dystopians interpret these findings differently, concluding with an overall negative assessment of most technological "progress" (Ihde 1993, 62). Perhaps the most strongly stated pessimistic position is that of autonomous technology.

Relationship Between Humanity and Technology

Investigations of the relationships between humanity and technology are by their very nature philosophical inquiries. The search for answers to these questions begins by acknowledging the importance of the position of technology in respect to the modern human condition, regardless of whether it is perceived as beneficial or deleterious. Technology pervades nearly every facet of human endeavor. The development and use of technology are among the most important defining aspects of humanity.

Definition of Technology

Discussion of any topic as important to the human condition as is technology requires clearly defining the term. Most authors writing on the subject offer their own definitions. Despite this, clusters of definitions sharing common features can be identified. From these, it is possible to establish a definition reflecting general principles upon which one may base a discussion.

In *Technological Change: Its Impact on Man and Society*, Emmanuel Mesthene offers a lucid and succinct definition of technology. He defines it as "the organization of knowledge for practical purposes (Mesthene, 1970, 25)." Mesthene's definition heavily influences the definition used in this work. It is closely matched with one offered by Ian Barbour. Barbour defines technology as "the application of organized knowledge to practical tasks by ordered systems of people and machines (Barbour 1990, 3)." Both Mesthene and Barbour believe organized knowledge and practicality are central components of a definition of technology.

John Kenneth Galbraith, like most other authors concerned with technology, agrees with the importance of the elements of organization of knowledge and practical purposes within any definition of technology. In *The New Industrial State*, Galbraith defines technology as "the systematic application of scientific or other organized knowledge to practical tasks (Galbraith 1985, 12)."

Neither Mesthene, Barbour, nor Galbraith mention capital in their definitions. However, while Galbraith's definition of technology makes no mention of capital, he immediately follows it with a discussion of six consequences of technology that

emphasizes the critical role capital plays in technological advances. From these capital-related consequences, Galbraith draws two preliminary conclusions. First, technology's demand for an increasingly inflexible commitment of both time and capital requires careful planning. Second, the greater the sophistication of the technology, the greater the requirements placed on time, capital, and planning. Specifically pointing to weapons systems as examples of complex technologies, he sees such advanced technology as needing "a quantum change" in the increase in these requirements (Galbraith 1985, 16-18). The conclusion Galbraith draws from his analysis is that an industry, because of the capital-related consequences of technology, becomes concerned mainly with its own advancement and survival. This thought is closely related to other arguments of technological autonomy.

Most definitions of technology share the common ideas of the application and organization of human knowledge with practical purposes in mind. With the tacit understanding of the critical role capital plays in the development, implementation, and use of advanced technology, Galbraith's definition of technology will be used in this study as the operative definition: *Technology is the systematic application of scientific or other organized knowledge to practical tasks.*

The capital component in technological enterprises must be constantly considered for two reasons. First, it is a primary driver for the production of any new technology. Without capital, it is difficult to develop new technologies. This was as true in the interwar period as it is now. Second, technologies are important generators of capital. Like breeder

reactors, technologies have the ability to convert investments into profits. Profits provide a strong motive for the continued use of even seriously flawed technologies. A technology's ability to generate revenue serves as a power base for those in control of the given technology. Holders of that power relinquish it with great difficulty, even in the face of severely negative consequences created by the technology. Mature technologies can be highly resistant to modification. This is particularly so if the cost of any change is significant.

Having defined technology as the systematic application of scientific or other organized knowledge to practical tasks, it is now appropriate to consider an important warning: definitions affect that which they define. Ihde states emphatically that no definition is neutral. Any definition of technology drives arguments concerning technology by skewing them or closing off alternative avenues of research (Ihde 1993, 47).[1] As an example, Ihde believes one of the reasons Classical Greek technology languished was due to the restrictive definition the Greeks assigned to technology. For the Greeks, *Techne* was simultaneously a craft and an art object. A properly produced technological object would hold true not only to its purpose, but also to its aesthetics. The overall emphasis on aesthetics evolved into concentration on artistry at the expense of practicality. Ihde draws the conclusion that the subordination of practicality in favor of aesthetics limited the maturation and proliferation of Greek technology (Ihde 1993, 26).

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[1] Ihde defines technology as "the systematic modification of the physical environment for human ends (Ihde 1990, 274)."