
APS1012 Management of Innovation – Final Team Projects, Fall 2010**Innovation in Space Propulsion Systems; a Technological, Economic and Political Analysis****Objective**

Innovation in space propulsion systems has been one of the most active and far-reaching avenues of scientific and engineering research in the last half-century. However, as NASA begins to retire the Space Shuttle program, North America moves into a period of limited government-funded space flight. This marks a dramatic shift in the structure of space flight innovation with an emphasis on private sector investment: It is unclear how this new approach to innovation will affect the development of space propulsion systems.

Prepare a critical review of past publicly funded space propulsion innovations in order to understand how current and future approaches to developing space propulsion systems may unfold. Examine present and future projects and review government, public-private partnership and purely private programs. Focusing on the political, economic and technological aspects, assess the obstacles facing each of these programs and provide professional opinions as to what must be changed to foster continued advancement and innovation in the area of spacecraft propulsion systems. In summary:

- Provide a brief history of space flight
- Examine the current atmosphere at major agencies (i.e. NASA) and discern if it conducive or detrimental to innovation and advancement
- Evaluate past publicly funded projects
- Evaluate current and future government programs
- Evaluate current and future public-private partnership programs
- Evaluate current and future purely private programs
- Examine scientific, engineering, economic, and political motives of each of the aforementioned projects
- Examine technological, economic and political obstacles of each of the aforementioned projects
- Provide recommendations regarding necessary economic and policy changes to be made in order to foster future innovation and advancement.

Summary

Space has piqued human interest for as long as history has been recorded. Humans are curious by nature, and as such, it is only natural that we explore space to our best ability. Ever since the first satellite was placed in orbit by Soviet Russia, it has been known that space *is* accessible, and it *can* be explored. Space has been the source of much innovation. The Apollo missions, for example, are the reason why we have integrated circuits today. Since the late 1950's, governments have been responsible for the bulk of space travel and exploration; this is due in part to the large budgets generally required of space programs. Their motives were sometimes competitive (i.e. the Space Race), but always had a backing of scientific curiosity.

As times progress a shift in the space industry can be noticed, resulting from private enterprises becoming more and more interested in space. Specifically, they are interested in commercializing spacecraft technology for the purpose of reputation and profit. Space has many untouched markets, such as space tourism and microsatellite launches. Where there is an untapped market, there is also the potential for profit to be made. A subset of space projects involve partnerships between the government and private

companies; the partners within these ventures have their own motives, as well as their own obstacles to overcome.

Fourteen projects and partnerships have been examined, and three key areas identified. These are the motivation driving the project, the obstacles to overcome and the advancements being made to achieve more efficient and successful operation. Economic, technological and political factors are examined within each are and an overall picture of the current space industry has been formulated, including its current problems and possible solutions.

The space industry has been a major source of innovation for mankind, and demonstrates the capabilities we have. The opinions and recommendations are not intended to criticize, rather to help foster future innovation and advancement in the space industry.