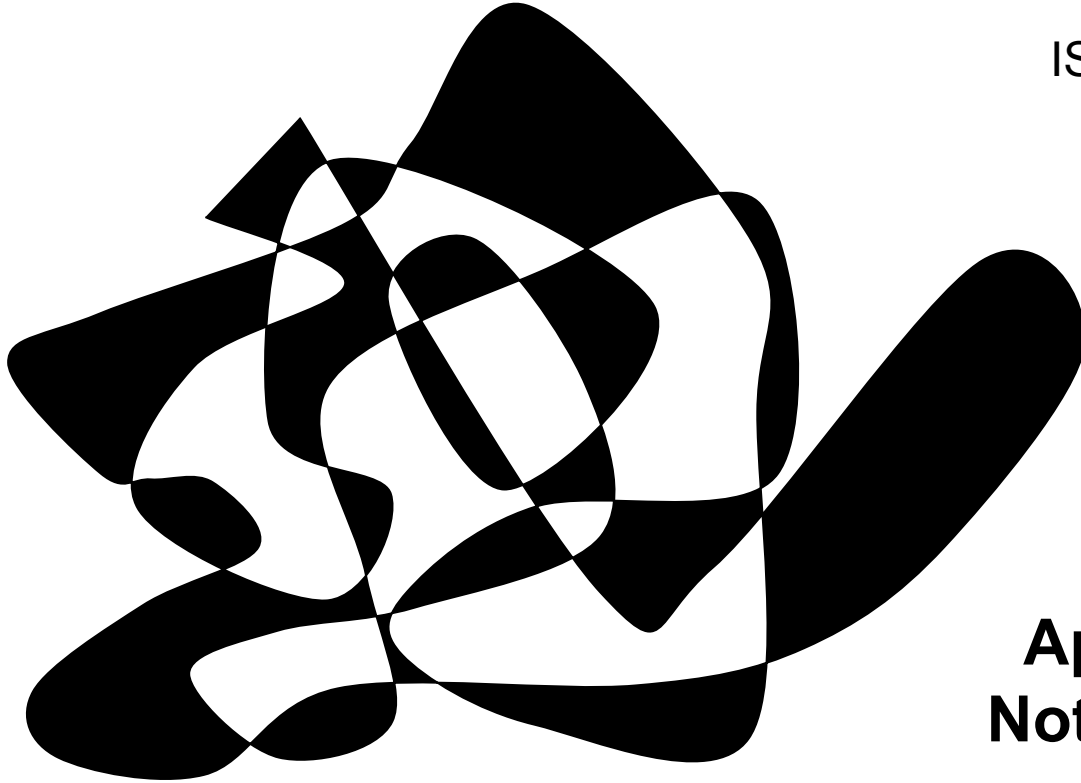# Advanced Project Management

IS 594, Section PJ

Applications II (But I'm Not A Software Engineer)

What are alternatives to Software Engineering-centric Methods for Project Management?

Examples:

- Manhattan Project, NASA's Moon Mission

- Maker Culture

- Audacious, large-scale projects and Jurassic Park (fun!)

- Holistic Project Management

- Progress in Biological Research

Quora

14 Project Management Insights from Oppenheimer's Manhattan Project with Examples

Krishna Kumar
CEO of GreenPepper | Practice Leader in Generative AI | 70+ workshops for 2K+ leaders in AI | Leadership & Innovation...

Race to develop first atomic bomb (under military control).

Thousands of people across multiple sites working on a shared goal.

Multidisciplinary collaborations (physicists/chemists) with clear unified goals.

Effective leadership/decision-making.

Other Components of the Manhattan Project

Risk mitigation, effective time management.

Resource allocation, adaptation to technical hurdles.
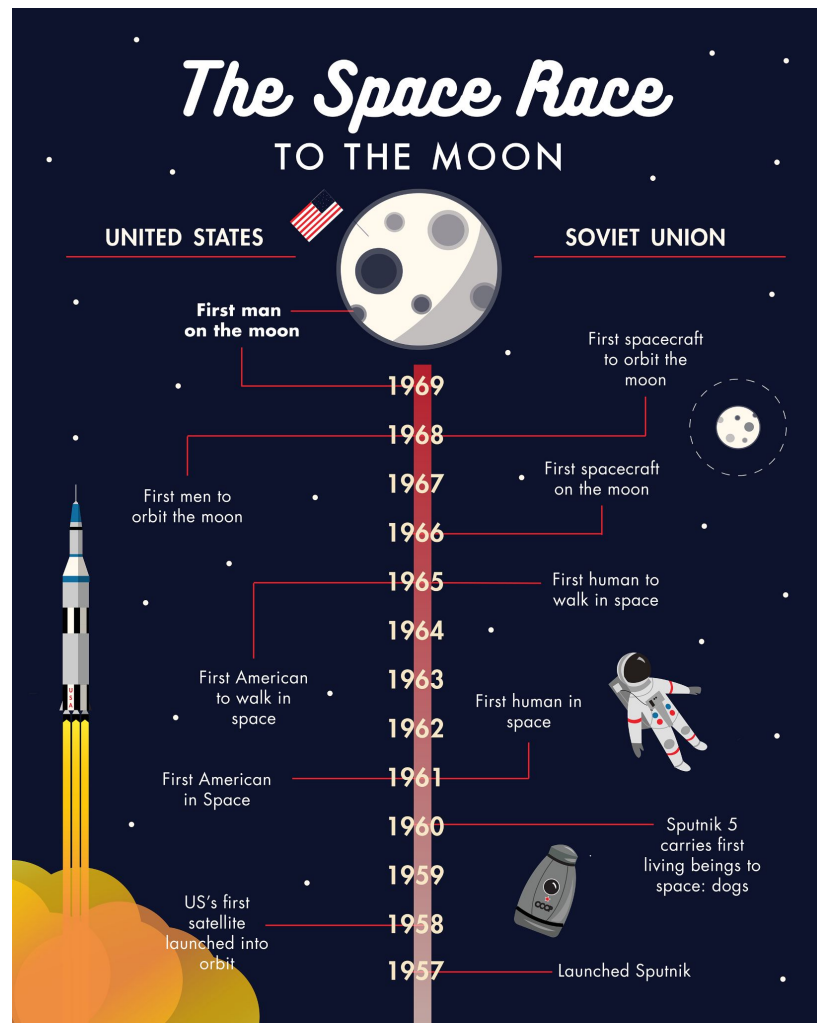
Continuous learning and improvement.

Ethics, legacy, and long-term impact.

Public perception.

Moonshot-type Competitive Projects

Racing towards a goal.

- achieve many goals on a compressed timeline.

- tit-for-tat: in competition with opponents, impacts your roadmap.

- Leads to many side innovations (need to solve problems on the fly).

- USA vs. USSR, Celera vs. Human Genome Project.

The Space Race
TO THE MOON

UNITED STATES — SOVIET UNION

First man on the moon

First spacecraft to orbit the moon

1969

1968

First spacecraft on the moon

1967

First men to orbit the moon

1966

First human to walk in space

1965

1964

First American to walk in space

1963

First human in space

1962

First American in Space

1961

Sputnik 5 carries first living beings to space: dogs

1960

1959

US's first satellite launched into orbit

1958

1957 — Launched Sputnik

Four surprising technological innovations that came out of the Apollo moon landings

Brown
(July 3, 2019)

The Conversation

Immediate need (on a compressed time-scale) to develop or perfect novel technologies:

- water purification (purified water for human space flight).

- lighter and more efficient respiration technology.

- polymer-based (tough and heat-resistant) fabric.

- cordless rotary hammer drill.

What Is 'Maker Culture,' And How Can You Put It To Work?

https://www.forbes.com/sites/williamcraig/2015/02/27/what-is-maker-culture-and-how-can-you-put-it-to-work/

Maker: someone who approaches projects with novel solutions, do-it-yourself (DIY) ethos, share skills and equipment. Constructivists (learn by doing).

Disposition of a Maker:

- value openness and community.

- embrace imperfection (not the enemy of the good).

- motivated by their craft.

"The secret: One day builds always take longer than a day"

Yvonne Harrison on Adam Savage's Model Making Process

https://www.batimes.com/articles/the-secret-one-day-builds-always-take-longer-than-a-day/

Mindset of a "Maker". Try to achieve a vision for a customized build.

Build will be non-standard (open-ended).

First build is not final (accept mistakes).

First version will be awful, refine over versions.

Helps to better estimate time to completion.

Project managers can sometimes be stereotyped as the "process police" or "paperwork junkie". But what is the alternative?

What Project Managers can learn from Jurassic Park

Danielle Burdon
People-focused problem solver | Project Leader | Delivering positive change & Continuous Improvement

https://www.linkedin.com/pulse/what-project-managers-can-learn-from-jurassic-park-danielle-burdon/

June 28, 2023

"the most advanced amusement park in the world" with *"living biological attractions [that] capture the imagination. A vision statement vulnerable to scope creep"*

"let's just add one more dinosaur can quickly become 8 velociraptors needing round-the-clock attention, hazard pay and extra insurance"

"Jurassic Park may have "spared no expense", but after the deadly incident on Isla Nublar, no PR or insurance claims are going to be celebrating the budget and schedule wins. Perhaps some more conversations with dinosaur experts could have helped avoid a bad launch"

Holistic Project Management

"*All the complexity of building a Disney World-plus-zoo, in a remote area with no infrastructure, with brand-new, unpredictable, life-threatening technology*".

Solinger, T. (2004). The whole works. *PM Network*, 18(9), 24–30.

- prioritizing, identifying root or systemic causes of problems, productivity and cost control.

- involvement of people at all levels of an organization to provide input and commitment that is critical to achieving lasting change.

- involves Six Sigma, Human Systems and Learning Organization (five disciplines), Minimalist Manufacturing, and the Theory of Constraints.

Human Genome Project

The Human Genome Project

Attempt to produce a draft of human genome:

- lasted from 1990 to 2003. International team sponsored by the DOE and NIH.

- sequence human genome in addition to *E. coli*, *Drosophila melanogaster*, *C. elegans*, and *Mouse*.

- initial five year goals in multiple areas (genetic/physical map, sequence data, informatics, model organisms, ethical considerations).

Understanding our Genetic Inheritance. US Human Geonome Project, first five years (1991-1995).

1. Mapping and Sequencing the Human Genome

Genetic Map

5 Year Goal: Complete a fully connected human genetic map with markers spaced an average of 2 to 5 centimorgans apart. Identify each marker by a sequence-tagged site (STS).

Physical Map

5 Year Goal: Assemble STS maps of all human chromosomes with the goal of having markers spaced at approximately 100,000 base-pair intervals.

Generate overlapping sets of cloned DNA or closely spaced unambiguously ordered markers with continuity over lengths of 2 million base pairs for large parts of the human genome.

DNA Sequencing

5 Year Goal: Improve current methods and/or develop new methods for DNA sequencing that will allow large-scale sequencing of DNA at a cost of $0.50 per base pair.

Determine the sequence of an aggregate of 10 million base pairs of human DNA in large continuous stretches in the course of technology development and validation.

2. Model Organisms

5 Year Goal: Prepare a genetic map of the mouse genome based on DNA markers. Start physical mapping on one or two chromosomes.

Sequence an aggregate of about 20 million base pairs of DNA from a variety of model organisms, focusing on stretches that are one million base pairs long, in the course of the development and validation of new and/or improved DNA sequencing technology.

3. Informatics: Data Collection and Analysis

5 Year Goal: Develop effective software and database designs to support large-scale mapping and sequencing projects.

Create database tools that provide easy access to up-to-date physical mapping, genetic mapping, chromosome mapping, and sequencing information and allow ready comparison of the data in these several data sets.

Develop algorithms and analytical tools that can be used in the interpretation of genomic information.

4. Ethical, Legal and Social Considerations

5 Year Goal: Develop programs addressed at understanding the ethical, legal, and social implications of the human genome project.

Identify and define the major issues and develop initial policy options to address them.

McCarty (Nov. 1, 2024)

Levers for Biological Progress

Asimov Press

Dario Amodei, the CEO of Anthropic, recently published an essay called "Machines of Loving Grace." It sketches out his vision for how AI could radically transform neuroscience, economics, diplomacy, and the meaning of work. Amodei also imagines the ways AI could accelerate biological research and yield miraculous cures in the 21st century; everything from the prevention and treatment of nearly all infectious and inherited diseases to the elimination of most cancers.

"Biology is probably the area where scientific progress has the greatest potential to directly and unambiguously improve the quality of human life," Amodei writes. "My basic prediction is that AI-enabled biology and medicine will allow us to compress the progress that human biologists would have achieved over the next 50-100 years into 5-10 years."

This is an inspiring vision, but as Amodei acknowledges, achieving it will first require that we think deeply about existing bottlenecks and then roadmap ways to solve them. Indeed, most of what we publish at Asimov Press are roadmaps of this kind, including essays that examine persistent obstacles to scientific progress (such as "Where's the Synthetic Blood?") or speculative fiction that imagines possible futures once these obstacles have been overcome (see "Tinker" or "Models of Life").

Amodei's essay considers what might happen to biological research should a "powerful AI" emerge that is "smarter than a Nobel Prize winner." However, it isn't clear that such a superintelligence could even be applied to its full potential in biology today, given the dearth of high-quality datasets needed to train it.

Although Amodei *does* acknowledge some real-world issues limiting scientific progress — such as the slow growth of organisms and tedious clinical trials — he mostly passes over the more general tools that will be required to accelerate research in the near term. Still, many of the bottlenecks slowing biology today are *biophysical*, rather than *computational*. Therefore, I'm using Amodei's essay as a rallying cry for researchers to innovate their way past existing bottlenecks in wet-lab biology, which, if achieved, would help scientists actually build more powerful AI models in the future.

It wasn't easy for me to write this essay because it's often difficult to predict exactly where a solution to a given problem will emerge. That's why researchers hoping to accelerate biology at large should strive to build "platform tools" that "can apply in multiple contexts," as Adam Marblestone has written, rather than narrow solutions to short-term problems.

The balance between AI advances on the one hand and wet-lab innovations on the other is also a bit like the chicken and egg problem. Yes, AI will accelerate biological progress, but first we must make it easier and faster to run experiments while creating better methods to study biology in a more holistic and less reductionist way. Solving the latter challenges will, oddly enough, require both machine learning *and* wet-lab innovations.