

**Science Fiction to Science Fact: The Link Between Early
Science Fiction and the Space Programs**

by
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Submitted to the Department of Mechanical Engineering
in partial fulfillment of the requirements for the degree of

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Abstract

To provide a link between the early writings of science fiction and the exploration of space. The first attempts at space travel occurred in the fifties and early sixties. Science fiction novels and pulp magazines which predicted and inspired space travel became popular in the late twenties and early thirties. The young men and women who read these stories became the engineers, scientists and administrators of the later space programs.

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Chapter 1

Introduction

1.1 Mythologies, Fables, Fantasy

Since the beginning of time, man has shown an innate desire to explore. The need to see and experience the universe to its fullest has evidenced itself in our actions and in our art through such feats as hikes to mountain peaks above the clouds in search of god, or rockets to the moon and outer space in search of knowing the unknown.

Before there was such a thing as hard science fiction there were stories of gods, monsters, elves, witches, fairies and giants. Often tales of this sort contained what could be termed magic or a mystical control of the world and elements far surpassing the abilities of man. The pixies and monsters of those old tales held secrets to our existence and always dwelled just beyond the reach of the campfire light, waiting for us to reach out to them in this primitive “outer space” of old. When there was contact with the supernatural in these stories we humans invariably learned a lesson about ourselves, but more importantly we learned to reach for these limits beyond our sight and strive to interact with the unknowns of “outer space”.

The story of Icarus, Daedalus and humans flying like the birds was completely fanciful at the time it was first told and retold in the oral tradition. Today we float above the clouds in comfort, without the fear of our wings melting in the sun. We cannot be so much more evolved as animals that we *acquired* the ability of flight much like walking upright and opposable thumbs. We must have come by this ability to fly through other non-biological means. As we have dreamed throughout history we have reveled in the “what ifs” posed by the story tellers and allowed our minds to flow freely over the earth and sea as the birds in the sky. Somewhere in the complexities of our minds we have also, over time, been

swayed to believe that we can somehow fulfill these dreams. This belief that the dreams we hope to live can be found just outside the light of our campfires (whether they be literal campfires of the early men or the earth's horizon for Leif Erickson or the dark side of the moon for the Apollo program) has driven us to discover. These discoveries have given us the magic of flight and the mystical ability to break free from this planet earth and these technological accomplishments began as some story teller's dream of the future.

1.2 Beginnings of Popular Science Fiction

The time line of science fiction can be stretched back in this manner to the first god or monster to inhabit the human mind. That time line contains some early pearls of future-truth, such as the aforementioned human power over flight, but is mostly barren in the very early days of story telling. An incredible change takes place in this history during the 19th and 20th centuries in which the stories crafted by science fiction writers become absolutely prophetic and inspiring.

As we step into the 20th century there is an increase in science fiction publication. Most work in the field is geared towards children in the age range of 7 to 18 through affordable pulp monthlies. Rocketry, trips to the moon, and intergalactic travel overwhelm the genre at this time and the line between fiction and cold fact begins to blur. Published in the 1930s, *Amazing Stories Science Fiction* contained not only popular science fiction short stories and serials of the day, but also discussions and articles concerning science fact and breakthroughs in engineering and science. Typical issues of *Amazing* (May-July 1935) contain stories such as *Moon of Arcturus* (a look into the future when space travel is an everyday occurrence) and articles on waste heat concerning:

“the sun and its action on earth and the effect of our jacket of air,”

Waste of Heat, Amazing Stories Science Fiction, June 1935.

or a letter from Dr. Donald Menzel of Harvard College Observatory dealing with the temperature in space and the methods used to measure it. Even under the title of the magazine, in every issue, there is a reference to this merger of fiction and fact:

“Extravagant Fiction To-day.....Cold Fact To-morrow.”

Amazing Stories Science Fiction, ongoing

The line between fiction and fact begins to shift at this time in history; we are flying planes and launching small, unmanned rockets into the upper atmosphere, we have begun to abandon the horse and carriage in favor of the man-made automobile and our dreams of reaching beyond the campfire seem to broaden as we learn more about the universe we live in and our potential to have power over it. No longer are we afraid of the darkness that lies beyond our reach, but rather intrigued by its possibilities.

Chapter 2

The Germans

2.1 Timelines of Germans Rocket History vs. German Science Fiction.

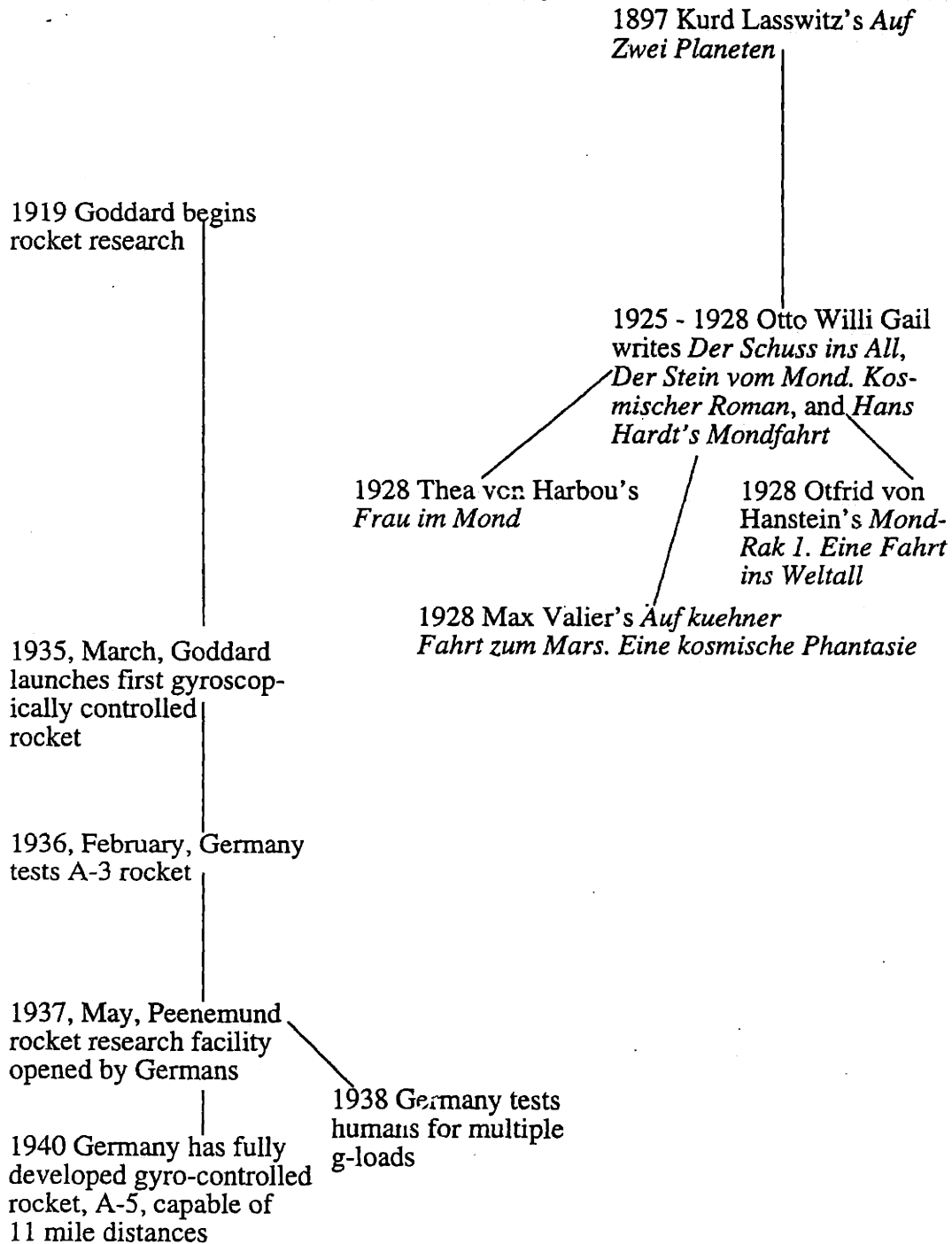


Table 2.1: German rocketry achievements and science fiction, timeline.

2.2 The German Rocketry Program

Most major military powers of the second world war were familiar with the usefulness of rockets as a means of missile weaponry and jet-assisted take-offs of aircraft. The Germans seemed to be the only ones interested enough in rocketry to make a decisive push into research and development of long-range missile weapons resulting in any innovation or expansion in rocket technology until the later years of the war.

The allied forces chose to rely heavily on bombers and developed the technology associated with bombing accuracy while the Germans focussed on long range attacks from Germany and France through their V-2 rocket program. The significant research being conducted for the allies was primarily done by Robert H. Goddard in the desert of Roswell, New Mexico. Goddard began his rocket research in 1919. In March of 1935, Goddard launched the first gyroscopically controlled rocket reaching a distance of over 2 miles and an altitude of 4,800 feet at 550 m.p.h.

The Germans had tested the A-3 rocket in February of 1936; achieving 3,300-ponds of thrust. This figure later served as a basis for all German military weapons specifications. Soon after this, during May of 1937, a joint German Army-Airforce rocket research station opened at Peenemunde on the Baltic Sea commanded by Captain Walter Dornberger. The Germans were clearly devoting much of their war effort to rocket development and research.

In the US, the military applications of rocketry remained limited at this time in history. Only in July of 1939 did the National Academy of Sciences show interest in rocket technology, and then only as a suitable assist to Air Corpse planes in takeoffs. They sponsored a research program at Cal Tech Rocket Research Project with total funding of \$10,000. That marked the first official US rocket program and it completely ignored the possibility of using rockets to deliver a payload to a target.

Goddard continued his research through May of 1940 at which time Harry Guggenheim arranged a meeting with representatives of US Army Ordnance, US Army Air Corps, and The Navy Bureau of Aeronautics. Goddard offered them all of his research data, patents, and facilities to be used by the military in order to strengthen the war effort. Nothing resulted from his presentation. Once again, the armed forces saw some possibilities for rockets to be used in jet-assisted take-offs of aircraft, but failed to see any possibilities in missile weaponry. By this time the Germans had developed gyroscopically controlled A-5 rockets which could attain an altitude of 7.5 miles and reach a distance of 11 miles.

2.3 Human Tests

The far seeing German rocket researchers didn't limit their rocket tests to ordinance payloads. As early as 1938 the Germans were testing human tolerance to multiple g-loads by exposing test subjects to subgravity in aircrafts performing vertical dives. Two years later Dr. Heinz von Diringshofen of Berlin discovered the effects of weightlessness through flight maneuvers with high performance aircraft.

As the German rocket program continued to make great strides in the use of controlled rockets for practical use in all areas -- jet-assisted take-offs, ordinance delivery, and (as the multiple g-load testing would insinuate) ultimately travel -- the allies, especially the US, lagged seriously behind. The US rocket program lacked the far reaching vision of the Germans until very near the end of the second world war.

2.4 Early German Science Fiction

Auf Zwei Planeten, Erich Lasswitz

Auf Zwei Planeten, Two Planets (Erich Lasswitz, 1897), is one of the greatest works of

early German science fiction and has been credited as an influence to young German scientists. The influence of this one novel reached far beyond the realm of fiction to promote early German programs in rocketry and space research.

“Young German scientists buried themselves in the pages of
Auf Zwei Planeten.”

Werner von Braun, German scientist

In the course of the story Martians have visited the earth. They have a mechanical means of controlling gravity and can produce a substance (diabar) which defeats the effects of gravity. The Martians use diabar for interplanetary travel and also to support two large space stations 6,500 miles above each of earth's poles. The space stations are used as a launching point, as a habitat and for surveillance. The diabar is a bit of “black-box magic” in that it is a tool to allow for an as-yet unrealized scientific achievement; begging the question “What would we do if humanity could find some way of escaping earth's gravity? What would we do with a substance such as diabar?” Many young Germans wondered along with Lasswitz at the possibility of space travel and space stations. Some felt that diabar was in their hands in the form of liquid and solid fuels for their rockets. The repercussions of Lasswitz's vision of life supporting structures above the atmosphere would be felt for all of time.

The novel, *Two Planets*, was widely read in Germany but it was little known in the English speaking world and had no direct influence. Although the novel was translated into other continental languages, the first publication of *Two Planets* in English was in 1971. It is therefore difficult to find its method of impact on the US space program or any link between the vision of Lasswitz and the vision of NASA.

Auf kuehner Fahrt zum Mars. Eine kosmische Phantasie, Max Valier

It could be said that Lasswitz's work was continued by Max Valier in 1928 with his story *Auf kuehner Fahrt zum Mars, A Daring Trip to Mars*. Valier was a respected German Engineer and a pioneer in rocket science research and he seems to use the science and technology of the day to give credence to Lasswitz's "theory" of space travel. *A Daring Trip to Mars* takes a doctor, an engineer and his wife first to a landing on the moon and then on to Mars. There are several important aspects of space travel which are taken into account for this trip: (1) the concept of escape velocity and the need to overcome this in order to achieve interplanetary travel, (2) inertia damping hammocks for comfort/survival in the rapid acceleration needed to achieve escape velocity, (3) space suits for use in harsh environments, and (4) the possible existence and use of water (ice) on the moon as a fuel source. In the course of the story the crew is deflected from its mission by a passing comet and is forced to simply "fly-by" Mars and return home to Earth rather than land on Mars. As they descend to Earth they use parachutes to slow their ship and escape from it unharmed. Soon after the publication of this story (in 1930) Valier was killed by an exploding rocket. The science fiction novelist was the first man to die in the course of space research.

Valier's story was translated from German in 1931 and published in the United States in *Wonder Stories* during July of that year.

2.5 Project Paperclip

On July 23 of 1945, *Life* magazine published the drawings of a manned space station as envisioned by the German rocket scientists of Peenemunde. This was the first step, although only on paper, toward "legitimate" space research through rocket technology. The Germans, who had all of Europe trembling at the sound of their rockets, saw yet another possibility for their vast knowledge of rocket science. The thought of putting

humans in space had only been envisioned previously by science fiction authors such as Lasswitz and Valier, and was commonly thought impossible at the time by those outside the science fiction reading and writing circles. This single picture linked the fiction of Lasswitz to the reality of Germany's rocket program and the possibilities of the future, if the technology were to be fully exploited. Lasswitz's vision in 1897 was given credibility by the great minds of the V-2 and later proved to be reality through the efforts of NASA and the Russian space program.

Soon after the *Life* publication, on August 14, a team of American scientists was dispatched to Europe to collect all information and equipment relating to German rocket progress. Although the war had been over for nearly three months, and the German rocket program widely respected before this time in the military community, no effort had been made to acquire their technology.

In October of 1945, Project Paperclip was approved by Secretary of War Patterson. Paperclip was an effort to bring top German scientists to the United States for the express purpose of stealing German rocket technology and to aid the military in its efforts to develop missiles and rockets at the Fort Bliss and White Sands Proving Ground. By the end of 1945 more than 100 German rocket scientists and engineers had arrived at Fort Bliss.

During this year of realization, a Navy Committee for Evaluating the Feasibility of Space Rocketry (CEFSR) was established by the Bureau of Aeronautics. A high priority recommendation was made by the CEFSR to develop satellites. The estimated cost of the program was between \$5 and \$8 million. This investment shows a dramatic change in the US military's view towards rocket technology and its use compared to the \$10,000 given to the Cal Tech Rocket Research Project in 1939.

Chapter 3

The Russians

3.1 Timeline, Russian Space Exploration vs. Russian Science Fiction

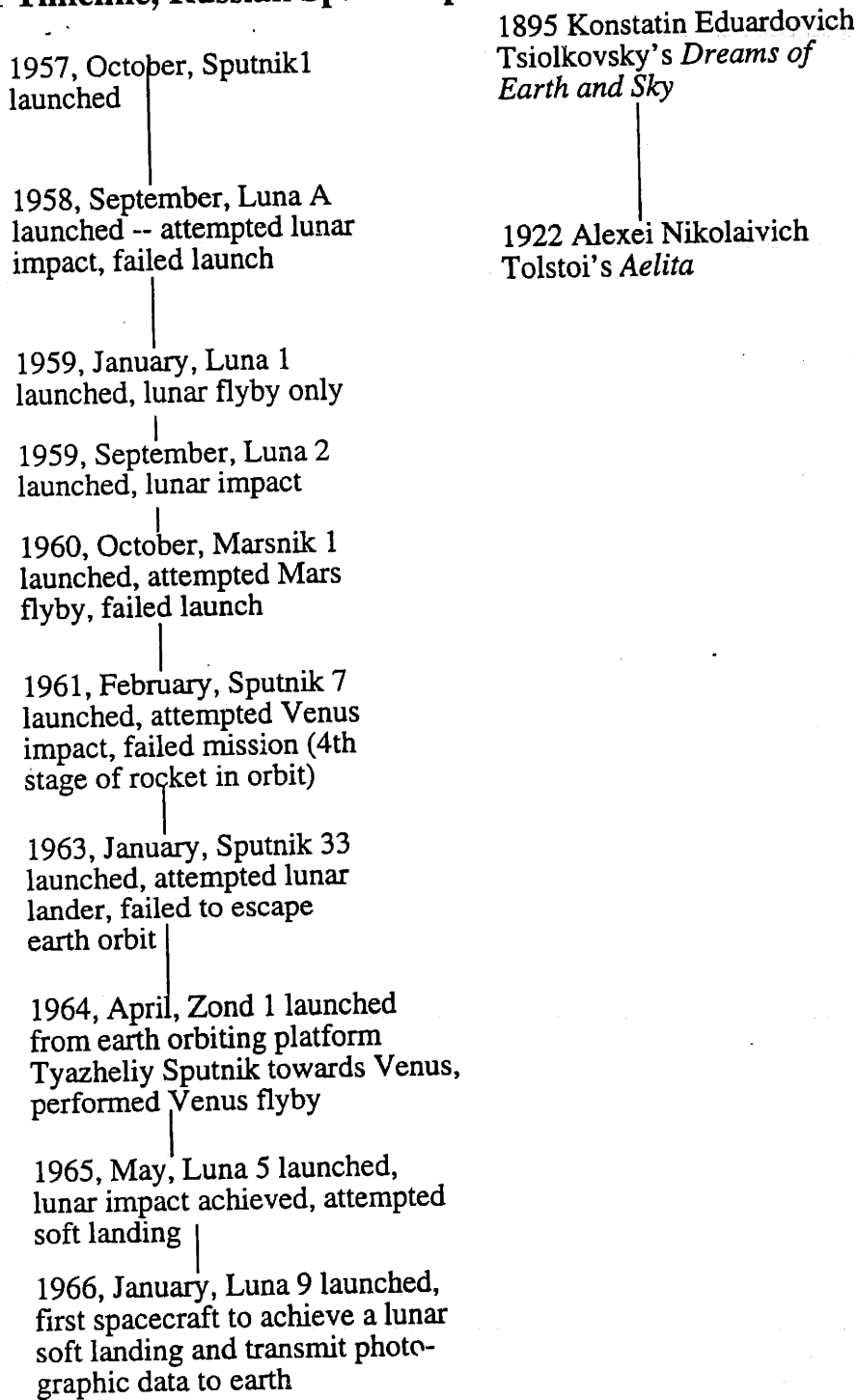


Table 3.1: Russian space achievements and science fiction, timeline.

3.2 Russian Satellites and Rocket Technology Inspired by Stories

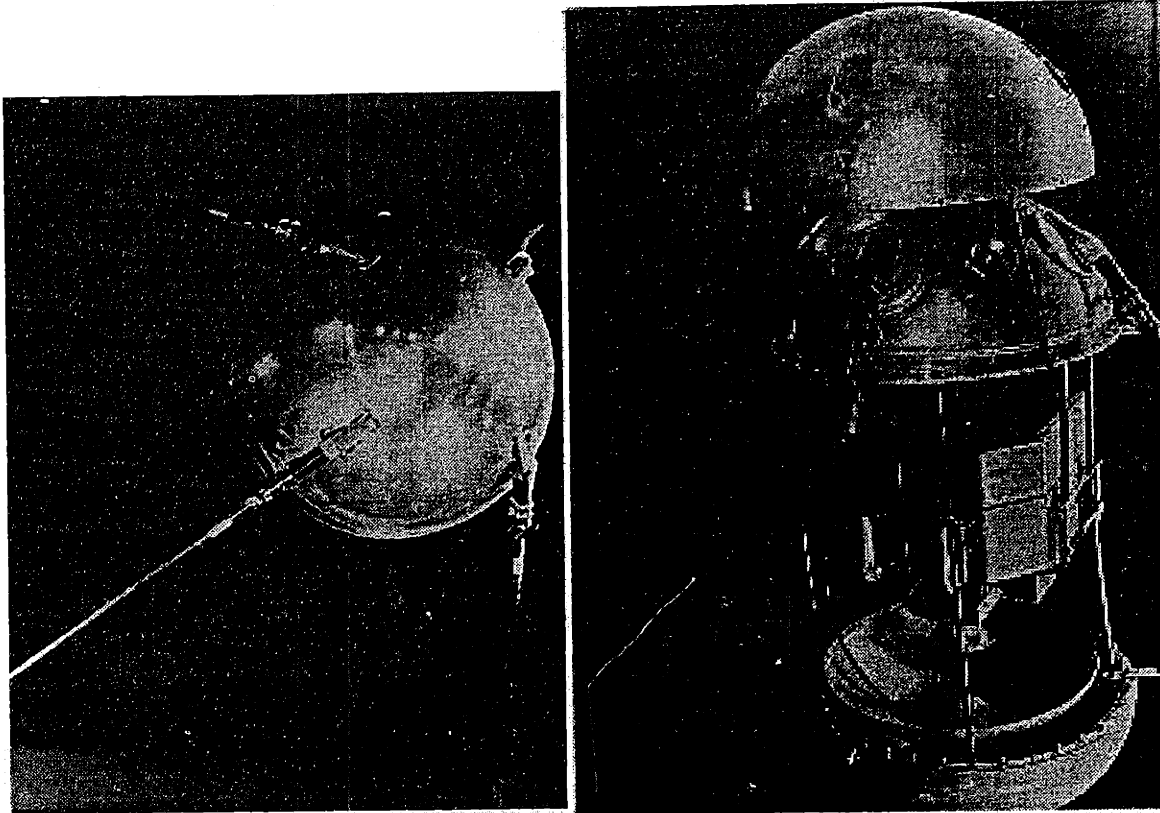


Figure 3.1: (a) Sputnik as deployed, (b) exploded view of Sputnik.

The first artificial satellite successfully placed in orbit around the Earth was the Sputnik 1. The Russians launched Sputnik from Baikonur Cosmodrome at Tyuratam in Kazakstan on October 4, 1957. It was the first of four satellites in the Sputnik program and one of three to reach orbit. Sputnik was a simple aluminum sphere with four antennas pointing to one side designed to obtain data pertaining to the density of the upper layers of the atmosphere and the propagation of radio signals in the ionosphere. The spacecraft ceased to function after three weeks when the on-board chemical batteries failed. Sputnik fell from orbit on January 4, 1958 after completing 1,400 orbits of Earth.

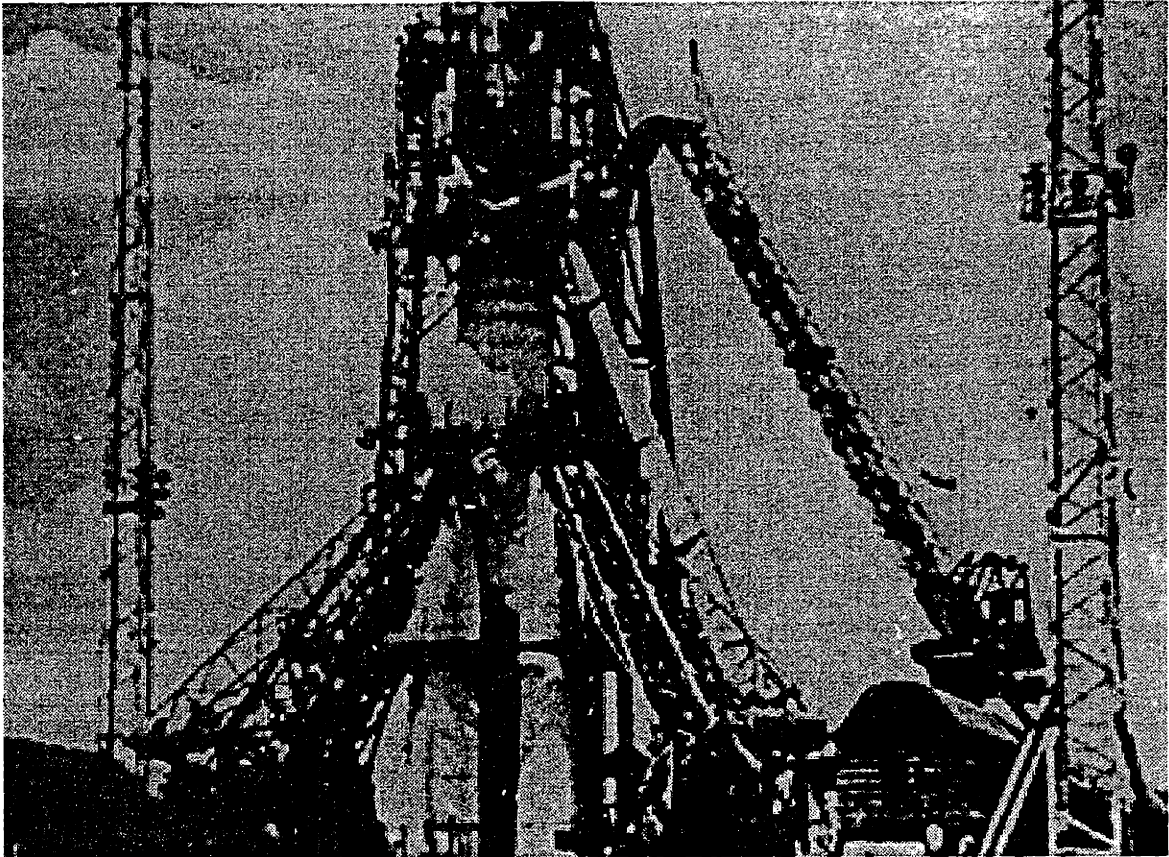
Alexei Tolstoi's novel, *Aelita*, is an adventure novel similar to western, non-Russian, social allegories. The story focuses around a planned trip to Mars and the adventures which ensue as a result of this voyage. Two points stand out from the novel; it was published in Russia in 1922 and the craft used for space travel is a spherical metal rocket ship.

The only dissimilar elements between Tolstoi's ship to Mars and the actual Sputnik probes is in size (the probe was merely 0.58 meters in diameter while Tolstoi's ship was 10 meters in diameter).

In 1896 the Russian author and scientist Konstantin Eduardovich Tsiolkovsky published *Out of Earth*. It is the story of a group of scientists from around the world who meet in a castle in the Himalayas and form an utopian scientific fellowship. They undertake the enormous joint project of exploring the universe. The Russian of the group proposes a liquid fueled, multi-stage rocket to reach a low altitude earth orbit which is agreed upon by the team and they set out on their mission. Through the characters' travels the author describes the nature and function of space suits and the problems of weightlessness. Artificial gravity is achieved by rotating the ship. The Russian scientists who developed the Sputnik satellite and the rocket technology used to launch it referred to Tsiolkovsky's stories, although fiction at the time, as the seminal works for Russian space research

The launch of Sputnik 1 signaled the start of the space age and the US-USSR space race. The start of the Sputnik project can be traced back to 1952 when the International Council of Scientific Unions decided to establish July 1, 1957, to December 31, 1958 as the International Geophysical Year (IGY). In October 1954, the council adopted a resolution calling for artificial satellites to be launched during the IGY to map the Earth's surface.

Figure 3.2: Sputnik 1 at launch, liquid fueled, multi-stage rocket.



Chapter 4

US Space Program

4.1 NASA

With the success of the Russian Sputnik program most American's regarded the slower US Project Vanguard as a failure. President Eisenhower took the brunt of the criticism and was seen as a lazy golfer compared to the Russians.

*Oh little Sputnik, flying high
With made-in-Moscow beep,
You tell the world it's a Commie sky
and Uncle Sam's asleep.*

*You say on fairway and on rough
The Kremlin knows it all,
We hope our golfer knows enough
To get us on the ball.*

Michigan Governor G. Mennen Williams

Sentiments such as these caused Eisenhower opponents such as Lyndon B. Johnson, then Senate Majority Leader from Texas, to take action and make an effort to lead the US into the space age in the hopes of surpassing the Soviets. Upon recollection of the Sputnik launch, Johnson stated:

“Now, somehow, in some new way, the sky seemed almost alien. I also remember the profound shock of realizing that it might be possible for another nation to achieve technological superiority over this great country of ours.”

Senate Majority Leader Lyndon B. Johnson, D-Texas

Johnson opened hearings by subcommittee of the Senate Armed Services Committee in November of 1957 to review American defense and space programs in the wake of the Sputnik crisis. At that time the US space program was still terribly underfunded and the organization supporting space research was so enmeshed in military research that it was difficult for any project to receive full support without a clear military objective. George E. Reedy, a Johnson aide, summarized the feelings of most Americans:

“The simple fact is that we can no longer consider the Russians to be behind us in technology. It took them four years to catch up on our atomic bomb and nine months to catch up on our hydrogen bomb. Now we are trying to catch up on their satellite.”

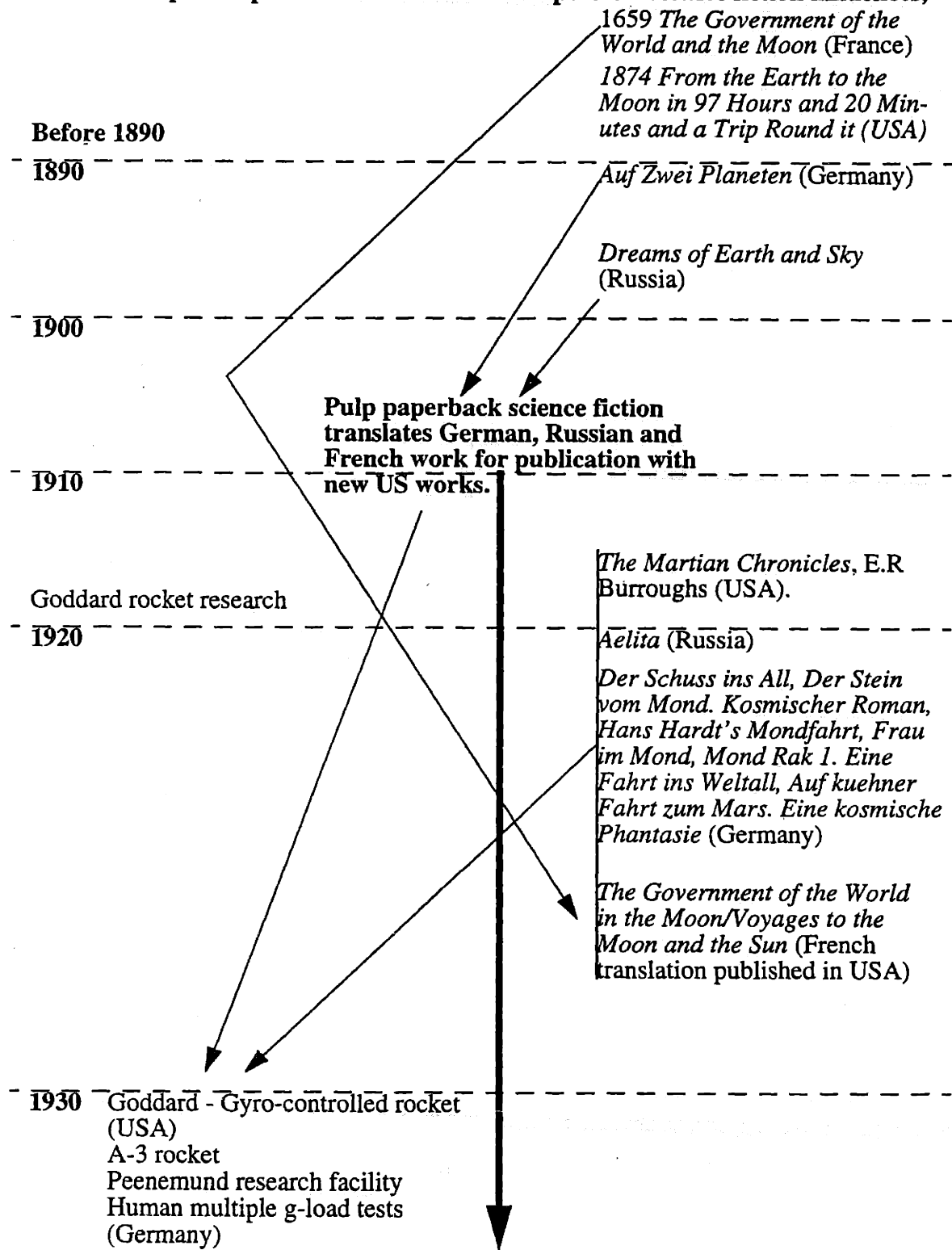
Sen. Johnson Aide George E. Reedy

The Eisenhower administration moved quickly to restore confidence in US prestige at home and abroad. Unfortunately, the first two attempts by the US to launch satellites resulted in failure. A Vanguard booster disintegrated on launch December 6, 1957. On February 5, 1958 the second attempt resulted in an explosion four miles above the Earth. The head of the Vanguard program, John Hagen, stepped down and the Vanguard project was dismantled.

Johnson was proven right in his findings when Wernher von Braun and other German immigrant rocket scientists who were acquired through Project Paperclip flew their Explorer in an amazingly short period of time. Project Explorer, though a successful model, was an unapproved plan which never would have been attempted if not for the Vanguard failures and growing public pressures.

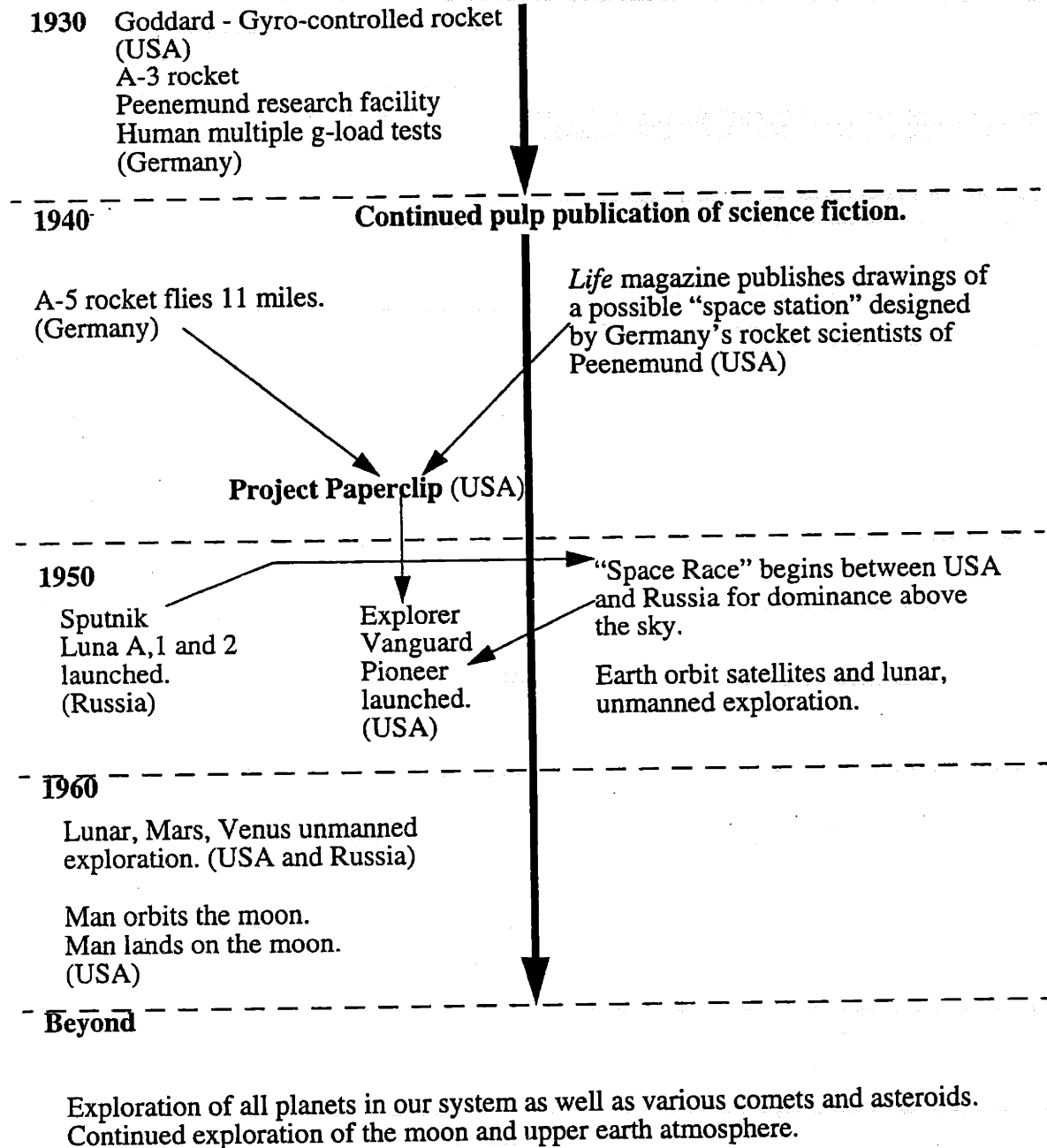
4.2 Comparative Timeline

Table 4.1: Space exploration achievements and possible science fiction influences,



arrows show possible direct linkage of events.

Table 4.2: Continued timeline flowchart.



4.3 Conclusions

As shown in the tables above, the earliest popular science fiction was mainly German and Russian which wasn't translated for an American audience until 1910 to 1920. The earliest rocket research was done in this same decade by the German scientists who would later found the Peenemund rocket research facility. The founders of Peenemund were children

at the time of *Auf Zwei Planeten's* publication and have been said to have "buried themselves" in it. It can therefore be said that the German rocketry program of the 1910s through the end of World War II was directly influenced by this seminal work of science fiction.

As the timeline moves into the decade of the 1920s there is a flurry of American publication and translation from the German, French and Russian classics of science fiction. Also, Burroughs begins publishing his *Martian Chronicles* which have a similar influence on the American scientists of NASA as the works of Lasswitz had on Germany's rocket program a generation earlier.

In the 1930s Germany continued to develop its rocket program. They also begin to contemplate space travel and even human space travel with the testing of multiple g-loads on human subjects.

As World War II comes to a close the German rocketry program at Peenemund ceases. Soon after the war a *Life* magazine article is published containing sketches or plans of a German "Space Station" which could be used as a launching point for further space travel as well as a surveillance or war platform. Soon after publication the US military begins Project Paperclip; gathering all data from the rocket research facility in Peenemund and recruiting all of Germany's rocket scientists to work in the US.

After this coup the US seems to progress slowly towards the goal of space travel. Then, in the 1950s, Russia unveils her own space program and "beats" the US in the "space race" by successfully launching Sputnik. The Russian scientists have been influenced, as had the Germans before them, by native works of science fiction such as *Dreams of Earth and Sky* by Tsiolkovsky. This defeat at the hands of the Russians then serves to push the NASA scientists and ultimately a German Design is used to Successfully orbit the earth.

In the end, a line can be drawn from present day space exploration and technology back to the writings of Lasswitz, Tsiolkovsky and Burroughs. The stories inspired the children of the early part of this century to build the rockets and spacecraft which were precursors to our modern day satellites and rockets.

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Table 3.1: **Russian space achievements and science fiction, timeline.**

Table 4.1: **Space exploration achievements and possible science fiction influences, arrows show possible direct linkage of events.**

Table 4.2: **Continued timeline flowchart.**

