

Teachers Guide: *From the Earth to Mars*

Version 1

This teachers guide is designed as a guide for teachers at all levels to help stimulate discussion and lessons on the first steps taken in our exploration of space. In this one guide are suggestions for both younger students and those in higher levels. Of course, we leave to you, the educator, to decide which suggestions and questions are for your students.

And please, send along any questions or suggestions for improvements.

*A big thank you to Tim Smyth, the Eisner Nominee and passionate author of *Teaching with Comics and Graphic Novels* <http://www.historycomics.net> who developed the first draft of this teachers guide. Tim would well understand the moment at our Washington, DC book party when the reporter interviewing me asked “Why is your book on space exploration so filled with illustrations and comics?” Rather than answer I turned to a young space professional in the audience. “Why don’t you answer that question?” His answer: “Because comic graphics are cool.” And hence this book.*

Before Reading

1. Big Idea of *From the Earth to Mars*:

What have been the traditional roles of private organizations, individuals, and government in space exploration How were each different from one another? And do you think it has changed over the years?

(As the big understanding in this story, this question will be revisited after students are finished reading the book)

2. What do you already know about the efforts to explore space, develop rockets and space stations and have humans live on the Moon?
3. Analyze the cover of the book– what do you notice? Predict – what will you be learning about? What questions do you have/want to know more about?
4. Who are Konstantin Tsiolkovksy, Will Ley, Fritz Lang, Thea Von Harbou, Robert Esnault-Pelterie, Nikola Rynin, Hermann Oberth? What role do you think they will play in this book? (Students can be assigned one of these people in groups to research and report out or be put into expert jigsaw groups).
5. Read the quote from Jules Verne – has this become a reality? Why or why not? When do you think this will happen? What needs to be done to accomplish this feat?
6. Read the opening quote from Elon Musk – he is being ironic, but what is his overall point?

During Reading:

I. Introduction

Vocabulary: reviled, pragmatist, embodied, interplanetary, entrepreneur, biopharma, private sector, whims, idealism, visionary, ICBM, apogee

1. P.1 – why might von Braun’s path to the Apollo 11 Mission Control room have been “hidden, ignored, celebrated, or reviled?” Students can research the role of von Braun in this mission (<https://earthobservatory.nasa.gov/features/vonBraun/vonbraun.php>)

Students can research the Apollo 11 Mission and its importance.

(https://www.nasa.gov/mission_pages/apollo/missions/apollo11.html - be sure to check out the videos!)

2. (Suggested for advanced grades) What was the relationship between some of these rocket pioneers and their government officials? In what way do you think “each side used the other?” And do you think this relationship is different today with space entrepreneurs and the government?
3. P. 2 – Opening quote – do you believe that the Apollo 11 mission is as impactful as “when aquatic life came crawling up on land?” Why or why not? What other moments in human history also has this vital importance?
4. What was Sputnik? Why did this cause fear in President Eisenhower and Americans? Has something happened recently that has caused this sort of national fear?
5. P. 2, panel 4 – President Eisenhower states that he doesn’t trust “those Germans” – why? What is in Eisenhower’s own history that might prompt this sort of lack of trust?
6. P. 2 panel 5 – what might the family be thinking? Put a dialogue balloon over one of their heads. What is the connection between von Brain and Walt Disney?
https://www.nasa.gov/centers/marshall/history/vonbraun/disney_article.html .
https://www.youtube.com/watch?v=0_yOXQ1Bd9Y
7. (Suggested for Advanced Grades) P. 2, Final panel – what is the risk when governments are involved in space exploration? What role should governments play in space exploration? What laws/restrictions should be put into place? Read the United Nations treaty on the “exploration and use of out space, including the moon and other celestial bodies” – with what do you agree or disagree? What is the most important part of this treaty? What would you add?
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>
8. P. 3 – Why was much of von Braun’s past hidden?

9. Pp. 3 and 4 – Using specific visual/textual evidence from these pages, do you think it was acceptable for the United States to include von Braun in its space exploration research given his past? Why or why not?
(Suggested for Advanced Grades) Do we have these sorts of issues today, in space exploration or other fields. of whether to invite experts from former, or currently unfriendly nations, to key national programs?
10. Pp. 4 and 5 – do you think that governments should play a critical role in space exploration, or should it be left up to private business? Or some sort of combination?
11. P. 5 – Predict – how do you think a French writer could have kick-started the serious interest in the exploration of space? What role does literature, tv shows, movies, pop culture, etc. play in imagining future possibilities?
12. P. 6 – what are the conflicting realities of space exploration and its origins? What was the role of the V-2 rocket in WWII?
13. This book is a story about pioneers from over a hundred years ago and centers on people’s excitement about aviation and space exploration. However, today, humanity has not advanced in space development as quickly as we have in aviation. Why do you think this is true? Is it because of the cost of space development or the policies or just that ‘space is hard’ as many say?

People to Research - Werner von Braun, John F. Kennedy, Adolf Hitler, Sergei Korolev, Joseph Stalin, Khrushchev, and Xuesen

II. Chapter One

Vocabulary: multinational, atmosphere, vacuum, velocity, interplanetary

1. P 7. What was the role of Jules Verne in inspiring space exploration? What movies, tv shows, books, etc. have you seen/read that might inspire in the same way?
Students can read the Verne story for free here - <https://www.gutenberg.org/ebooks/83> (If there is access, HBO has a wonderful series that has the same title as Jules Verne’s story - <https://www.hbo.com/from-the-earth-to-the-moon> .
HBO also offers free clips on YouTube, such as <https://www.youtube.com/watch?v=GVAaPy7CMAM>)
2. Students could even just watch the trailer and make comparisons from the series to the book. Students can also conduct a text to text-to-text analysis of the prose story, the HBO series, and this book. Jules Verne’s book was *From the Earth to the Moon*. The author chose as the title of his book *From the Earth to Mars*. Why do you think it was important to him to have Mars as the goal here and not the Moon?

3. Pp .7-12 Students should keep a bulleted list to describe the ways Verne influenced NASA and space exploration. Put it all together – do you agree with the author of this book that Verne was a direct influence on space exploration?
4. P. 7 Students can be assigned groups to research other space exploration stories from cultures around the world, as mentioned on this page and report back in a whole class discussion. (One possible resource - <https://vocal.media/futurism/surprising-science-fiction-stories-from-the-ancient-world>)
5. P. 8 Tsiolkovsky was a philosopher who pondered the role of religion on humans in space. What do you think will be the impact on religions, if any, as people eventually live and work off the earth?
6. Pp. 8-11 Who was Konstantin Tsiolkovsky and what was his role in space exploration? What did he prove about the necessity of rockets for space exploration?
7. P. 10 – Why is the Tsiolkovsky rocket equation important?
8. Pp.12-13 Compare the images of Verne’s ship and that of SpaceX. What similarities do you see? Is there a direct comparison?
9. Students can explore the connections between Jules Verne and Blue Origin by exploring <https://www.blueorigin.com/>
10. P. 14 – Analyze and discuss the quote from Verne’s narrator. What should be the role of humanity in space exploration? Why? Is this possible today?
11. Students can read all or portions of the science-fiction stories mentioned in this chapter, write a summary, and report to the class. In what ways did this literature inspire space exploration? (Teacher Tip – many copyright free stories and silent films can be found on the Project Gutenberg website - <https://www.gutenberg.org/>) and at the website www.fromtheearthtomars.com)

People to Research – Jules Verne, Isaac Newton, Robert Goddard, Elon Musk, Jeff Bezos

III. Chapter 2

Vocabulary – quixotic, utopian, commercialization, dissertation

1. P. 15 – analyze and discuss the quote from Herman Oberth. Do you agree or disagree that education is sometimes looking backwards and not forwards? What does that mean?

2. P. 16 – Panel 3 – describe the faces/reactions of the two professors. Why do they react to Oberth’s thesis presentation in this way?

3. P. 16, last panel. Describe Oberth’s reaction. Was his prediction correct?

4. Pp. 16-17 was Oberth’s thesis correct? Revisit your answer from #1 with this new info.

5. P. 18 The author of this book, Jeffrey Manber, was able to have a short conversation with Oberth. What would you have asked a genuine pioneer of space exploration? Why do you think that space commercialization has had such a “slow pace?”

6. P. 19 Why do you think governments have “thwarted the dynamic progress necessary for commercial development” of space exploration?

People to Research – Jeffrey Manber

IV. Chapter 3

Vocabulary – perception, geostationary orbit, prophetic

1. P. 21 Kurd Lasswitz wrote the science-fiction novel *On Two Planets*. Describe what you think the first meeting between humans and Martians (or other planetary species) would look like – perhaps make an illustration. How would meeting another intelligent species change us here on Earth?

2. P.21 Why did the German government not initially grant the license to the Society for Space Travel? Why was it important for the author to include this small bit of information? What is the point he is making?

3. P. 21- what was the role of Willy Ley in 20th century space exploration? Ley built no hardware, probably did not understand advanced rocket physics—so why was his role so important?

4. What was described in the *Problem of Space Travel*? How many space stations exist today? And are these space stations privately owned or commercial? And who do you think owned the space shuttle and now the SpaceX rockets?

5. Explore https://www.nasa.gov/mission_pages/station/main/index.html to find out more about the International Space Station. Compare to the imagined illustration on p. 23.

6. P. 23 – explore the original Amazing Stories pulp magazine here - <https://www.pulpmags.org/content/view/issues/amazing-stories.html> . Look through the covers

– what do you notice? Choose one magazine to read in its entirety and report back to the class what you discovered. (Students could be assigned a magazine to read). What impact do you think they had on scientists and space exploration?

7. P. 24 – read Arthur C. Clarke’s original *Wireless Magazine* article here - chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://clarkeinstitute.org/wp-content/uploads/2010/04/ClarkeWirelessWorldArticle.pdf . What did he accurately predict? What did he get wrong?
8. P. 24 – watch the part of the movie based on Arthur C. Clarke’s 2001: a Space Odyssey here - <https://www.youtube.com/watch?v=OZoSYsNADtY> – what do you notice about how space travel is depicted? What is accurate?
9. P. 25 – last paragraph – Predict: How might governments stop the idea of “to spread the thought?” Do we have examples of governments taking this sort of action today?

People to Research – Willy Ley, Johannes Winkler, Hermann Oberth, Max Valier, Hermann Noordung (Hermann Potocnik), Arthur C. Clarke, Wernher von Braun, Kurd Lasswitz

V. Chapters 4, 5, and 6

Vocabulary – convalescence, validity

1. Pp. 27-29, and P. 37 what was the role of Thea von Harbou and Fritz Lang in space exploration? (Suggested for Advanced Grades) Why is her apparent political view on Nazism important to be included in the story of space exploration? Does this change our perception of her role in the early days of rocket travel?
2. Pp. 31-38 What was the role of *The Woman in the Moon* in inspiring space exploration? What was accurately predicted? (Students can watch the full movie, *The Woman in the Moon*, here - <https://www.youtube.com/watch?v=IB0--GnGSU>). (The space scenes start about 1 hour into the film!)
3. In *The Woman in the Moon*, the motivation to travel to the moon is for gold. What do you think the motivations are for today’s space exploration? What are the main reasons humanity embark on such a perilous journey?

People to Research – Thea von Harbou, Fritz Lang, Rudolph Nebel

VI. Chapter 7

Vocabulary: cosmism, underpinning, transhumanism, post-human, treason, dirigible

1. P. 41 Analyze the quote about cosmism (in orange) – do you think there is a role for religion (or spiritual values) in space exploration?
2. (Suggested for Advanced Grades) P. 42 Why do you think Fyodorov's views on religion in space were so popular in the Russia of the 1920s?
3. Pp. 41-43 What was the role of Konstantin Tsiolkovsky in space exploration? (Suggested for Advanced Grades) How was his role unique compared to the other pioneers of the 1920s.
4. P. 44 – What is the importance of the relationship between these engineers and authors?

People to Research – Konstantin Tsiolkovsky, Nikolai Fyodorov, FM-2030 (Fereydoon M. Esfandiary), Sergei Korolev, Yuri Gagarin, Alexander Schershevsky

VII. Chapter 8

Vocabulary - projectile

1. P. 47 Look at the title of the chapter and the year. What is your reaction?
2. What was the role of the Society for the Study of Interplanetary Communications in space exploration?
3. What was the “fake news” article in this chapter? Even though fake, what was the impact it had in inspiring others?
4. How did Robert Goddard help inspire Russian space enthusiasts?
5. P. 48 analyze the Perelman quote. Imagine that this was a fake news posting about space exploration today. Instead of being about the first ‘projectile’ to the moon, what would be a space exploration topic of similar excitement for today’s audience that would not be accurate?

People to Research – Yakov Perelman

VIII. Chapter 9

Vocabulary – barometer, avant-garde, post-revolutionary

1. Students can watch the full *Aelita: Queen of Mars* movie here - <https://www.youtube.com/watch?v=yoROo4Ur49c>
2. 1924 is after the establishment of the USSR and communism. How does the movie, *Aelita: Queen of Mars*, mirror this reality?
3. Why did the Soviet government distrust the director and director?
4. How might this movie have inspired space enthusiasts?
5. (Suggested for Advanced Grades) Both in Germany and in the Soviet Union there was a popular film on rocket travel. Why is that important to the author and his recounting of the first steps of space exploration?

People to Research – Alexei Tolstoy, Leo Tolstoy, Dmitri Shostakovich, Pablo Picasso

IX. Chapter 10

Vocabulary – evangelizing, waxing, elixir, habitation, fickleness

1. What was the role of Friedrich Tsander in space exploration?
2. What was the role of journalists to help share information?
3. P. 54 What ideas did Tsander first propose to help further space exploration? (Students can research one of these ideas and present it to the class. Example - <https://www.youtube.com/watch?v=VhWQ-r1LYXY> – this video shows how static electricity can be used to move objects and could be replicated by students).
4. P. 54 – do you agree or disagree with the premise that people living on the moon “could probably construct a habitation in which living conditions would be much better than on the Earth.” And what about the argument that we should be spending all of our public funds and efforts to better living conditions on the Earth? Suggest some supporting arguments for funding space exploration.
5. P. 55. Using visual evidence, what is Tsander’s reaction when meeting with Lenin? Why does Lenin support his efforts?

People to Research - Friedrich Tsander, Nikolai Rynin, Ensault-Pelterie, Vladimir Lenin

X. Chapter 11

Vocabulary – layman, correspondence, kaleidoscope,

1. What was the role of Nikolai Alekseevich Rynin in space exploration? Compare his role with Willy Ley in Germany.
2. P. 57 What would be the benefits in the 1920s of creating an encyclopedia of all worldwide knowledge on space exploration?
3. Students can read the first volume of Interplanetary Communications here - chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://epizodyspace.ru/bibl/inostr-yazyki/rynin/rynin-angl-1t.pdf . Curious students can read the entire volume, but much can be understood just by reading and analyzing the foreword.
4. Analyze the quote by Rynin on Pp. 57-58 (in orange). What organizations are mentioned? What role did they play in space exploration?
5. P. 58 – how did the engineering authors support one another? Why would governments step in to end this international correspondence?
(Suggested for Advanced Grades) Should we encourage international cooperation today in space exploration? If so, with whom? And are there nations today we should not be cooperating with in space exploration and why?
6. P. 59 – what do you notice about this chart? How does it support the idea that international cooperation between engineers is valuable?

People to Research – Nikolai Alekseevich Rynin, Yakov Isidorovich Perelman

XI. Chapter 12

Vocabulary – exhibition, cosmonaut, capitalism, communism, socialism, trajectories,

1. P. 61 Students can research the “*World’s First Exhibition of Models..*” and report back to the class. How did it help push forward efforts to space exploration? What surprised you most about what was presented at the exhibition? Do you think the international cooperation of the 1920s helped to push forward space exploration?
2. What was the role of Ary Sternfeld in space exploration?
3. P. 65 What might the role of companies be in space exploration? Can you think of other roles that would be needed? If you started a space company, what would your company do?

People to Research – Ary Sternfeld, Yuri Gagarin, Robert Ensault-Pelterie, Franz Abdon Ulinski, Henri de Graffigny, A. Ya. Fedorov

XII. Chapter 13

Vocabulary – pragmatist, ecosystem, visionary, ecstatic, astronautics,

1. The title of this chapter is “Finally, a True Space Businessperson” – what do you think this person would do in early space exploration? How would businesses operate in space?
2. What was the role of the Wright Brothers in inspiring space exploration?
3. What was the role of Esnault-Pelterie in aviation? How might this have helped spur space exploration?
4. P. 68 – What were the predictions of Ensault-Pelterie? Did any come true?
5. P. 68 – (Suggested for Advanced Grades) Research the idea of passive thermal control and share your thoughts.
6. P. 69 – Why would governments be needed in space exploration development when it was not needed for aviation? What can the dangers be of governments being involved in this type of research?
7. What if the French had been the first to develop rocket technology? How might history have differed?
8. What was the role of the REP-Hirsch International Astronautics Prize?
9. P. 71 – analyze Oberth’s quote in Orange. Why was the German Hermann Oberth so surprised and happy he was awarded the first REP-Hirsch International Astronautics Prize? Was it the money awarded or something else?

People to Research – Wright Brothers, Joseph Henri Honore Boex (J. H. Rosny)

XIII. Chapters 14 and 15

Vocabulary – futurist, indifference, treatise, feasible, churlish, folklore

1. Pp. 73-74 Why does the author believe that the *New York Times* hindered American advancements in space exploration?
2. Do you believe the *New York Times* treated Robert Goddard fairly? How do you think it made Goddard feel. How would you feel if you were described in a major news site the way the *Times* described Dr. Goddard?
3. How did the New York Times “correct” its earlier article as explained in chapter 14?
4. (Suggested for Advanced Grades) Was it a tongue-in-cheek correction by the editors of the *Times* or is the author suggesting there is another reason to include the ‘correction’ during the historic Apollo 11 landing? Do you believe the ‘correction’ is warranted?

XIV. Chapter 16

Vocabulary – czar, virtuous, ecosystem

1. Infer - What was the impact of the Great Depression on the public’s fascination with space exploration?
2. Pp. 79-82 How is the story of space exploration left at the end of this chapter/book. Predict – what might happen next?
3. P. 81 last panel. Who is everyone looking up to? Why is Tsiolkovsky depicted in this manner?
4. P. 82 second panel. Why is Robert Ensault-Pelterie drawn in this way? Draw a thought balloon and write what he is thinking.

People to Research – General G. Arturo Crocco, Nikolai Ivanovich Tikhomirov

XV. After Reading

1. Revisit your answers to the first question - What are the roles of individuals, private organizations and governments in space exploration? What do you think should be the roles of each? Why? What is the opinion of the book’s author, Jeffrey Manber?
2. What is the status of space exploration today? What is the role of governments and private companies? Do you think the book’s author is pleased by companies like SpaceX, Blue Origin and other private companies or not?
(Suggested for advanced grades) And do you think everyone is pleased by the expanding role of private companies in space exploration. If not, why not? And what about in other countries? Do you think other countries will let companies be involved in space exploration?

4. Most of the pioneers in this book are from European countries. Why do you think they are overwhelmingly men. How hard do you think it was for women to be rocket pioneers in the 1920s? Do you think this is still true today?

Research the author of this book. Why do you think he wrote this book? If you could interview him, what would you ask? Some resources on the author:

https://en.wikipedia.org/wiki/Jeffrey_Manber

https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/ISS/ManberJ/manberj.htm

<https://www.youtube.com/watch?v=jWDS9zc2mLI>

4 Students can research the history of space exploration timeline, using pictures to depict important events. These can be photographs and original illustrations.

5 Students can be a space exploration entrepreneur and give a name to their own company.

(Suggested for Advanced Grades) Put together a sales pitch to potential investors as to why they should invest in your space company.

6. Reimagine one of the first pages where there are seven people illustrated – are these the seven you would choose to depict the most impactful on space exploration in the 1920s? What if you could only keep three? One?

7. Draw a sample comic page from the next book in the series that will focus on rocket development from the 1930s and 1940s.

8. Draw the cover of the next book.

9. Explore the companion website to this book - <https://fromtheearthtomars.com/> - what do you notice, think, wonder?

10 People to research – students can choose/be assigned one the space pioneers from the book and create a biography and comic or turn them into a superhero. See the below templates or have students create their own.

In the large box, have students draw their historical person or they can use an online tool such as <https://charactercreator.org/> . Students can also use a picture of their person and manipulate it in PowerPoint, Photoshop, etc.

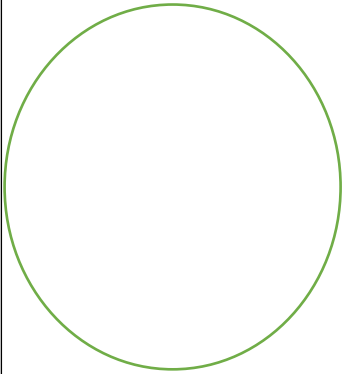
Name:

Class:

Name:

Actions Achieved to Advance
Rocket Travel:

Biography:



Story:

