

***Rocketship Galileo* Lesson Plans**

By
Robert James, Ph.D.

Introduction:

Rocketship Galileo is the first of the juveniles Robert Heinlein wrote from the late forties through the early sixties. The series is widely regarded as the finest science fiction ever written for young people; many, including Grandmaster Jack Williamson, believe them to be the best science fiction Robert Heinlein ever wrote. Heinlein himself felt that this was not a perfect book: “*Rocketship Galileo* was a fumbling first attempt; I have never been happy with it...I cringe whenever I think of its shortcomings.”

Although Heinlein had become a master of science fiction as it was published in the pulp magazines prior to the war, this was his first fiction after returning home from naval weapons research in Philadelphia during WWII. There was bound to be a little creakiness in using creative muscles for the first time in years, but when you add in that his marriage to his wife Leslyn was cracking apart due to her alcoholism, that he was convinced a nuclear war was a serious danger to civilization (and he was writing his “world-saver” articles as he tried to educate Americans on the new realities), and that he was writing for the first time for boys – and in a form of science fiction that hadn’t been done for decades, and a form that he wanted to update to the standards of his adult science fiction – well, it’s a wonder that it is as good as it is. It is only in comparison with the later juveniles that *Rocketship Galileo* has any cracks at all in it; compared to what came before it (primarily the venerable Tom Swift series of the early twentieth century), it’s downright revolutionary. The Tom Swift books featured a young scientist, with a new invention in each book. The Tom Swift series first began in 1910, when Heinlein was three; he had read many of them as a boy, and specifically named the series as his main precedent in writing what he thought would become a series about the same characters: *Young Atomic Engineers and the Conquest of the Moon*, followed by going to Mars, then to the asteroid belt, and so forth. Heinlein’s juveniles would prove to be so immensely successful that the owners of the rights to Tom Swift began an entirely new series in 1954, concerning the young son of the original character, Tom Swift, Jr. Other science fiction authors would follow Heinlein into writing stories for boys, including Lester Del Rey, Isaac Asimov, Gordon Dickson, and others. In what must be the most stunning validation of any author’s purpose in writing, many of the engineers and astronauts who created America’s space program credited Heinlein’s juveniles for inspiring them to want to go to outer space.

And this was Heinlein’s entire reason for writing for them, beyond branching out from the pulps after WWII. He intended them to be the Horatio Alger books of the new generation, to train young men in the values and attitudes of being American, while also showing them that intelligence, science, moral standards, and hard work were to be highly valued, above all else. Anyone caught by the adventure of Heinlein’s stories would necessarily imbibe the lessons Heinlein place there: be smart, learn as much as you can, do the right thing, work hard, and dream big!

And *Rocketship Galileo* begins with the biggest dream of Heinlein’s life: building a rocket to go to the moon! Writing this book went hand-in-hand with Heinlein’s success

in convincing Hollywood to make a realistic, science-based movie about traveling to the moon. *Destination Moon* would be one of the biggest successes in the film industry in the early fifties, spawning a whole slew of imitators, and sparking a wave of science fiction films. The movie is very loosely based on this book, which makes it very important indeed, as *Destination Moon* played a critical role in educating America about the prospects of traveling to outer space, which would become a reality in less than a decade.

We hope you find the following lesson plans helpful, and that you will choose *Rocketship Galileo* or another Heinlein work to use in your classrooms. We would like to hear from you about your own experiences using Heinlein's works. Please email us!

Edition Used:

As of the writing of these lesson plans, a very rare thing has occurred: *Rocketship Galileo* is out of print. Occasionally, this occurs, but given that there is no paperback edition available, I will be using my well-thumbed Ace paperback edition, for sheer nostalgia's sake.

Date of Publication / Dedication:

The novel was written in February and March 1946, and published on October 15th, 1947.

The novel was dedicated to Colin and Matt Hubbard, Heinlein's nephews by marriage to marriage to Leslyn, his second wife. Colin Hubbard went on to become a pediatrician, and Matt became a college counselor. In an interview with me, Colin recalled reading the book and not liking it as well as some of Heinlein's other work, because it was "too Tom Swift." The novel was also dedicated to Buddy, who was []

Chapter Summaries / Discussion Notes:

Each chapter will be summarized, and pertinent details and issues explicated. Any of the details might be turned into extra credit questions, which require the student to do research on the internet or in a library. Heinlein often inserted historical, scientific, and literary references into his novels, as a way of gently urging the reader to explore these references. Vocabulary words which students may have difficulty with will be suggested, with particular attention paid to words Heinlein invented (which, unless we've adopted the word, won't be found in a dictionary).

I strongly urge that students learn vocabulary not by checking the dictionary, but by the following procedure: 1) say the word aloud (this begins to fix the word in long-term memory); 2) look for roots (Spanish speakers often have an advantage here, since the longer Latinate words in English often have a simple Spanish root, as in the word "facilitate"; 3) use context to make TWO guesses as to what the word means; 4) then, and only then, check the dictionary. Students need to be reminded to learn new vocabulary words, because they will often choose to simply skip the word they don't know, or in running to the dictionary, will fail to permanently learn the new word as they only place the definition into short-term memory. I require my students to learn at least seven new

words a week; in this, Heinlein is very helpful, because he actually used a more sophisticated vocabulary in his juveniles than in his adult fiction. If teachers do not encourage students to acquire the new vocabulary, students often have a hard time with Heinlein's juveniles for precisely that reason: they are more difficult than today's more controlled, simplistic vocabulary in most young adult novels.

CHAPTER ONE

The novel opens with a bang. Literally.

Ross Jenkins, Art Mueller, and Maurice Abrams hide behind a concrete wall. They are about to test a rocket they have built. There is a countdown to launch, which is one of the first (if not *the* first) one in American literature. As the rocket fires while it is captive on the testing stand, the boys watch the instruments, and take film of the test. Ross hears that the sound of the rocket turns to a dangerous sound, and tries to warn Morrie to get down; when Morrie can't hear him, Ross tackles him. As they begin to argue about it, the rocket explodes in a blinding flash of light. After some bickering, Art reminds them they will just build another one, and that the film he took will help them improve their rockets. They inspect the rocket, then cover up their equipment and prepare to head home.

Before they get far, they find the body of a man. They check, and he is still alive. They are worried this will be the end of their rocket experiments. They worry about a law suit, and Art in particular is worried that a lawsuit would ruin his mother; then Art starts to get angry, and wonder why the intruder didn't bother reading their warning signs. Then Art recognizes the man as his uncle, the atomic expert, Dr. Donald Cargraves.

CHAPTER TWO:

Art isn't quite sure it is his uncle. The ambulance arrives. The boys begin to wonder why Dr. Cargraves was there. Ross's father arrives, having heard the explosion. Art can't remember his father, and he compares Ross's calm father with Morrie's boisterous one. They talk about their feelings about the accident, and Art is embarrassed because he was only worried about his mother being sued. One of the moral lessons Heinlein hoped to teach his readers: "...the test is in what you do, not in what you think." Ross says this is his Dad's belief; Art then counters with "wrong ideas can be just as bad as wrong ways to do things." What Heinlein is doing is quite unusual: rather than pontificating, he introduces an opposing idea into the discussion, thus bringing up what the point of a democratic society, and human maturity is: the free and fair exchange of different ideas. Quite an unusual event in a book written for boys.

Dr. Cargraves is not seriously hurt. He isn't going to sue.

Art goes home to tell his mother what happened; she isn't mad, largely because Art can do no wrong in his mother's eyes. Morrie's father isn't worried; lawsuits are what lawyers are for.

The boys go back to the test pad the next day, after calling the hospital to check on Dr. Cargraves, who is fine. They are going to go see him that afternoon after checking on their rocket, the shattered *Starstruck V*. They want to gather the pieces in order to try

and figure out the explosion; the film of the event hasn't been processed yet. Dr. Cargraves shows up, a bandage around his head. Dr. Cargraves explains why he was at the test site yesterday: he had heard about the boys Galileo Club, and wanted to see the test on the rocket. When the boys protest that their rocket is just a model, to which Dr. Cargraves passes on another nugget of Heinleinian wisdom: "A new model of anything can be important, no matter who makes it or how small it is." The boys show Dr. Cargraves around their work, and Art is very proud that his uncle is one of the greatest scientists in the world.

Heinlein then lays out what seems to be a commonplace observation, for the boys of his generation: "It is common enough in the United States for boys to build and take apart almost anything mechanical, from alarm clocks to hiked-up jaloppies. It is not so common for them to understand the sort of controlled and recorded experimentation on which science is based." What Heinlein is hoping to do here is to connect with his audience's love of tinkering, and make them embarrassed enough to want to learn the more difficult, rigorous means of science. In 2010, what is terrifying to anyone concerned with the strength and capacity of the next generation (as Heinlein so clearly was in the 1940s), is that the first part of that equation is gone. Boys don't tinker in America the way they used to. Videogames, computers, and the dizzying complexity of most of the electronics that run our cars and even our appliances have all contributed to the decline of mechanical ability in the boys of this generation. As a teacher of inner-city boys, I can tell you that twenty years ago, most of them could still take a car apart and put it back together. That is no longer true, because computers now run cars. The kinds of toys we give to our boys simply don't encourage tinkering: Gameboy and Wii can't be disassembled and reassembled. In the fifties and sixties, the number one hobby for boys was making models, a hobby I and all my friends were obsessed with: when you add in erector sets, chemistry sets, and all other kinds of do-it-yourself hobbies that very few boys participate in today, and what we have is a recipe for cultural and technological disaster. The Heinlein juveniles can be one tool in fighting that, since they have a tendency to lead boys to wanting to do the things that happen in the novels.

The boys explain why they are working on the rockets; they want to enter the competitions soon. Dr. Cargraves is very impressed. The boys explain how they used the metal shop to make all their parts. Dr. Cargraves is impressed that the high school has such equipment, and Heinlein sticks in a plug for the kind of school he thinks America should have: "It's a mechanical-arts-and-science high school and it has more courses in math and science and shop work than most." Today, we do have charter schools focused on science and math, but few, if any, have shop classes. Shop classes are vanishing all across the country, due to a shift to college preparation, and because they are expensive programs to run (insurance, primarily). So, in one sense, we have headed in the direction Heinlein wanted, but we have abandoned the other prong.

The boys explain how they had built a telescope the previous year; it was Morrie's obsession. Ross is into chemistry and rocket fuels. Art is into radio and camera work. What Heinlein has done here is taken several of his own interests and spread them into the different boys. His childhood obsession, and one of his purposes in going to the Naval Academy, was to become an astronomer; he spent much of his spare time before WWII with a camera, and he also knew ham radio. His greatest lifetime goal was to get to the moon, and he spent much of the forties and fifties pushing America towards space.

Dr. Cargraves tells Art that he snuck into Art's basement and looked at his things down there; he tells Art it is a real, working laboratory. Ross's father taught the boys to keep notebooks, as all good scientists do, in order to keep track of their experiments. Ross's father used to look over them, until he was sure they had the idea.

They decide that they're going to look for the piece of the rocket that hit Dr. Cargraves. It turns out that there isn't a piece missing, and that, in fact, Dr. Cargraves couldn't have been lying on his face if he was hit from the rocket.

They go back to their clubhouse. They wish they had air conditioning, because it would help in their experiments. They explain that they haven't, because they are all going to college the next year (a tech school). There used to be other members in the Galileo Club, but they went on to school or the military or other things. Dr. Cargraves realizes it would be hard to find others who were serious scientists like them. Heinlein then slips another set of enticements into his narrative: the books the boys are reading include Jules Verne and H.G. Wells, pulp science fiction magazines, H. Rider Haggard, Willy Ley (a friend of Heinlein's and early rocket advocate), and various science and engineering manuals (including a fictional one, based on the Smyth Report on atomic energy). Heinlein knew some boys reading his tale would track down those books. Dr. Cargraves feels like he is looking back into his own past, since he was once one of those boys.

Ross's mother invites them all to lunch. They discuss atomics, and the boys are surprised at how much Ross's father knows. In a comic note reminiscent of Twain's comment about his father, Heinlein notes: "They had the usual low opinion of the mental processes of adults." (Twain said "When I was a boy of fourteen, my father was so ignorant I could hardly stand to have the old man around. But when I got to be twenty-one, I was astonished by how much he'd learned in seven years.") Dr. Cargraves has recently lost his position with General Atomics.

After lunch, the boys and Dr. Cargraves go back to the clubhouse, where he talks to them about the Manhattan Project and what it was like developing the atomic bomb. Dr. Cargraves asks them what they know about atomics, and grills them on their level of math knowledge. Morrie explains that math is purely fictional, an "invention of the mind", except where it happens to explain the world.

Dr. Cargraves then stuns them with an offer: to go to the moon with him.

CHAPTER THREE:

The boys all want to go to the moon. Dr. Cargraves wants to explain what he wants, before they agree. Dr. Cargraves makes them promise not to tell anything he is about to reveal, unless there are "moral or legal reasons why you should." Dr. Cargraves relates his education and career, including his hopes for an atomic rocket. Dr. Cargraves then explains how rockets and atomic power work. Clearly, Heinlein has worked out the science as well as anybody in the world could have in 1946. Dr. Cargraves then explains that he couldn't convince his employer to finance a trip to the moon, because nobody could figure out a way to make a profit from the enormous cost (a million and a quarter was a huge amount of money in 1946, but still, far less than Apollo ultimately cost). They discuss the various prizes out there, and explain that nobody has gone for them because they won't pay the expenses it would take to get there.

Dr. Cargraves has a ship, an “Atlantic freighter-rocket.” He has just enough money to buy that. He can get the atomic materials as well. What he needs, and can’t pay for – is labor and a crew.

And that’s where the boys come in.

They definitely want to go, but how will they ever convince their parents?

CHAPTER FOUR:

Dr. Cargraves knows that he is asking a lot of the boys, because it means changing their life plans. They have to keep it all secret as well, because he is afraid somebody will steal his idea for space travel. The boys ask him to speak to their parents, so they will take the project seriously. Dr. Cargraves begins with his sister, Art’s mother. She doesn’t want to let Art go, because she’s lost her husband (a German scientist who refused to knuckle under to the Nazis, and who was put into the concentration camps; he was released because his wife was American, but it ruined him). Dr. Cargraves convinces her this way: “We have a tradition of freedom, personal freedom, scientific freedom. That freedom isn’t kept alive by caution and unwillingness to take risks.... You owe it to his son not to keep him caged.” She agrees.

Morrie talks to his father; his father insists on him waiting a week to think about it, and if Morrie still wants to go then, he will allow it.

Ross’s father asks Dr. Cargraves to come over and discuss the project. Ross’s father doesn’t think it’s right that Dr. Cargraves is asking boys to do this. Dr. Cargraves points out how young most of the scientists were at Los Alamos, and that Newton was very young, and so was Einstein, when they made their primary discoveries. Ross’s father is an engineer, and Dr. Cargraves asks if he recognizes how well-trained the boys are. They engage in an interesting argument, particularly given how the Apollo program happened (Heinlein didn’t foresee the space race, or the effect JFK’s assassination would have on the space program): “But space flight is not a backyard enterprise. When it comes it will be done by the air forces, or as a project of one of the big corporations, not by half-grown boys.” Dr. Cargraves responds by telling him that “The government won’t do it. It would be laughed off the floor of Congress.” Heinlein had already tried to get the Navy, and the US government, to invest in a rocket program, and had failed. While there would be some rocketry program run by the government, it was largely based on the captured German V-2 scientists, and poorly financed, and heavily restricted. What is remarkable is that Heinlein then predicts that the Russians are the most likely ones to get to the moon. This was written in March 1946, at a time when the Russians had displayed little or no capacity to match America’s technical ability, although their tanks were the best in the world at that point. Heinlein would be entirely wrong about how we got to the moon, but it is remarkable that he foresaw the Russian fascination for the possibilities.

Ross’s father is very unhappy about the boys going. He makes a remarkable offer: he himself will pay for the workers and the crew. Dr. Cargraves says that he would have gladly accepted his offer, but now that he has offered it to the boys, he is committed to them. He won’t “welch on the proposition.”

Ross’s father’s objection is actually not the danger; it is the interruption to his education. Dr. Cargraves offers to be the boys’ teacher. The answer is still no. Ross works out a deal with his father to be allowed to work on the rocket, since that won’t

prevent him from going to college. Ross's father agrees. Then Ross's mother intervenes, because it would be a betrayal of her pioneer ancestors: "I would hate to think that I had let the blood run thin." Ross gets to go.

CHAPTER FIVE:

Art and Ross are driving out to the construction site in the desert. Ross pushes the speed up to near one hundred, and Art suggests that dying in a car crash isn't a good idea. The area they are going to is a former training ground for WWII combat, and Dr. Cargraves has it rent free.

A ranger meets them at the gate, and tells them that a man was killed inside by a mine when he was illegally trespassing. The ranger tells them to stay only in the designated area, and then he asks what they're going to be doing. The boys joke about raising eight foot tall jackrabbits. He hands them a telegram about Dr. Cargraves and Morrie getting their rocket pilot's license. Art is jealous.

Their compound is near a vast expanse of green glass – the "1951" explosion site of "the UN's Doomsday Bomb." Heinlein himself had a piece of such glass from the first A-Bomb explosion, at the Trinity site. He kept it in a lead lined film pouch, because it was still radioactive. Art and Ross talk about how atomic war could ruin the world, and then they mention the "UN police" and that "Wars are out." Heinlein believed in one world government, at least at this point in his life. Later, after he had toured the world, he changed his mind. His next novel, *Space Cadet*, would explore this idea of a world state, and world police, preventing war through the control of nuclear bombs.

Art and Ross start cleaning up the cabin, and making lunch. The next morning, they pour the concrete floor and begin assembling the machine shop. Some of the boxes of equipment have been broken. Dr. Cargraves and Morrie arrive, landing in the rocket ship. Morrie made the landing. Art is going to make the moon landing, because it will have to be by radar. Dr. Cargraves has been in Washington, clearing up all the bureaucratic paperwork. Dr. Cargraves hears about the broken crates, and thinks there might have been sabotage from the dead man. They decide to rig up a security system around the ship and cabin.

Dr. Cargraves tells Morrie he will be second-in-command, and Morrie worries about Art's feelings, and Dr. Cargraves says Art is just upset about not getting rocket training. Dr. Cargraves tells Morrie he would rather have Ross as second-in-command, because Ross is "less flighty" [no pun intended...I think]. Dr. Cargraves says "American boys are brought up loose and easy" but that they need to "be willing to obey." This is like the same conflict between Heinlein's libertarianism, and his valorization of service in the military. The difference is, one can choose when it is time to obey – and Morrie recognizes that, and does what he was told to do. Dr. Cargraves reminds himself to talk to Art later.

CHAPTER SIX:

The space suits arrive. The boys are so excited, Dr. Cargraves realizes that no work will get done until they get to try them on. Heinlein then explains how spacesuits work, including the de Camp joints, designed by his friend and fellow science fiction

author, L. Sprague de Camp. Yes, a science fiction writer had a major impact on the development of the space suit. Heinlein then explains radiation, and how atomic power works. The boys jack the rocket around so that the rocket is safely positioned away from the cabin. Dr. Cargraves warns them about the atomic material coming, and how to take the proper precautions. Art is made medical officer, and has to keep track of their radiation exposure. Dr. Cargraves decides he needs to get a gun, in case they get another break-in. Art wakes up Dr. Cargraves at 3 am, because their security system has been tripped. Dr. Cargraves investigates, to find the ship door open. He wishes he had bought a gun. He doesn't find anything.

Dr. Cargraves buys 2 rifles and a handgun, and food supplies for the moon trip. He also buys rhubarb plants, to help recycle oxygen.

On returning, Dr. Cargraves discovers that a phony inspector showed up at the site. The inspector managed to ditch the boys long enough to be alone in the ship, but he didn't notice any damage. The chain to open the gate has been tampered with, however. That night, they try and figure out what the intruder wanted. They decide to protect their power supply, and then they have to study. That night, there is an explosion.

CHAPTER SEVEN:

The explosion has blinded Ross. The thorium has come, and Dr. Cargraves wants to send it back. Cargraves is hurt as well, particularly his ankle. They get Cargraves out of the ship, and back to Ross in the cabin. All Ross can see are purple and green lights. They take Ross and Cargraves to the hospital, and it turns out there is no permanent damage to Ross's eyes. Doc has a sprained ankle and a wrenched back.

Cargraves wants to end the moon shot. He says he had no business bringing the boys into this affair. They take his temperature, and claim he's running a fever, and so isn't in charge any more; Morrie is. The boys took possession of the thorium. Dr. Cargraves says that they still need him to build the atomic drive, so they aren't going. The boys insist that they are going.

Dr. Cargraves explains that their rocket never hit him; somebody slugged him. Now he realizes that some group is out to stop his flight to the moon. Ross insists that he is still going to the moon, blind or not. The boys continue with their routine, including studying.

The next morning, Cargraves investigates the ship. He finds six pieces of explosive, which were not set off. The saboteur didn't have time to wire more than one of his devices.

Ross apologizes for the previous night. Ross says he is starting to be able to see. Cargraves has changed his mind: they're going to the moon.

CHAPTER EIGHT:

The boys want to know how much longer it will take to be ready for takeoff. Cargraves says not long; he just needs to put all the piece together. Cargraves explains how his atomic engine works. They decide to move ahead as fast as possible, They set up night watches to guard everything. They continue working on the ship.

Ross's eyesight is almost back to normal. Mail comes. They run into a snag, as the testing equipment they need isn't available. They then argue about names: *Starstruck*, *Moonstruck*, *Pioneer*, *Thor*, *Einstein* – and they decide on *Galileo*.

The dynamometers aren't available; Morrie and Doc argue about what to do next, with Morrie volunteering to run the test from inside the ship, or even test-flying it. Doc decides he is going to test fly it himself. Doc tells the boys to wait outside camp, and he hands them papers to give to Ross's father if he dies.

The test flight goes perfectly. They decide to leave first thing in the morning. Art will notify the media, so they will get coverage.

Everybody is ready to go, but tired. The ranger shows up, and sets up security. The press starts to arrive. A stranger shows up with a court order to stop the flight, but Cargraves points out that it is a state order, but they are on federal territory. They wonder if he is a phony too, and keep him under control.

They take off!

CHAPTER NINE:

The takeoff is described in beautiful detail, and it is quite remarkable how accurate Heinlein was, particularly in the feelings of takeoff with the g-forces pressing down. Art feels sick, but then it gets better. Free fall is explained, as is speed. The problems of navigation are discussed. Heinlein perfectly predicts how many days it will take to get to the moon: 3 days. He explains the difference between gunnery and rocketry. They talk about sleeping, and eating. There is a bit about not having a can opener (this is a bit straight out of one of Heinlein's favorite books, Jerome K. Jerome's *Three Men and a Boat*). They eat and fall asleep.

Heinlein slips in one of his classic touches by saying there are 51 states.

Art watches the beauty of the moon and stars when he gets homesick.

CHAPTER TEN:

Art is joined by Cargraves, and they both talk about how they wouldn't want to go to the moon alone. Cargraves also notes the irony that the first thing people do when they travel is go find something to do in the new place that they can do at home. Art wants to take a picture, but Cargraves suggests waiting for pictures of the Earth (another prescient guess: the shot of Earthrise is the single most requested picture of the Apollo years.) They discuss Cargraves' proposition that there might not actually be a back side of the moon, since nobody has ever seen it. This is an opportunity to display scientific thinking, and how "common sense" can so often turn out to not be true.

"Proof comes from experiment" and "experience."

Heinlein slips in another idea that he would play with further in later fiction: "It's part of the pattern of fictions I live by, but that doesn't prove it's right."

Cargraves makes them study, even on the way to the moon. Without books, he teaches them verbally: "A school is a log with a pupil on one end and a teacher on the other." Art has to describe a cyclotron, Ross a radioactive series.

As they are about to enter free fall for the first time, they switch to food that won't upset their stomachs, in case they get spacesick. And they do suffer. Dr. Cargraves flip the ship, and they see the Earth for the first time from outer space.

Art takes pictures of the sun and Earth. Cargraves is worried about exposure to the sun, and rolls the ship to radiate the built up heat. They decide it's time to contact the Earth, through their radio. They get a recorded message and realize that the whole world knows about them.

CHAPTER ELEVEN:

They reach the point where the Moon's gravity is stronger than the Earth's. Weight returns as the jet comes on to decelerate them. As they see the craters, Morrie suggests they were caused by a nuclear war by the moon people. They get ready to land. They almost crash. Cargraves again wishes he hadn't come to the moon with minors, and he wants to go back. Morrie lands the ship.

CHAPTER TWELVE:

The boys want to get out their spacesuits. Cargraves almost trips in the 1/6th gravity. Morrie tries to figure out what longitude and latitude would be on the moon. Cargraves explains what happened in the landing. They get ready to go outside. Cargraves and Art go outside; Art has forgotten his camera. Cargraves realizes he smells bad; Heinlein was correct in this prediction as well: astronauts stink. They explore, and Morrie starts acting crazy, and then passes out from oxygen deprivation. Cargraves gets him back to the ship in time, however. Morrie recounts what he thinks might be hallucinations, with a piece of metal with a hole in it, and a little man. Cargraves sets the boys to creating a way to make sure what happened to Morrie never happens to anybody else.

CHAPTER THIRTEEN:

Cargraves goes out with Art and Ross, to keep an eye on them, and to look for the piece of metal Morrie thought he saw. They get ready to contact the Earth, and to set up a small shelter called the Dog House. The Dog House is a first step towards colonization. They plant the flags of the United Nations and the United States and claim the moon. Ross says "Man isn't a collection of chemical reactions; he is a collection of ideas." For Cargraves (and Heinlein) this is a sign of "growing up." They talk about exploring, and set up to receive radio transmissions from Earth. This is when Art discovers there is a radio source very, very close to them.

CHAPTER FOURTEEN:

They try to figure out where the radio source came from. They contact the source, and begin a conversation. They are told to stay where they are. A rocketship shows up, only to destroy the *Galileo*.

CHAPTER FIFTEEN:

The boys and Cargraves are furious. Art is told not to turn on his radio again. They plot to attack their attackers when they land. But their attackers don't land on the first pass, but they return. When their attackers land, and three of them go to enter the *Galileo*, Cargraves enters the attackers' vessel, and Cargraves tackles the only man left aboard. The boys take out the other attackers. They are happy that they have a ship to get home in – until they realize it's only good for local hops.

CHAPTER SIXTEEN:

They investigate the ship, and it doesn't have any range other than local trips. They interrogate their prisoner, in German. The man claims they are at war, and so the attack was allowed. The prisoner reveals there is an underground base nearby, and a ship capable of going to Earth. They are Nazis, and the Third Reich is still at war. They were the cream of the crop of the Third Reich, and had a secret mountain base from which they operated on Earth (actually, this was one of the great fears of the Allied Command in Germany towards the end of the war – there was a real fear the Nazi leadership would retreat into a mountain fortress, and hold out there until the Allies stopped the war out of frustration).. They had been on the moon for three months, and planned world conquest. The Nazis had atom bombs, and planned to use the moon as their base to take over the world with the threat of nuclear holocaust.

The discovery of Nazis on the moon sometimes provokes snickers from readers and critics of this novel. I actually think it isn't that far-fetched. The Nazis were the world's foremost rocket experts; von Braun's intent all along had been to get to the moon. Given time, and enough resources, the plot of this novel was at least possible, if improbable. If *Raiders of the Lost Ark* can have Nazis find the Lost Ark....

The boys and Cargraves realize they have to stop the Nazis on the moon. They realize there is no time to waste, because very soon, the Nazis will know their ship is missing. The main Nazi rocket is called the *Wotan*. Morrie uses the Nazi ship to blow up their base. They land near the *Wotan*. Cargraves and Ross and going to investigate the *Wotan*. If they don't come back. Morrie is to bomb the *Wotan* and Art is to find a way to contact Earth and warn them. They find nobody aboard the *Wotan*, which turns out to be a ship made in America (the Nazis bought it much as Cargraves bought his, then converted). They investigate the hideout – the Nazis are all dead, but more importantly, they discover the homes of the original moon people!

CHAPTER SEVENTEEN:

Cargraves and Ross don't have time to explore the idea of the moon people building the underground lair, because they need to get back to the others, or Morrie will blow up the *Wotan*. They find the radio room, and two hundred nuclear missiles. Cargraves finds a man still in his suit, dead or unconscious, and takes his gun. Cargraves takes the man along. They exit, and Ross is sent to get the others. Cargraves takes the man to the ship, and removes the space suit. The man is still alive, and Cargraves works to revive him. The boys arrive, and Morrie wonders why they should try to revive him

(Morrie is Jewish; the man is a Nazi). Art wants to go take pictures of the moon people ruins, but Cargraves wants to get them back to Earth. Morrie ties the prisoner up. Cargraves sends two of the boys to get the other prisoner, because they need him to explain how the *Wotan* works. They interrogate the prisoner, von Hartwick. He dithers and prevaricates; he claims the Nazis have allies in high places, including Washington. They find out that the Nazis were behind the sabotage on the *Galileo* in New Mexico.

The boys come back with the captured pilot. Von Hartwick snatches the pistol from Cargraves, and shoots the pilot before he can explain to the Americans how to fly the *Wotan*. Von Hartwick knocks Cargraves out, and holds the body up. Von Hartwick drops the pistol, and surrenders to the boys. Ross wants to kill him, but Morrie won't let him, because Cargraves wouldn't like it. They tie him up. They tell von Hartwick they will kill him if Cargraves dies. Von Hartwick says they are all dead anyways, because nobody can pilot the *Wotan*.

CHAPTER EIGHTEEN:

Cargraves wakes up; he tells them to throw von Hartwick into the hold, and that he will be put on trial back on Earth – for killing the pilot. They can't figure out the ship, and they can't find the control manual. They are going to explore the Nazi lair, when Art remembers he left his camera in the Dog House. They search the lair, and Art finds a new camera. They realize another ship must be on the way, because there isn't enough food for all the men who were here. They find records that show where the Nazis are on Earth. They also find out von Hartwick knows how to fly the *Wotan*. A supply ship is on the way; they have more than one rocket capable of going to the moon: the other one is the *Thor*. Cargraves realizes he has to do something fast about the nuclear missiles, because the *Thor* is on the way.

CHAPTER NINETEEN:

Cargraves and the boys eat, and he tells the boys to follow his lead with von Hartwick. He tells the Nazi he is going on trial immediately, here on the moon. Von Hartwick defends his actions, and says the Third Reich owns the moon. Cargraves tells him that isn't possible, because there is no Third Reich. He is on trial for murder and piracy, for what they did to the *Galileo*. The Nazi has nothing to say in his defense; he is found guilty. The sentence is death. Cargraves tells him they will have to kill him, so they can be free to destroy the missiles, the *Wotan*, and the *Thor*. Von Hartwick is shaken up by this. They get ready to space him, and von Hartwick finally cracks and explains how the *Wotan* works. They fly back to Earth, and warn the UN. The Nazis and the *Thor* are captured. They return to Earth as heroes.

Chapter Tests / Quizzes:

Personally, I do not care for many published textbook tests/quizzes, as I often find them to not fit what we have actually discussed in class, or what the students have themselves found in the text. I therefore tend to make up my own quizzes and tests, and I also rely heavily on questions about relationships, more than I do questions about specific details of the books. I teach very poor readers, and I am far more concerned that they understand what is happening between the characters, than I am in what color shirt a particular character is wearing, or some other pithy little detail that teachers dealing with very good readers might ask to make sure that their students have read. I check to make sure they've read by insisting that they answer the following kinds of questions using specific details (and by always asking a question about the end of the chapter), but I allow them to choose the details themselves to fit the question. I train them to answer questions this way by giving them several sample questions, then answering them on the board, using their input to craft a model response. I hope that the following questions are useful for quizzes and tests, as well as for classroom discussion. Again, I expect students to use specific details from the novel to answer these questions. If the extra credit questions seem appropriate for your class, you can add them to the quizzes, or use them as extra credit homework assignments.

CHAPTER ONE:

1. What are the three boys trying to do?
2. What happens to their experiment?
3. How do they respond to failure?
4. What bigger problem presents itself on the way home?
5. Who is the man?

CHAPTER TWO:

1. What is the boys' education like?
2. What does Dr. Cargraves offer the boys at the end of the chapter?

CHAPTER THREE:

1. Explain Dr. Cargraves' plan to go to the moon.

CHAPTER FOUR:

1. Explain what happens with each of the boys when they ask for permission to go to the moon.

CHAPTER FIVE:

1. What odd thing happened at the site before the boys got there?
2. What damage do they discover?
3. Why did Art get jealous of Morrie?
4. Why does Dr. Cargraves choose Morrie to be second-in-command? Why does he worry about that decision?

CHAPTER SIX:

1. What preparations do they make for the trip?
2. What phony do they encounter?
3. What bad thing happens at the end of the chapter?

CHAPTER SEVEN:

1. How did Ross and Cargraves get hurt?
2. What does Cargraves no longer want to do? Why not?
3. What does Cargraves discover on board the ship?
4. What decision does Cargraves reverse?

CHAPTER EIGHT:

1. How does the test flight go?
2. What almost stops them from taking off?

CHAPTER NINE:

1. What is it like in outer space?
2. What conflicting emotions is Art experiencing?

CHAPTER TEN:

1. What problems do they encounter?
2. What do they get to see for the very first time? How does that make them feel?
3. What happens when they contact the Earth?

CHAPTER ELEVEN:

1. What does Morrie suggest might have caused the craters on the moon?
2. What almost happens the first time they try to land?

CHAPTER TWELVE:

1. Who is the first man to step on the moon?
2. What did Morrie think he saw?
3. What happened to Morrie?

CHAPTER THIRTEEN:

1. What do they set up on the Moon?
2. What do they then plant on the Moon? What does this mean?
3. What do they discover at the end of the chapter?

CHAPTER FOURTEEN:

1. What happens to the *Galileo*?

CHAPTER FIFTEEN:

1. What happens when the attacker ship lands?
2. What do they realize about the attacker ship when they take it?

CHAPTER SIXTEEN:

1. What evil plot do they uncover on the moon?
2. What secrets do they discover from their interrogation?

3. How do they stop the Nazis?
4. What surprising secret do they discover inside the Nazi hideout?

CHAPTER SEVENTEEN:

1. Who are the two prisoners?
2. What does one prisoner do to the other one?
3. Why does he do that?
4. What happens to Cargraves?
5. What problem do they have at the end of the chapter?

CHAPTER EIGHTEEN:

1. What do they find in the lair?
2. What is due to arrive soon?
3. What problem does Cargraves realize has to be solved very, very soon?

CHAPTER NINETEEN:

1. How do they convince von Hartwick to show them how to pilot the *Wotan*?
2. How does the book end?

Extra Credit Questions:

CHAPTER TWO:

- p. 25: Who were the Quiz Kids?

CHAPTER EIGHT:

- p. 27: What is Heron's turbine?

CHAPTER TWELVE:

- p. 128: What is the *Danse Macabre*?

- p. 130: Who was Nijinsky?

CHAPTER SIXTEEN:

p. 155: Why call the Nazi ship the *Wotan*?

Vocabulary Words (these are all words I've had students ask me about):

- p. 7: venomous, stub, illuminated, periscope
- p. 8: barricade, dynamometer
- p. 9: millimeter, modification, cantankerous, audible, snarling, goon
- p. 10: recalibrate; rack-and-pinion
- p. 11: tarpaulin
- p. 15: lamed
- p. 16 taciturn; lavish
- p. 17: soothed
- p. 18: barricade; ricochet
- p. 19 jalopies
- p. 22: linoleum; humidity
- p. 24: anachronism
- p. 25: fuddy-duddy; differential equations; quantum theory; wave mechanics
- p. 31: emphatically; squawk; vehemence
- p. 32: fissionable
- p. 34: venture
- p. 37 enterprise
- p. 39: welch; proposition
- p. 42: Conestoga wagon; homesteaded
- p. 43: decontaminated
- p. 47: pre-fab
- p. 49: fretting
- p. 51: aniline; nitric
- p. 52: thermocouples
- p. 54: stratosphere
- p. 60: c-rations; k-rations
- p. 66: peevishly
- p. 69: technicality
- p. 80: steadfast; gallant
- p. 84: trajectory
- p. 100: humdrum
- p. 103: invariability; librations; eccentricity
- p. 112: crescent; obscured; beckoning
- p. 113: vantage; brooked;
- p. 119: conoid
- p. 127: dun; oblique; impromptu;
- p. 132: anoxia
- p. 137: canisters; bales
- p. 161: gloomy

- p. 162: grimace; gauntlet; grappled
p. 168: inaction
p. 177: drastic

Essay Questions and Projects:

1. Students might present a model rocket launch to the class, along with an explanation of how rockets work, and demonstrate the physics through the rocket launch. Teachers might choose to show the Woody Woodpecker segment of *Destination Moon* as a special treat after the presentation.
2. Research the state of rocket development during and after WWII, and evaluate the extrapolations of this novel in terms of what was known at the time. Coming at it from a different direction, students could research the current state of rocketry, and evaluate the degree to which we've failed to live up to Heinlein's predictions.
3. Explore the idea that "It is common enough in the United States for boys to build and take apart almost anything mechanical, from alarm clocks to hiked-up jaloppies." Conduct interviews with fathers and grandfathers, and report on the kinds of activities that they used to do as boys. Choose one of them, do it, and present it to the class. For example, my son and I did a model together of King Kong, and he took it to his class and brought the box, the instructions, and pictures we took of each stage of the process. It was such a successful day, that other fathers contacted me and wanted to know where I bought the model. The Boy Scouts are still very good at inculcating this attitude, as they were when Heinlein wrote several pieces for them back in the fifties.
4. Research the comparative costs of commercial space flight as opposed to government space programs. What benefits can be found from commercial space flight, as opposed to government financed space programs?
5. There is an award for developments in commercial space flight, similar to those mentioned in chapter 3 of this book, called the Heinlein Prize, financed by the estate of Robert Heinlein. Research the various commercial space programs in development today, and propose one of them for the Heinlein Prize. Write up a proposal for the Prize to be awarded to one of those programs.
6. Write a letter to your parents, explaining why your parents should allow you to work with Dr. Cargraves and go to the moon. Be very, very convincing.
7. Research the history of computers, from the late thirties to Eniac, and show how Joe the Robot is a direct extrapolation from Heinlein's understanding of computers up to 1946.