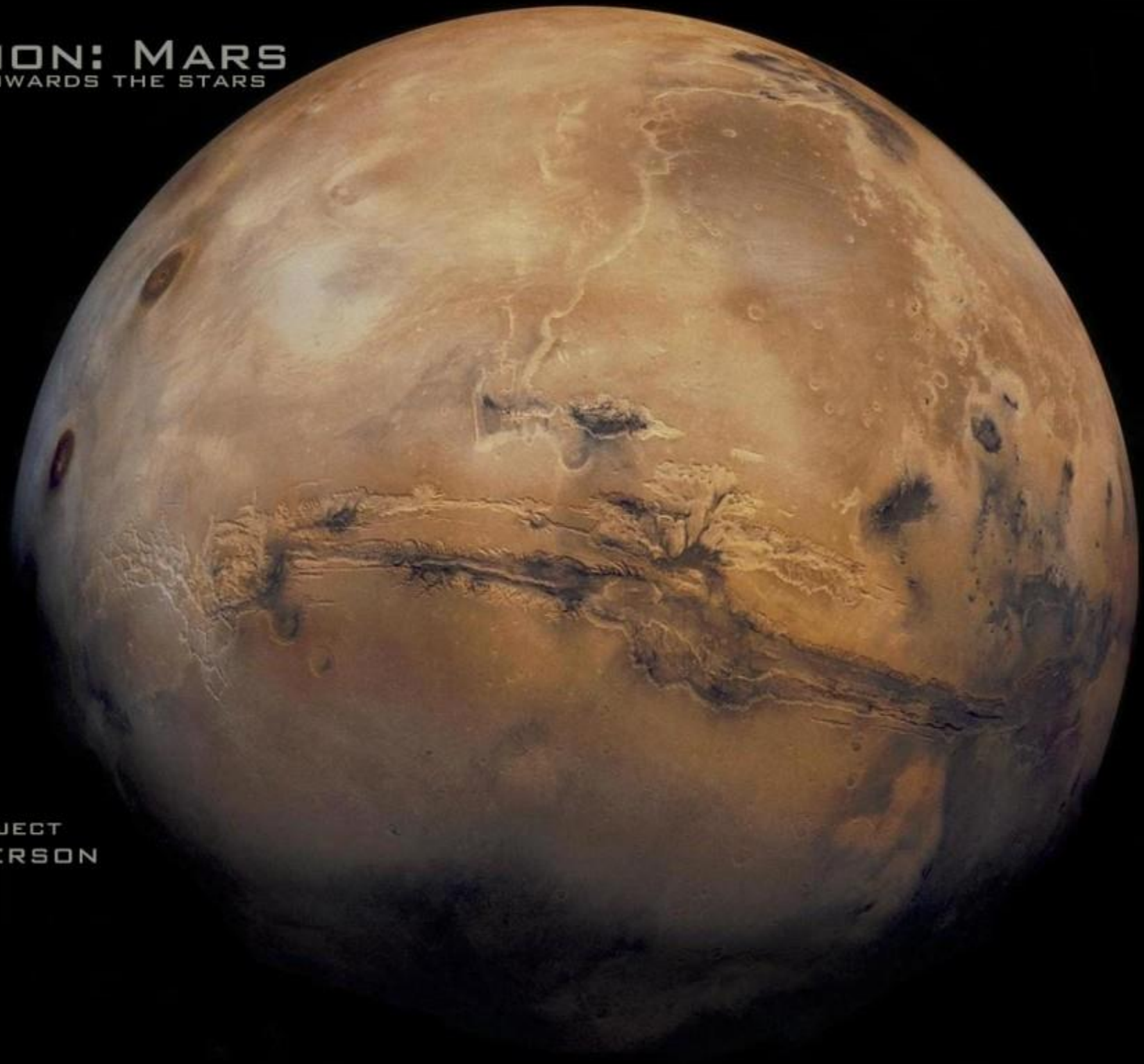
Destination: Mars

Our first step towards the stars



A multigenre project

by Rachel Anderson

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Introduction

In 1994, I lay on the floor watching the Shoemaker-Levy 9 comet impact Jupiter. It had broken into several dozen pieces, which made for an amazing show. However, it was more than just a show: it was a grim reminder of will one day happen to Earth. Some 65 million years ago, the Chicxulub impact wiped out three-quarters of life on Earth—and yet "each piece of Shoemaker-Levy 9 hit with the equivalent energy of the Chicxulub impact" (Tyson 52). Asteroids, comets, plagues, wars: these and many other things threaten our species. The only solution to this problem is to get all our eggs out of one basket—we must expand beyond Earth. Mars may be our best option, but a number of issues stand between us and Mars (Carroll 122). The primary goals of my project are to convince the reader that the colonization of Mars is possible, using technologies and materials currently available, and that colonization would prove beneficial to humanity as a whole.

The idea of going to Mars is not a new one. President Eisenhower felt the need to add "This is not science fiction" to a 1958 pamphlet that discussed a mission to Mars ("Introduction to Outer Space"). Following the success of the Apollo missions, which landed men on the moon in 1969, NASA planned missions to Mars in the 1980s; however, these ambitions were crushed by President Nixon, whose policies reduced NASA's budget to less than 25% of what it had been (Logsdon). A manned mission to Mars received little interest for many years after that, until 1989, when President Bush announced the Space Exploration Initiative (SEI), a program which would have put humans on Mars by 2019 (Carroll 124). However, the program was overly ambitious, and with a nearly $500 billion price tag, it ended as quickly as it began. More recently, President Obama called for a manned mission to Mars—while canceling the Orion propulsion system that could have gotten us there (Zubrin, "Obama's Failure to Launch"). It

would seem that exploring the red planet is once more within the domain of science fiction. However, it could just as easily be science fact; a Martian colony is not an insurmountable challenge.

Many proposals have been put forth for establishing a permanent base on Mars, without the bloat from which the SEI suffered. For example, Zubrin's Mars Direct program could have resulted in a colony before the turn of the century, for a "mere" $20 billion over 10 years (*The Case for Mars* 3). What is holding us back from Mars, then? In large part, public opinion. Drawing on nearly 50 years of opinion polls on a variety of NASA projects, Launius found that "Most are in favor of the human exploration and development of space and view it as important, but also believe that federal money could be better spent on other programs" (165). Furthermore, Launius adds that despite the excitement surrounding humankind's first landing on the moon, the "public was never enthusiastic about human lunar exploration, and especially about the costs associated with it" (168).

If the public is not invested in space, they will not support it—nor vote for those who do. During the 2012 presidential elections, Newt Gingrich attempted to bolster his campaign with the promise of a Moon base and mission to Mars, only to have his ideas mocked for being too expensive, and requiring technology that we don't have (Sunseri). At this point, it seems like it might just be wise to save space for another time. However, I believe that humanity has a vested interest in the stars—we literally cannot afford to wait.

This urgency underlies my multigenre project. Taken as a whole, the project is arranged into a chronological narrative, which tells the story of how NASA narrowly avoids a crushing budget cut in the last weeks of 2013 and eventually colonizes Mars in the 2030s. I began with my persuasive genre piece, a *New York Times* editorial, which is defending NASA from a

proposed crushing budget cut. Following the article is a simple transitional piece: a magazine article for the online edition of *Popular Science*. Set several months after the events in my editorial, this article discusses possible locations for NASA's upcoming colonization plan, including the Moon, Mars, and Titan. Although the article plays up the unreal landscape of Titan, which has been described as the "Persian Gulf of the Solar System," it ends by supporting a Martian colony (Zubrin, *Entering Space* 161). Immediately after this, the Martian colony is made reality by the second transitional element: a recruitment poster for a NASA colony on Mars. Finally, my tale ends more than 20 years in the future, with a series of journal entries written by Jessie Reitz, an astrogeologist and one of the first settlers to arrive on Mars.

Although this idea of colonizing Mars for the safety of our species' future is perhaps noble, it is also an intangible goal. Taken by itself, it is also not particularly motivational. However, I believe that our desire for economic stimulus, technology, and gadgets that improve our everyday lives *is* motivational, and it is clear that NASA's work has provided such things in the past ("NASA Technologies Benefit Our Lives"). A Martian colony would be beneficial to us, both on the individual and species level. Although it would be an enormous challenge, we don't need to reach for the stars—Mars will do just fine.

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NASA under fire

WITH a mere two weeks before the government shuts down again, the House has submitted a final budget. The House budget must still be approved by both the Senate and President Obama, and it features hefty cutbacks—including a devastating $4 billion cut for NASA. Although Speaker John Boehner defended the cuts saying "they were necessary for America's future," the truth is that America cannot afford a future without NASA.

Exploring and colonizing space are ambitious goals, but NASA has frequently been targeted by critics who question the merits of those goals—and the value of the agency itself. Opponents, such as Speaker Boehner, question why we "waste" money in space when we could use it here on Earth. The answer: money spent on NASA is an investment in our future—and not the distant future, either.

As far back as the 1970s, independent studies conducted by the Midwest Research Institute, among others, have found that every dollar spent on NASA returns between 7 and 9 dollars to the economy. How? In short: money spent on space drives research & development, creating jobs along the way. Maybe we should turn to NASA next time we need an economic stimulus package.

Then again, NASA's budget, which was just over $15 billion in 2012, before the sequester budget cuts took effect, seems astronomical. However, NASA is paid for with less than 0.5% of the federal budget. To put that in perspective: the entire 55-year cost of running NASA, including the Apollo missions that landed men on the Moon, is roughly equivalent to what we spend on the military in two years.

Furthermore, money isn't the only thing we get out of NASA. What do Mars rovers, moon landings, and orbital laboratories have in common? Aside from the obvious connection to space, they all required new technologies. The need for a cabin sensor on the Apollo missions led to the commercialization of smoke detectors. Space-suit design resulted in life-like prosthetic limbs, and the software and hardware designed for the Hubble Space Telescope ended up being used by surgeons.

In short: NASA drives innovation and invention. Trickle-down technologies from NASA are so widespread that there is a program—NASA Spinoffs—dedicated to keeping track of them. Ever heard of memory foam? You can thank NASA for that, too.

Beyond innovation, NASA provides inspiration. Close-ups of comets and Saturn's rings, galaxies billions of miles away: these things are what capture childrens' imaginations, instilling a sense of wonder and curiosity in them. Later, these children will then grow up to be scientists and engineers, which is great for both the economy and the country, as economic growth is intrinsically linked to research.

Cutting NASA's budget would be a bigger expense than continued funding.

Strictly speaking, of course, all these things are merely fringe benefits. By definition, NASA's purpose lies in space. Exploring the distant reaches of our solar system, tracking (and figuring out how to deal with) potentially world-ending asteroids, widening our understanding of the universe—these are the things NASA is supposed to be doing.

More importantly, NASA also provides options for the future. Mining asteroids for rare earth minerals, creating colonies on distant worlds to reduce overpopulation and lower our impact on Earth. Perhaps even safe-havens from potential disasters, such as asteroids or pandemics.

Even though we can scarcely afford a repeat of the October shutdown—which cost the nation some 16 billion dollars—this is one issue on which we must not compromise. Mr. Obama has not yet commented, but initial feedback from the Democrat-controlled Senate has been mixed, with some saying it might be a painful-but-needed measure.

Granted, we urgently need a budget, but painful is a horrifying understatement. If money is tight around the house, do you pull money out of your 401k—or stop eating out and skip movie night? The answer to that question may be obvious. Unfortunately, the questions are never quite that direct.

Here's a historical example: One week before the Wright Brothers flew, an article—published in this newspaper—opined about their competitor: "We hope that Professor Langley will not ... [continue] to waste his time and the money involved, in further airship experiments. Life is short, and he is capable of services to humanity incomparably greater than can be expected to result from trying to fly....For students and investigators of the Langley type there are more useful employments."

Where would we be today if manned flight had been written off as a waste of time and money?

Ideally, the Senate will reject this budget. But, as a country, we can't afford to sit here and hope for the best. If you feel strongly about this, please, contact your legislators and tell them you don't support the House budget. Let them know that crippling NASA to save pennies on the dollar is <u>not</u> worth bankrupting us technologically, intellectually, and in the long run, financially.

<u>OPINION</u>

BY RACHEL ANDERSON

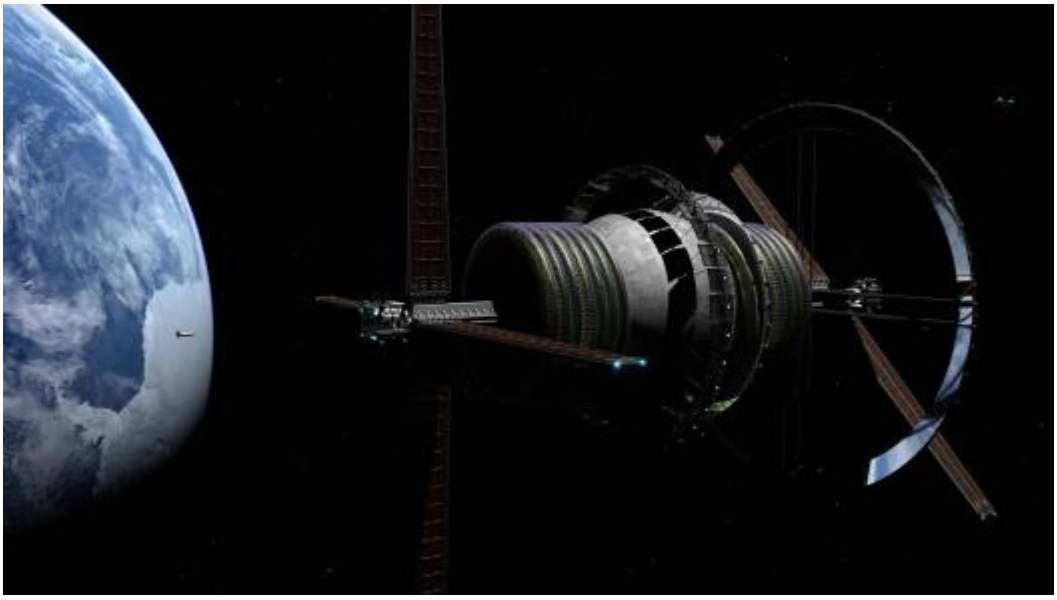
A contributing opinion writer and freelance space researcher.

POPULAR SCIENCE THE FUTURE NOW

NASA To Announce Space Colony, But Where?

NASA says it will hold a press conference next week to announce plans for a permanent space colony. Let that sink in for a moment.

By Rachel Anderson Posted 05.24.2014 at 1:49 pm 33 Comments



Home Sweet Home A near-Earth habitat, such as this Bernal sphere, could be home to tens of thousands—but do we really want to stay so close to Earth? *Nick Stevens via* ISAN

If you've been living under a rock for the past six hours, this morning NASA announced a press conference to reveal their plans for a permanent colony in space. Almost four months after NASA's budget was vastly increased, they've finally figured out what to *do* with it.

Unfortunately, we still have to wait four whole days to find out exactly what they have planned. If you're like us, you can't wait for the big reveal—so here are some possibilities to tide you over.

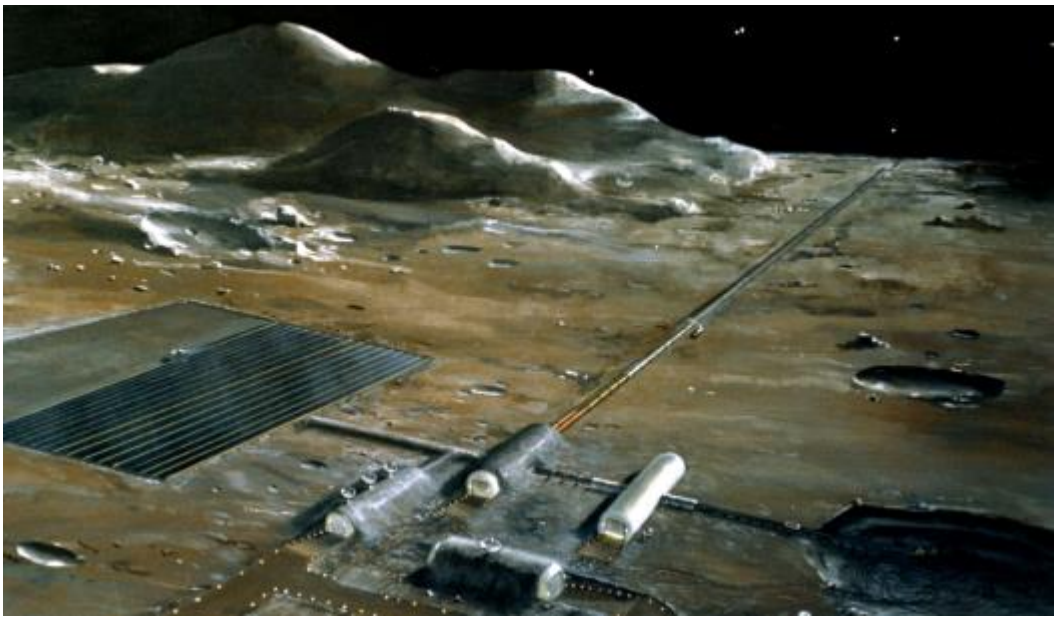
Location, location, location

Launching a permanent station into orbit isn't just viable, it's also the simplest option. Unfortunately, it's also one of the worst. Without local materials to process, a free-floating

orbital habitat would be entirely reliant on Earth, which means *everything* has to be imported. To us, at least, permanent implies some measure of self-sufficiency, which means orbit is out.

If local materials are important, what about returning to the moon—this time to stay? Compared to orbit, it makes a lot more sense. The moon has a vast amount of usable materials, including water, oxygen, silicon, and iron. Although processing moon rocks would pose both an engineering and a legal challenge, it's still possible with today's technologies.

A moon colony would also have the potential for commercial export: helium-3, which is useful in nuclear fusion, can be extracted in small quantities from moon rocks. Furthermore, because the Moon has far less gravity than Earth, it is easier to launch materials from its surface. While this would make returning cargo to Earth (relatively) easy, it also means that the Moon could be used as a launching point for exploration of the rest of the solar system.



Space Capitalism With rock processing (left), and a mass driver (center), a lunar colony might be able to turn a profit by exporting resources back to Earth. NASA, *Artist's impression*

Or, perhaps, we could head somewhere entirely new. What about asteroids? Although NASA (among others) has considered capturing an asteroid and bringing it to orbit the moon, their plans only called for a 20-25 foot asteroid. If an asteroid is involved, it's a new plan—and asteroids aren't an entirely bad idea.

While their compositions vary, asteroids frequently have water, and can be extremely rich in precious minerals. As Planetary Resources founder Peter Diamandis says, “A single 500-meter [asteroid] has more platinum on it than has been mined in the history of humanity.” Given that platinum is worth more than $1400/oz, it seems clear that a mission to an asteroid might pay for itself. The question is: would the benefits of an asteroid, such as mining and insulation from radiation and space debris, outweigh the dangers involved? While we're hesitant to label the film *Armageddon* as scientifically accurate, it correctly depicts asteroids as dangerous and potentially unstable. Perhaps asteroids should wait until we've found our space-legs, so to speak.

Distant relatives
Moving further away from Earth, a great number of potential sites open up. Unfortunately, most of them are horrible. For example, both Mercury and Venus have surface temperatures upwards of 800F. That's more than twice the melting point of lead. Similarly, the gas giants—Jupiter, Saturn, Uranus, and Neptune—are so massive that their gravity would crush our bodies.

And then there's Mars. A favorite of both science fiction and grassroots colonization movements, the red planet is a very real possibility for NASA's pick. Surface analysis, as well as meteorite analysis, has shown Mars' geology is uniquely similar to Earth's. With local supplies of water, oxygen, silicon, deuterium, and all sorts of metals, Mars may be the most viable location for a self-sustaining colony. Such deposits of rare minerals might even fuel a modern day "gold rush," driving companies—and colonists—to Mars.

Mars is not without its challenges, of course. It has little to no atmosphere, and little protection from radiation. Its distance is also a factor. A trip to Mars would take six to nine months with existing rocket designs, and launch windows only open every two years, which means that any sort of "emergency" mission would be out of the question.

Moving past Mars, there are few viable options. What about Titan? Saturn's largest moon may seem like an odd choice. Then again, Titan is something of an odd place: it's the largest moon in the solar system, as well as the only moon with an atmosphere. This atmosphere—with some help from Saturn's magnetic field—would provide significant protection from cosmic radiation. Titan is also home to unique geography, like so-called cryovolcanoes: frozen volcanos that erupt with ice instead of magma. Although not quite as cool as ice-spewing volcanos, Titan is also home to immense hydrocarbon reserves (similar to oil or natural gas) larger than Earth's.

No Drilling Required Unlike Earth, Titan's hydrocarbon reserves are not locked deep underground—they are easily accessible on the surface, in lakes and seas. It is thought that the entire landmass of Titan floats on an underground sea of methane. NASA, *Artist's impression*

Titan would also make an excellent staging area for long-term plans, such as mining the upper reaches of the gas giants for helium-3. A colony on Titan would have numerous obstacles to overcome, however. As Titan is more than 9 times farther from the Sun than the Earth, it would take a manned mission years to reach Titan with conventional rockets; however, NASA has been looking at other methods of propulsion, which would cut that down significantly. Additionally, Titan poses health risks to colonists, in the form of bone-weakening low gravity, and flash floods of methane. Oh, and the ever-present risk of *ice volcanoes.*

There you have it—the most likely locations for NASA's new colony. While it's possible they're about to announce something even more fantastic than one of these locations (Alpha Centauri, perhaps?), it's not very likely. If we had to pick the most likely destination, we'd have to say the moon—but to be entirely truthful, we're hoping for Mars.

ONE SMALL STEP FOR YOU
ONE GIANT LEAP FOR HUMANKIND

WHERE: SUB POLAR ASSEMBLY NETWORK (SPAN) COLONY
WHEN: MISSIONS BEGIN LAUNCHING IN 2032
WHO: HIGHLY QUALIFIED APPLICANTS FROM MOST FIELDS

FOR MORE INFORMATION
OR TO APPLY, VISIT

A Bumpy Landing

Jessie Reitz
Mission Specialist Serenity-09
en-route to Sub-Polar Assembly Network colony
Selected excerpts from personal mission log

06 October 2035

I've spent the last week watching it grow.

And now it's finally here. Or *we're* finally here? I don't know. Doesn't matter, either way. It's prettier than I expected—I just spent an hour watching clouds floating through a dust storm.

In something like 18 hours, we'll be on the surface, heading for the SPAN colony at the north pole, where I'll spend the next couple years looking for rare ores to send back to Earth. Sounds boring, but after a 30-some bazillion mile trip, I'm really looking forward to having solid ground under my feet again. Kappa disagrees, *of course,* but I guess I can't blame him—if I was a pilot, I wouldn't want to be stuck underground for a couple years. Well, he knew what he was getting into...

06 October 2035 – again

Can't sleep. 5 hours 'till we pile into the lander. I made another vid for mom and dad. I wasn't really sure what to say? It kind of felt like saying goodbye all over again... and then I couldn't send it, because we're on comm lockdown. Mission control is using all the bandwidth to look at that storm southwest of our landing zone. I really hope they don't ground us; I don't want to sit up here for weeks waiting for it to clear. Don't get me wrong, this is a great crew, but Serenity does *not* have room for six.

Heh. Ground us. I guess that doesn't apply in space, does it?

06 October 2035

We got the go-ahead!! We're all sardined into Calypso, the lander. There's not much for an Astrogeologist to do during landing, so I'm mostly just waiting for Kappa to get us down in one piece. Trying not to throw up, or think about how tiny this thing is. I'll never call Serenity claustrophobic again, that's for sure. Blegh.

07 October 3035

Dear Diary,

Today I lay in a pile of vomit, laughing uncontrollably. Also, Kappa is my personal fucking hero.

Let me back up.

To land on Mars, we've got to slow down, right? Mars's atmosphere is so thin that it would take weeks to slow ourselves with aerobraking. Instead, we use retrorockets. Calypso has a ring of 9 rockets around her base, and more on the sides, so we can adjust our trajectory.

Anyway. Just into the landing sequence, two of the primary rockets shut down. Normally, we'd just shut down some of the others to equal out our thrust, except there's some kind of a glitch. We can't adjust our uneven trajectory, so we're drifting off-course. Fast. We can't get back to Serenity, we don't have the time or ability to fix the engines, and we can't ask mission control for help. Not when it'd take 15 minutes for a reply. If we don't do *something*, if we can't fix this, we're going to land sideways—that is, crash.

So what does Kappa do? He spins us like a top to neutralize the drift. For almost three minutes.

Good news: We're alive. Calypso is still in one piece.
Bad news: It was rough. Lot of minor injuries. Commander Eagers and I did what we could, but this is a horrible environment for treating people. Looks like a couple fractures, detached retina... Kappa tore something in his arm from his deathgrip on the controls.
Worse news: We're not at the LZ. The commander thinks we're on the north side, but he can't be more sure than that... because it looks like the comms are down. We can't raise Serenity or SPAN. It looks like we're sending OK, but we're not getting anything back.

Right now we're taking a 90-minute “rest” before we try to unpack the rover from Calypso. The mood right now is really sombre—we're really on our own out here. It's just us and the team at SPAN, but there's only 4 of them, and they really aren't equipped for a rescue mission.

07 October 2035

I am so exhausted. Mars may have less gravity than Earth, but after a month without any gravity, everything takes so much effort!

We managed to get Calypso detached from the rover and take inventory. What a pain. We'd trained for dealing with dust, but I don't think anyone was expecting to land in a sandstorm. The rover is OK, and our gear seems to be in one piece. We have enough supplies for 3, maybe 4 days. Trying not to think about after that.

The commander and I have been working on the comms—Kappa would be a better choice than me, but he can't move his right arm. The rover has a separate comm system, but we're still not picking up SPAN. For now, we're trying to repair Calypso's system and waiting for Serenity to pass overhead, to try and bounce a signal off her. Might work?

08 October 2035

We moved out as the sun rose this morning, heading towards a signal we found overnight. It was

from one of the MetNet stations—I hadn't heard of them. Apparently, MetNet was an atmospheric monitoring system from like 20 years ago. Our computers say they've been derelict for years, but apparently this one is still transmitting. Unfortunately, we have only bare-bones data on them in the computers here. Still, it's a lead—the commander thinks if we can reach it, we can figure out which one it is and locate it on a map. *If*.

Somehow this all seems surreal. We're lost, 30 million miles from home. And our only hope looks to be 30-year-old weather stations. As Kappa so eloquently put it: "Fuck. Ain't nothing like the movies, is it?" I think we were all expecting a little more "Beam me up, Scotty."

08 October 2035

We got a signal back from Serenity! She was only over the horizon for about 90 seconds after the sandstorm started to clear up, but we picked up mission control's transmission. With the time lag, we won't know if they got our reply until Serenity's next orbit, but... needless to say, we're all feeling really hopeful.

09 October 2035

Last night, everything came together at once! We're in contact with SPAN and on-course for them now. We're not actually *that* far from them, but the sandstorm managed to knock out their comm antenna. They didn't want to risk fixing it until after it had passed on... reasonable, I guess, but I think we're all a little grumpy that they left us hanging.

On top of that, mission control managed to roughly estimate our position. Apparently, they pulled the MetNet team out of retirement to help. They were pretty happy to hear from us. I guess everyone at home thought we were goners for the last 40-or-so hours. It's strange, I don't think it really hit me—how close we came to dying—until just now.

We're not entirely out of the woods yet. We still have to reach SPAN, after all. It's about 60 kilometers to the colony, which will really stretch our supplies. But, honestly, I'm feeling pretty confident—we've already weathered about the worst this planet can throw at us.

And I'm *really* looking forward to a shower.

Writer's Statement

As this project grew to maturity, I found that I was getting progressively more passionate about space, and the need for a colony on Mars. The challenge, of course, was passing that intensity on to my audience, who have formed their own opinions long before reaching this project. This difficulty was underlined by the scope of the topic: moving from Earth to Mars is a lot of distance to cover, even on paper. Despite the challenges involved, I believe that I have created a high-quality piece of work, and achieved my goals. My primary goal for the project was to convince my primary audience—voting-aged Americans, who are not particularly familiar with NASA or space exploration and colonization—that that we can and should colonize Mars.

The first step in convincing them was using the persuasive piece to illustrate the benefits of a well-funded space program, and then urge them to get involved in NASA's funding. Following that, I informed them of the myriad potential options for a space colony, as well as benefits colonies could give them, such as platinum in asteroids, or rare minerals on Mars (Bukszpan; Zubrin, *Entering Space* 107, 137). Lastly, the narrative piece is the pay-off for my audience; they invested time, effort, and money (from their taxes) into this idea of colonization, and now they are able to see it paying dividends. There are numerous primary and secondary audiences that emerge from the individual projects, and combinations of them. For example, children or teenagers reading the informative piece, who would later look forward to reading about the expanding Martian colony with excitement.

Although the pieces have implied transitions between them, I believe my audience, and thus the project, benefited from a “mini-genre” recruiting poster. This helped in two ways: by providing continuity between genre pieces, and also by reducing the text-heavy nature of the project. Since the poster should be occurring sometime in the future—most likely in the mid 2020s—I attempted to make it look futuristic. I achieved this with a minimalist design, opting to

omit most details except a QR code for contact information and modified NASA logos (“Unofficial NASA mission patches”; “Lone Astronaut”).

Using NASA's emblems also helped to bolster my authority. In a project of this scope, ethos is crucial: without it, readers will not trust carefully built logical chains and emotional appeals. Thus, I put special effort into developing my ethos. My simple-yet-polished title page gave readers a critical first impression of quality work (“Mars HD”). Then, by using reputable genre sources—the *New York Times* and *Popular Science*—I established immediate credibility. I built on this foundation by speaking authoritatively, referencing my sources, and breaking the complex topic of space exploration and colonization into easily digestible portions. Finally, the time and effort I put into this project in terms of focus, clarity, and reasoning bolstered the legitimacy of my writing (Parks 2, 6).

With my ethos established, logos was the next crucial piece. The persuasive piece used logos to “hook” the reader by convincing them that NASA's activities benefit their everyday lives, in the form of economic stimulus and trickle-down technologies like LED lights and memory foam (Comstock 2; "NASA Technologies Benefit Our Lives"). As such, it gives my reader a sense of investment, by explaining how they personally have benefited from space programs—and could continue to do so in the future. The informative piece continued this use of logos, by explaining the variables involved in choosing a colony site, such as mineral wealth and difficulty, before declaring Mars the best option (Zubrin xv-xvii). The final narrative piece is the logical conclusion to the previous two: if continued funding of NASA provides the most benefit, and a Martian colony would also be the best choice, then NASA will use its funding to go to Mars.

Having used ethos and logos to convince my audience that we *could* go to Mars, I used pathos to convince them that we *should*. Pathos was the “hook” for my audience, in order to keep

them reading, and ultimately believe my overall message. For example, in the persuasive piece, I employed pathos by threatening the loss of useful things if NASA is defunded. Then, I concluded the project with my narrative piece, which uses pathos to draw the audience in as the threat to Jessie Reitz unfolds. I believe that ending the project with an appeal to pathos is particularly effective, as my audience will transfer their good feelings about Jessie's survival to the entire project.

By this point, I believe that my audience should be thoroughly persuaded that the colonization of Mars is possible. My hope is that they are also convinced that it is beneficial—so that they could take steps (such as voting) to ensure it comes to pass. In his famous speech, President Kennedy said “We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard” (qtd. in Podelco). The satisfaction of conquering a challenge is not enough to motivate people, especially when they cannot directly participate in it. Instead, we must offer them something better: the promise of a reward. It's a less noble goal, but the survival of our species depends on it.

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