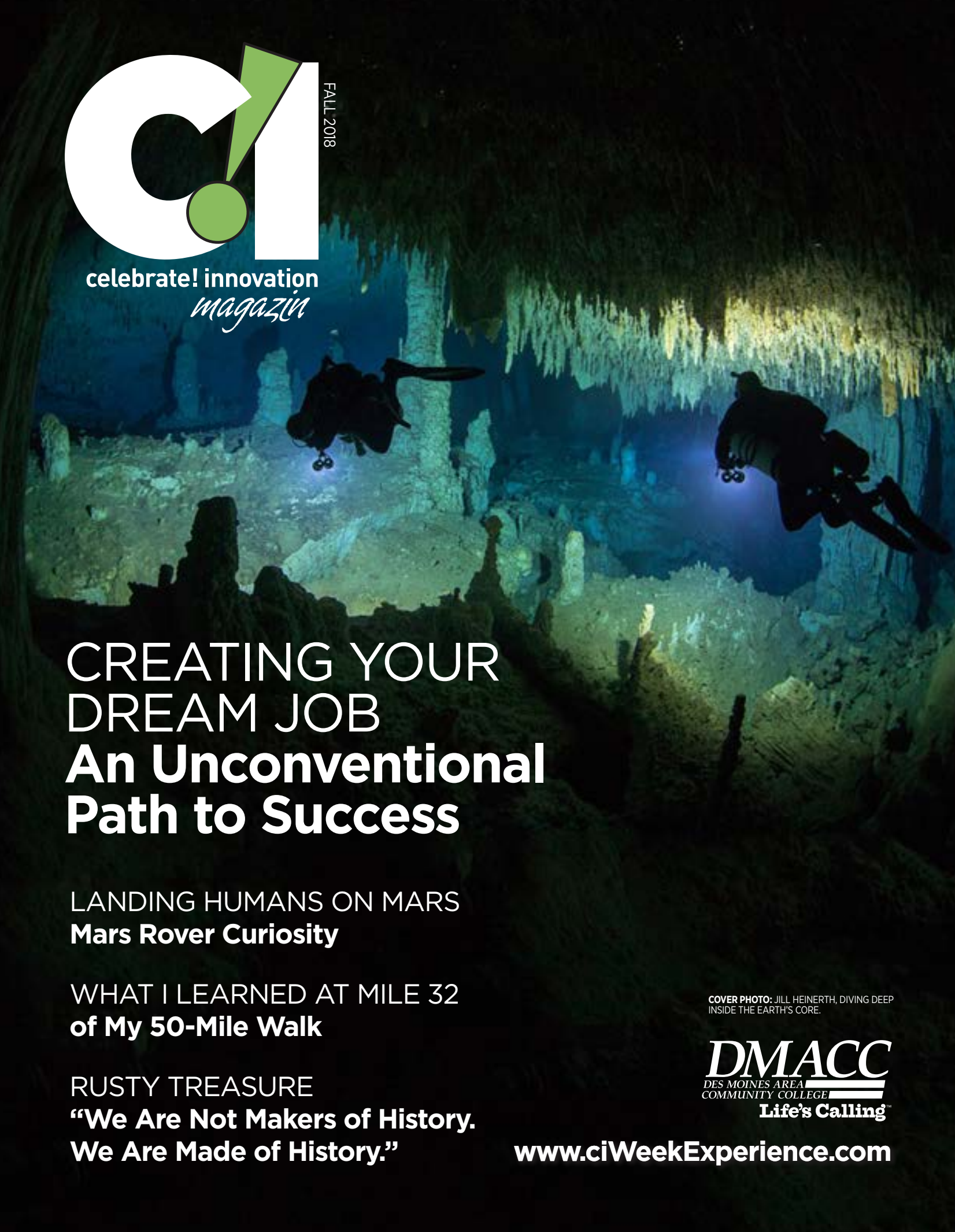

FALL 2018

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CREATING YOUR DREAM JOB
An Unconventional Path to Success

LANDING HUMANS ON MARS
Mars Rover Curiosity

WHAT I LEARNED AT MILE 32
of My 50-Mile Walk

RUSTY TREASURE
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COVER PHOTO: JILL HEINERTH, DIVING DEEP INSIDE THE EARTH'S CORE.

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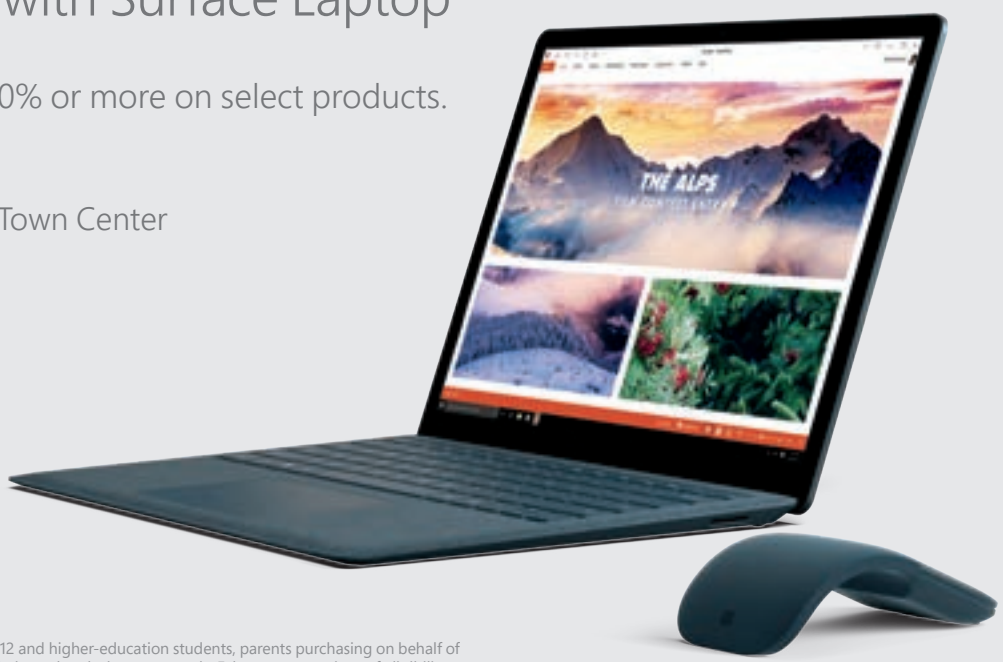

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EDITOR'S NOTE

"Success is stumbling from failure to failure with no loss of enthusiasm." –*Winston Churchill*

Our culture loves to celebrate successes—the rocket lifting into the sky, the business selling for millions or billions of dollars, the athlete achieving the gold medal, the artist winning international acclaim. The thought of "making it" evokes these images. And while all of these accomplishments should be celebrated, what we may overlook the years of work—and more important, the many failures—that preceded the accomplishment. Those should be celebrated just as much as the end result.

Failure itself is a multidimensional concept, but we tend to think of it only as negative—failure means failure, and that's it. It's so negative that it approaches the status of a four-letter word. Failure as a concept is far more nuanced, and it's important to consider what kind of failure leads to success and what kind of failure leads to lack thereof.

Without a doubt, failure by quitting carries the most negative consequences. When we stop trying, or even when we fail to make the first attempt on our fabulous idea, we don't get the benefit of learning from the action of getting out there, "moving fast and breaking things," as Facebook CEO Mark Zuckerberg says. It takes hardiness and a willingness to work to accomplish anything of importance—that should go without saying. If we lack the drive and the ability to endure when the going inevitably gets rough, we'll give up on our dreams far too early. That's certainly a failure.

Is quitting always a failure? The answer is a resounding no. Sometimes quitting may be the best option available, especially if continuing on means dishonoring yourself or your body. On pages 7 and 23, you'll read about Jill Heinerth and Dr. Tony Paustian, respectively, and their advice on what it means to honor yourself. As Heinerth says, going after your goal even when the hair stands up on the back of your neck and you're putting yourself at risk isn't worth it—coming back alive is more important than the achievement. Paustian shares his story of honoring his body over his goal and ego. Both stories teach the importance of refusing to view decisions as setbacks or as failures. It takes just as much wisdom to know when to quit as it does to press on in the face of doubt.

That brings us to the best kind of failure there is. On page 15, you'll hear from Robert Manning, a chief engineer for NASA and one of the key people involved in the Mars rovers: Spirit, Opportunity, and Curiosity. While trying to figure out the problem of landing humans on Mars, Robert and his team tried and failed many times; success didn't come within the expected time frame, but they kept trying until the project ended.

On page 29, you'll read Robert Wolfe's story of reclaiming old "pieces of junk," objects that have "failed" and are now viewed as worthless. Robert's piece illustrates the value of reclaiming and repurposing those pieces and making them into treasure—the kind of treasure people will pay for and use. In his line of work, he gets to resuscitate previous failures.

The key component in all of these examples: the ability to step back, glean the big-picture lessons, and identify the value in failure as a key determinant of future success. Heinerth and Paustian didn't view their setbacks as failures, but as valuable lessons they incorporated into their next attempts to reach their goals. Manning and his team eventually had to abandon their mission for lack of resources, but the knowledge they gained throughout their attempts was later used by SpaceX and is still being expanded upon today. Wolfe recognized worth in failed objects and their stories, recovering both for preservation and profit. When we bear in mind these examples, it's difficult to call them failures. Instead, it's better to view them as learning lessons along the way.

Don't be afraid to fail. In fact, eagerly seek it out. Break stuff and learn. Then try again.

To your failures and your successes,

SARA STIBITZ CO-EDITOR
SRSTIBITZ@GMAIL.COM.

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CREATING YOUR DREAM JOB

An Underwater Explorer's Unconventional Path to Success

BY JILL HEINERTH

When I was fresh out of college, my father worried about how I could possibly succeed in life; after all, I held a degree in Fine Arts with advanced training in curiosity. How would I put food on the table? His degree in mechanical engineering led him into a predictable career with great prospects for supporting a family. Although I graduated with high honors, he could not see a path for me to succeed.

HEINERTH DIVING IN DEVIL'S EAR CAVE, GINNIE SPRINGS, FLORIDA.

But his worries didn't stop me. Against all odds, I took the entrepreneurial route and created a thriving business in the advertising world. Clients like Canon, Kimberly-Clark and IBM flocked to my door, and I was cashing checks that supported an enviable lifestyle. A red sports car was a sign of my youthful success, but I started to wonder if I was truly happy—if the paycheck was more important than pursuing my true dreams.

As I sat at my drafting table one afternoon, designing the next spring catalog for Nike Canada, I could feel the walls closing in. An outdoor enthusiast at heart, I needed to be outside. I knew I aspired to something different. I was already teaching scuba diving lessons a couple of nights per week, and I couldn't wait to flee the office for a weekend underwater. But could I possibly create a career in the diving world? Was it worth trying? In the early 1990s, with the Internet barely a fledgling, the task of completely changing my life seemed daunting.

Rather than leave you wondering, I'll give you the spoiler right away. Today, I have a career as an underwater explorer. From sitting at a drafting table in Toronto, Canada, I ventured on a creative path to become one of the top diving explorers on the planet.

My job is comprised of a hybrid set of skills. Besides exploring, I write articles for magazines, publish books on diving, shoot footage for iconic clients like the BBC and *National Geographic*, capture photos, support scientists, consult with underwater life support companies, and travel around the world speaking about my expeditions. I've blended a mix of different literacies to build a media production company, and today I also serve as the Explorer in Residence for the Royal Canadian Geographical Society. My curiosity has served me well.

Success lies with the creative souls who can put together a wide variety of skills to make themselves unique and valuable.

As you look ahead to your future, how can you pursue an unconventional path? The good news: practically every career of the future will be unconventional. Frankly, we have not yet created titles for many of the jobs you may hold. Success lies with the creative souls who can put together a wide variety of skills to make themselves unique and valuable. Creative people won't be replaced by artificial intelligence or automation anytime soon. And by creative, I include all types of careers—science, social services, industry, or any of the other subjects that drive your passion. The key is discovering that passion, followed by a few important steps.

Embrace Fear

As a specialist in cave diving, I am motivated to swim through the veins of Mother Earth, exploring the lifeblood of our planet. Most people peer into the darkness of a cave and see only terrifying blackness, but for me, the darkness beckons, drawing me into an unexplored world of possibilities. Every fin stroke takes me farther into the unknown, offering an opportunity for discovery and growth.

As you complete your studies and look toward the future, you may feel like you are looking into the claustrophobic blackness of an underwater cave. Today's world is a place where fear influences the actions of the populace. People are terrified of world events, failure, and change in their daily lives. But learn to embrace fear rather than

A DIVER USING A REBREATHER FLOATS WITHOUT MAKING BUBBLES OVER THE WRECK OF EL LIMON IN LA CALETTA NATIONAL MARINE PARK NEAR SANTO DOMINGO, DOMINICAN REPUBLIC

simply run from it. The secret to survival and growth is finding a way to swim into the unknown instead of sinking into reactionary oblivion. I am not suggesting you cast away all your fear and run headlong into danger. Instead, it is more important to embrace and confront a certain amount of fear in your life.

Back to the cave analogy. If the dark doorway of a cave scares you, start by asking, "Am I really in imminent danger or am I afraid of the unknown?" If you are simply afraid of the darkness, then step a tiny bit closer and allow your eyes to adjust to the light. In that point of transition, while you adjust to the unknown, you stand on the threshold of discovery. You have become an explorer too. And on that threshold, no matter what the field, you will be entering a new realm of possibility.

People often suggest I might not want to dive with them because they are afraid. My response, "You are precisely the type of person I wish to dive with." Being fearful means you care about the outcome. Fear helps you make calculated choices regarding risk and reward; it drives you to move closer to the edge and take on things that inspire growth. When we work to liberate ourselves from the restraints of fear, personal limitations shrink and our perception widens. We increase our overall potential.

Fear resides in humanity as a defense mechanism. Our primal instincts are programmed in a series of responses intended to keep us alive. Such preconditioning may keep us safe from harm but is not necessarily designed to increase our potential. When we find ourselves in danger, our bodies are set to respond with fight or flight. However, I would offer a third option. In the face of danger, it can seem overwhelming to envision success or survival. It is easy to lash out instead or run screaming to the closest source of familiar safety. But in my job, either option can end in death.

When I'm trapped in a claustrophobic cave underwater in the darkness, I must summon the inner calm necessary to make the next best step toward survival. If a rock has me pinned, I must use reason and logic to figure out how to free myself. If the safety guideline is broken, I must methodically deploy my cave diver's reel and carefully patch the broken guideline. I must do all of these things in the absence of panic, with every breath measured and calm. I must keep my heart rate low and focus on the next best step toward survival.

Unchecked emotions won't serve me in these life-threatening situations; they will only distract me and use precious air supplies. Pragmatism and confidence must rule the moment, so I can solve my dilemma and safely exit the cave.

IN JUNE AND JULY, EXPERIENCED DIVERS CAN SLIP IN THE WATER WITH ICEBERGS THAT MARCH SOUTH FROM THE ARCTIC.

Take Calculated Risks

Whether you're a sales person striving to reach a quarterly target or a researcher attempting to cure a disease, it can be challenging to envision solutions to big problems. You may not know what success will look like or when it will come, but I challenge everyone to consider this simple fact: we are all capable of knowing the next best decision at crucial moments in our lives. In the depths of our subconscious, we know what we should do next. We just need to get out of our own way. And if we keep making positive steps toward our highest goals, we will achieve great things.

When fear gets in the way, simply ask yourself, "If I take this risk, and take responsibility for my choice, what might be my reward? Alternatively, what is the worst thing that could happen?" By taking responsibility for your decisions, you empower yourself to choose your destiny. Moving methodically toward a solution enables you to overcome terrible situations and bring big dreams to fruition.

Being fearful means you care about the outcome. Fear helps you make calculated choices regarding risk and reward; it drives you to move closer to the edge and take on things that inspire growth.

Know When to Abort

People look at my work and suggest that documenting the world of underwater caves might be the most dangerous job on earth. Certainly, I have lost my share of colleagues, some of whom have made unwise choices in the blackness of remote cave systems. Their names have been added to a long list of divers who ran out of air, got lost in the labyrinth or pressed too far into new exploration before turning back.

You must be willing to assume risk, to push the razor's edge of possibility, to be bold and confident in what you take on. However, I believe you must also temper this boldness by following the ultimate goal: When you are within sight of complete success, within arm's reach of grasping the treasure you seek, you must heed your intuition. When the hair stands on the back of your neck alerting you to danger, you must be willing to let go. Swim boldly toward new endeavors, with the knowledge that you may not achieve your ultimate goal, at least the first time around.

With training, preparation and dedication to proper safety procedures, I have managed to maintain a career

HEINERTH KICKING UP DUST FROM THE SAHARA DESERT LOCATED IN THE BOTTOM OF A CAVE ACROSS THE OCEAN.

HEINERTH HOLDING THE ROYAL CANADIAN GEOGRAPHICAL SOCIETY FLAG IN GRENADA

of nearly 30 years of exploration and scientific activities. It would be arrogant for me to say I will never make a mistake or poor choice that could ultimately cost me my life, but I believe following my intuition has played a major role in keeping myself alive. As you reach for the tempting summit of the mountain or further exploration in a virgin cave, remember you also have to return home safely. Knowing when to turn back is as important as embracing the fear to climb or swim into the unknown in the first place.

Patient, diligent work is the key to an explorer's success. Take a deep breath, focus, and make the next best choice. Before you know it, you will have challenged the unknown and succeeded in making your dreams a reality.

Control Your Brand

In the age of instant social communication, it is essential that you think of yourself as a brand. You have to control how you are perceived by the world. Perhaps your parents warned you that whatever you put on the Internet will be out there forever? That's true, but you have to go a lot further than just protecting your image—you need to actively control your brand.

The next time you apply for a scholarship, job or grant, your prospective employer or grantor is probably going to Google your name. Hopefully they won't find some unfortunate picture from a frat party gone wrong, but it's just as bad if they find nothing at all. Whether you want to pursue a job as a physiotherapist, accountant, or augmented reality programmer, your brand matters. When someone searches your name, you want them to find positive articles, blogs and photos about your success and excellence.

Even if you have no Internet programming skills at all, buy your domain name. You should own www.YourName.com. Even if you are not ready to populate the website, get control of it. Pepsi and Apple would never let anyone else own their brand identities. You shouldn't either. If your name is not unique, then start referring to yourself with a middle initial or something that differentiates you from other people called Jane Smith. Perhaps you'll be Jane Smith Penguin Lady or Joe Jones Web Guru. If you offer a quote to a journalist, insist they reference you with that same unique name. Your name is your brand. Use the same spelling for hashtags, Twitter, Facebook and every other relevant social media platform.

Once you have gained control over

HEINERTH DIVING WITH HER PRISM REBREATHER.

your name brand, develop basic web skills and use social media to represent yourself in ways that support your future career goals. Start a blog. (Not just through Facebook or Instagram, but an independent website where you own the content and moderate comments.) If you don't want to write your own blog posts, at least populate it with links to articles that are interesting and relevant to you. Post photos when you get an award, give a speech or work on a project you're proud of. Post selfies with mentors. Mention talks you attended. And above all else, be positive!

Reach Out and Collaborate

Your global, interconnected audience is filled with mentors who can help. Some might not answer your email, but what can you lose by reaching out? Every single opportunity I have nurtured in life began with me making an overture to someone. I reached out and volunteered to work on projects. I didn't ask for a paycheck, just the opportunity to learn. In many cases, my willingness to collaborate and offer my unique skills paid off.

You can also find collaborators on the Internet. Much of my work involves working with scientists and policymakers. How can your skills and interests support someone else's work? Can your coding skills help a nonprofit in your area of interest? Can your scientific credentials be used to pitch an expedition to the *National Geographic* grants division? Can your diverse mechanical skills be useful to a tourism destination? Can your interest in photography support the marketing needs of a particular business or enterprise? Pairing with individuals, institutions and businesses opens new doors for the future. Once you are inside the door and working hard, make it tough for collaborators to envision working without you.

Be confident in presenting yourself and your ideas to others. When you can communicate your passions, you have the opportunity to create your ideal career.

Ask for the Gig

The best advice I ever received was to express my interest in no uncertain terms. If you want a job or opportunity, then clearly ask for the gig. Tell the prospective employer you really want to work with them. Don't wait for a

HEINERTH ENTERING THE WATER FOR THE DEEPEST DIVE EVER CONDUCTED IN BERMUDA.

More people have walked on the moon than have been to the places Jill Heinerth has explored on earth. Heinerth is a 30-year veteran of scientific diving, filming/photography, and exploration, working on projects in submerged caves with *National Geographic*, National Oceanic and Atmospheric Administration (NOAA), and various educational institutions and television networks worldwide. She is the inaugural Explorer in Residence for the Royal Canadian Geographical Society and the 2017 recipient of the diving world's highest award for sports and education from the Academy of Underwater Arts and Science. For her work at the extreme ends of the earth, Canada's Governor General presented Heinerth with the rare and prestigious Polar Medal.

callback. Be persistent and ask when it is okay to check back. If you are rejected, ask what you can do to improve your prospects for the next time around. Employers love dedication. Prove that you really want to work with them in the future by improving on the skills needed for the job.

When a prospective employer tells you they have no openings, ask if there are opportunities for unpaid internships. Demonstrate you are truly interested and willing to prove your value.

Get Literate

Looking into the dark uncertainty of your future can be overwhelming. The good news: you can change your mind at any time and choose a different path. Develop basic literacies like writing, media, computer skills and public speaking. (You may find that writing code is a talent that sets you apart from the competition.) Be confident in presenting yourself and your ideas to others. When you can communicate your passions, you have the opportunity to create your ideal career. When you are living the dream, it certainly doesn't feel like work. Bravely step into the dark void and keep doing the next best thing that brings you closer to your goal. Before long, you will have achieved your wildest ambitions.

When you can communicate your passions, you have the opportunity to create your ideal career.

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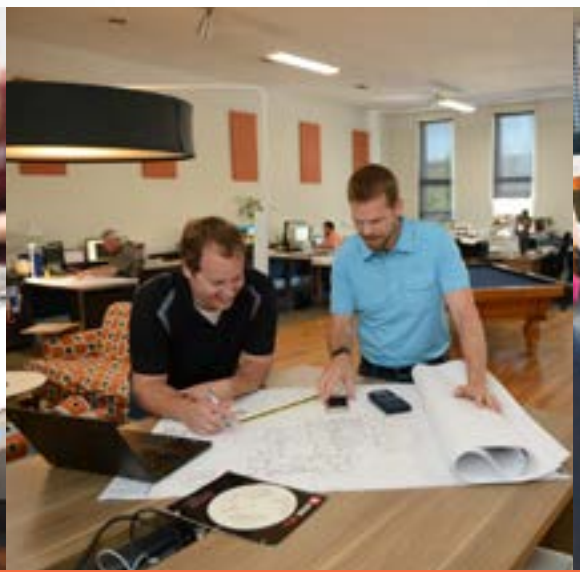

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BY ROB MANNING

MARS IN ALL ITS SPLENDOR.

LANDING HUMANS ON MARS

Mars Rover Curiosity: An Inside Account From Curiosity's Chief Engineer

At 10:07:34.3 PDT on July 4, 1997, my colleagues and I received a radio signal indicating that NASA's Mars Pathfinder had made its first contact with the surface of Mars. Everyone in the room was bouncing off the floor and walls. We had done it. After a hiatus of more than 20 years, a new lander had navigated its way to a safe landing on Mars. Mars Pathfinder was the third fully successful landing and the first rover on Mars. It was also my first robotic Mars mission.

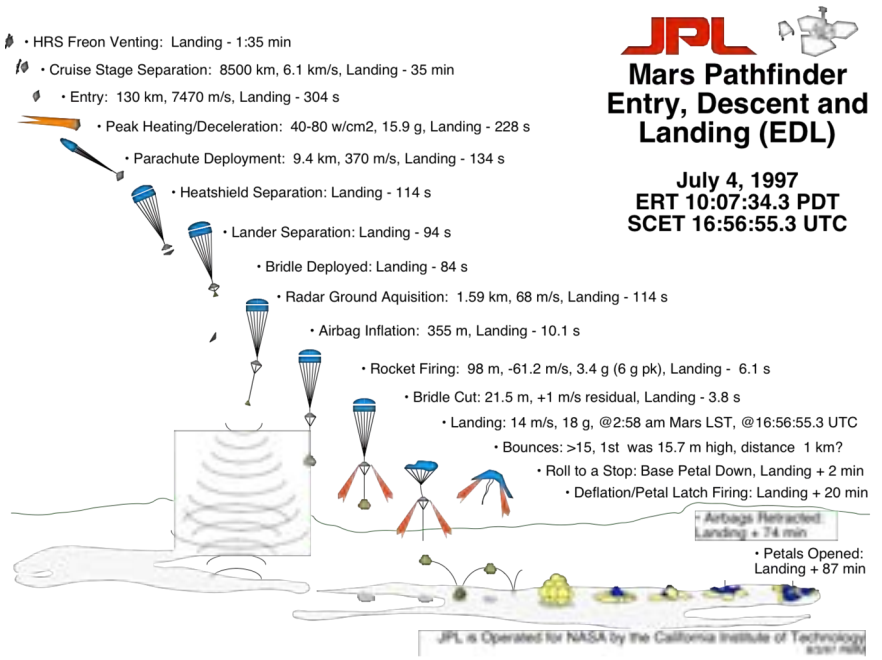
NASA VIKING LANDER (ONE OF TWO). THESE FIRST SUCCESSFUL MARS LANDER MISSIONS LANDED IN JULY AND SEPTEMBER OF 1976. INTENDED TO DETECT EARTH-LIKE LIFE, TWO OUT OF THREE LIFE DETECTION INSTRUMENTS ON EACH OF THESE LANDERS FAILED TO DETECT LIFE ON THE SURFACE. COURTESY OF NASA/JPL-CALTECH.

I would be fortunate to be deeply involved in many other missions that followed, including Spirit, Opportunity and Curiosity rovers. But for now, it was amazing to consider that our Pathfinder lander was so small it could have fit easily inside your living room. The little Sojourner rover, hitching a cramped ride inside one of the lander's petals, was no bigger than a microwave oven. When folded up, the tetrahedral lander was only about three-and-a-half feet high and about the same across. Unlike the two NASA Viking landers that had landed 20 years earlier using rockets, this lander was surrounded by gas-filled airbags, giving it a 17-foot tall, lumpy beach ball shape designed to bounce as high as 14 stories on Mars and roll as far as a kilometer. During our early design efforts, we showed the airbag manufacturer, ILC Dover Inc. in Fredericka, Delaware, a video of how we thought the lander might escape from its cocoon of deflated airbag fabric. After staring in silence at a surreal video of our test using ropes and winches to draw in the airbags so the lander could right itself and open like a flower, the top ILC engineer turned to us and said, "If I saw that thing land in my backyard, I'd kill it."

The airbags we used to land Mars Pathfinder and Sojourner provided an expedient, low-cost solution. Our little project had only one-tenth the budget of the prior Viking mission, and we did not have the money to re-develop Viking's throttled (i.e., controllable) descent rocket engines. Ironically, after Viking and Apollo went to the moon, demand for small, throttled rocket engines dried up; production eventually ceased. Rather than redeveloping and qualifying them for a Mars landing (thus draining our budget), we opted for low-cost, solid rocket motors hanging on ropes between the descent parachute and the lander, which would bring the lander to a dead stop some 32–55 feet (10–17 meters) above the ground. Only then would the space capsule release the airbag-encased lander, allowing it to drop and bounce for the next few minutes before rolling to a stop.

As we designed this system, I slowly became surprised by how bloody hard this Mars landing thing would be! It's a lot cheaper to go straight into Mars from deep space, which actually consists of a large looping orbit around the sun. The space capsule looks like it's wearing a round hat, which is the cruise stage that provides solar power, cooling, radio antennas and propulsion. The cruise stage "hat" is jettisoned about 30 minutes before hitting the atmosphere. The space capsule, with its protective heat shield facing into the atmosphere, hits the upper atmosphere at 17,000 MPH. Without that heatshield, the lander and rover would become a Martian shooting star. Interestingly, while the outside of the three-quarter inch heatshield reaches thousands of degrees, the air inside warms only to about room temperature. Not bad.

Watching a movie of the landing sequence is a bit like watching a scene



MARS PATHFINDER'S (AS-FLOWN) LANDING SEQUENCE FROM ITS LANDING DATE OF JULY 4, 1997. NOTE THE MANY COMPLEX TRANSITIONS FROM BEING AN INTERPLANETARY SPACECRAFT ON THE UPPER LEFT UNTIL FINALLY OPENING LIKE A FLOWER ON THE LOWER RIGHT. NOTE ALSO THAT THE VEHICLE EXPERIENCED ABOUT 16 G'S DURING ENTRY AND 18 G'S ON THE FIRST AIRBAG IMPACT—A GREAT DEAL MORE THAN A HUMAN BODY COULD WITHSTAND. COURTESY OF NASA/JPL-CALTECH

MARS PATHFINDER ON THE SURFACE OF MARS IN 1997 AS RECORDED BY LITTLE SOJOURNER ROVER. COURTESY OF NASA/JPL-CALTECH

from *Transformers*. Within about two minutes, the lander slows down to approximately 1,000 MPH, a speed it maintains as it descends even farther into Mars' atmosphere. At this speed, the lander is still supersonic (Mars' speed of sound is a bit slower than Earth's but not by much). Like the Vikings, we designed Mars Pathfinder to kick out a large supersonic parachute as high and as fast as we dared, so the lander could slow down before hitting the ground. About 20 seconds after the parachute inflates, the heatshield releases and falls away. A few seconds later, while still descending under the parachute, the capsule lowers the lander about 60 feet using a long rope attached to the capsule's back.

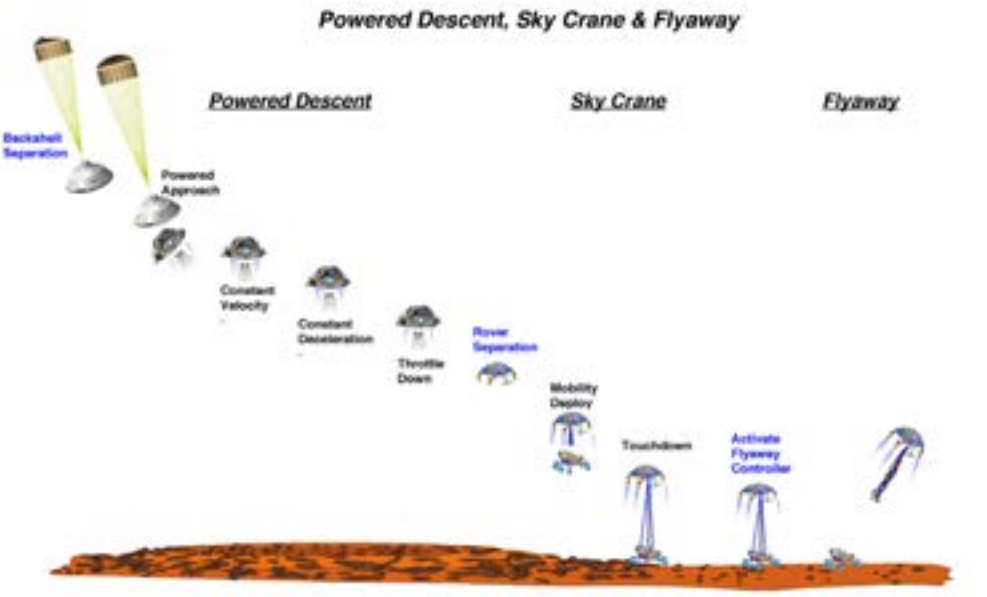
Three solid rockets stabilize the capsule, and a small radar mounted on the lander measures distance to the ground.

This brings us to the hard part. Mars' atmosphere is only about 1% as thick as Earth's. On Earth, as a lander arriving from outer space penetrates our atmosphere, it easily slows to well below the speed of sound fast, but not that fast. It is easy to wait until the lander decelerates to below the speed of sound to open a parachute and then gracefully and somewhat slowly land on the ocean or on land. If the lander has wings like the Space Shuttle, one can use the wings and the thick air to land on a runway just like an airplane.

However, on Mars, even with a big parachute and a small lander, the lander descends faster than a skydiver on Earth descends without a parachute: about 200 MPH. This speed allows for only a few precious seconds between the parachute opening and touching ground. All of those mechanical, Transformer-like changes during the descent have to happen fast enough so that when the ground arrives, the lander is ready with airbags inflated. Approximately 500 feet above the ground, the solid rockets fire for about 2.5 seconds, which brings the lander to roughly a dead-stop in mid-air. From there, the tether to the rockets are cut and the lander drops and bounces on Mars.

The Pathfinder lander, including its airbags and Sojourner, was about 360 kg (about 790 lbs. on Earth and 300 lbs. on Mars). That's a lot for a human to pick up, but it is way too small to land a person and far too small for all the stuff a person would need for the return trip home. A human-scale Mars lander would have to weigh at least as much as the Apollo lander (about 7,000 kg). In fact, since the gravity of Mars is about double that of the moon's, a Mars lander that could support a couple of astronauts for a couple of days would have a mass of at least twice as much as the Apollo lunar lander (after burning its descent stage fuel). And that's assuming a Mars lander could land on Mars like it would on the moon!

So how would a human lander for Mars work? Given we had major challenges landing something weighing a few hundred kilos, how could we land something 40 times more massive? To slow down an object that big using parachutes would require a parachute that would dwarf a football field. Additionally, I concluded there was too much atmosphere on Mars to land like humans did on the moon and too little atmosphere to land like we do on Earth. Finally, despite its relative thinness, Mars' atmosphere would melt the Apollo lander as it entered



MARS SCIENCE LABORATORY (MSL) LANDING SEQUENCE THAT LANDED CURIOSITY ON AUG. 6, 2012. USING THE PROPULSION SYSTEM ABOVE THE ROVER ELIMINATED THE NEED FOR THE POST-LANDED "EGRESS" PROCESS. THE ROVER WAS ON THE SURFACE READY TO DRIVE FROM THE MOMENT OF TOUCHDOWN. COURTESY OF NASA/JPL-CALTECH

the atmosphere at high speed. Clearly our Rube Goldberg-like entry descent and landing technique would not work for landing humans on Mars.

My colleagues at JPL and I were robotic Mars explorers; we had no experience with human space travel. At the time, we were the only people in NASA working on a Mars landing; no one I knew had answers to that question. Surely by the 1990s, someone in NASA must have figured this out. After all, NASA and many science fiction writers had been talking about sending humans to Mars for decades. I was curious. What was NASA's official architecture for landing humans on Mars?

It turns out NASA's first answer was the same one I remembered from my childhood. In the 1950s, the captured (and somehow rehabilitated) former Nazi rocketeer Dr. Wernher Von Braun had been inspiring Americans with his visions of human space travel. He enrolled space artist Chesley Bonestell to paint fantastic but remarkably real architectural images of spinning space stations, moon buggies and Mars landers conjured from Von Braun's sketches. A monthly series called "Man Will Conquer Space Soon!" in *Collier's* allowed the imaginations of a new generation to believe these things would come true. During my childhood, a decade later, copies of those magazines still lingered in my school's library; to this day, I have not forgotten them. I remembered Von Braun's vision and wondered if it might work.

Von Braun imagined that in the not-too-distant future (1982), a massive aerodynamic rocket would be launched into Earth's orbit near a large, rotating bicycle-tire of a space station. A crew of space construction workers from the station would bolt on massive wings to either side of the rocket. Another rocket would be bolted to the bottom of the first rocket, where it would eventually push a crew of 17 astronauts out of Earth's orbit and into a large orbit around the sun that would, seven months later, cross Mars' more distant solar orbit. After burning its rocket engine in the direction opposite of its travel, it would be placed into a Mars orbit. Using telescopes to find a safe landing site, the crew would then fire their rocket again and head in at a grazing angle toward Mars' atmosphere. The rocket's belly and its large wings would work as heatshields, much like the US Space Shuttle designs of the future. Minutes later, the rocket would act like a supersonic glider until, near the surface, it would slow to aircraft landing speed. Without runways, the lander-glider would land on Mars' surface using large skids. After weeks of exploration, the crew would remove the wings and a large crane would lift the body of the rocket back toward a vertical position. From there, it would launch back into Mars' orbit and onward toward Earth.

Space scientists in the late 1960s and the 1970s would later discover important details Von Braun was not yet aware of, later to be discovered by One was the discovery of just how rough Mars' surface is. On Earth, it is relatively easy to find places where wind and water erosion smooth and level the surface enough for a lander. Additionally, volcanism and plate tectonics rough the Earth's surface on very slow time scales. Finally, where Earth's thick atmosphere filters out meteors, the moon and Mars experience constant bombardment. Ironically, however, the complete absence of an atmosphere on the moon helps to smooth the surface for the size of a lander. Despite the occasional very large impact that throws massive boulders everywhere, billions of tiny meteor impacts grind these boulders to dust and compact and flatten the surface, making the moon a pretty good place to land and drive.

Mars, on the other hand, seems to have the worst of both worlds: mountains, cliffs, and mounds dot the landscape, and ancient lava flows spread into boulder-strewn fields as far as the eye can see. The air is too thin to filter out big meteor impacts but thick enough to filter the

ARTIST'S CONCEPT OF CURIOUSITY LANDING ON MARS. COURTESY OF NASA/JPL-CALTECH

HARRISON "JACK" SCHMIDT FROM APOLLO 17.

tiny meteors that pepper the top of the atmosphere. Unlike the moon, small meteors never make it to Mars' surface to gradually grind these boulders into smaller pebbles. Finally, fine dust makes low but fast hops in the thin Mars wind, and over millions over years sharpens the rocks into knife-like edges. Finding safe yet scientifically interesting landing sites for our robotic landers is a primary challenge.

The other detail unbeknownst to Von Braun was the annoying fact that Mars has a poor excuse for an atmosphere. Von Braun knew it was thinner than Earth's, but he believed it was much thicker than it really is. Instead of landing at 100 MPH, I calculated his lander would have touched down at closer to 1000 MPH. On skids. On Mars. On rocks. On big, sharp rocks. Probably not a good day for those 17 astronauts.

OK, so Von Braun's design wouldn't work. What was NASA's "official" position on how landing would happen? I was surprised and a bit shocked to learn that NASA engineers had not been allowed to work seriously on this problem for years. The reason was that the Space Shuttle, followed by the International Space Station, had dominated NASA's human space flight budget for much longer than those in Congress were hoping it would. Any engineering study or even discussion of work unrelated to the Shuttle and Station, especially human return to the moon or human exploration of Mars, was effectively banned inside NASA. Congress worried, perhaps legitimately, that any money spent on thinking about Mars or the moon would further delay NASA's overdue projects. Ironically, we—my teammates and I on the science robot side—were now NASA's Mars landing experts.

Instead of landing at 100 MPH, I calculated his lander would have touched down at closer to 1,000 MPH.

On skids.

On Mars.

On rocks.

On big, sharp rocks.

That's not to say no work had been done; various Entry, Descent and Landing (EDL) technologists had been working on pieces of the problem. One small NASA crowd worked on Mars heatshield materials (needed for our little robotic landers), another small NASA crowd worked on what they called in-situ resource utilization (using Mars' atmosphere and other resources to make useful stuff, like air to breathe). Yet another small crowd worked on entry guidance systems. But no one appeared to be working on the whole problem end-to-end, other than those of us trying to land robotic explorers.

I put this problem to one side. A few years after Pathfinder, my friends and I proposed the two Mars Exploration Rovers "Spirit" and "Opportunity." We built them in three years and, in early 2004, both landed on Mars. I enjoyed a year of exploring and discovering Mars'

ONE OF THE SPACEX FALCON 9 ROCKETS FIRING ITS ENGINES WHILE FLYING BACKWARDS TO SLOW ITS DESCENT ON ITS WAY TO A LANDING PAD ON EARTH FOR RECYCLING. COURTESY OF NASA/JPL-CALTECH

ancient water history with some of the most excited scientists I have ever had the pleasure of working with. But I needed a break.

My family and I had just landed minutes earlier on Kauai for a family vacation when I received an odd phone call from one of my JPL colleagues who had moved to Washington, DC, to work at NASA headquarters. NASA Administrator Sean O'Keefe was looking for someone to lead a NASA study that would identify the technologies and capabilities needed for NASA to land people once again on the moon and then onto Mars. "Would you be interested?" My old curiosity returned. "Of course! Why not?"

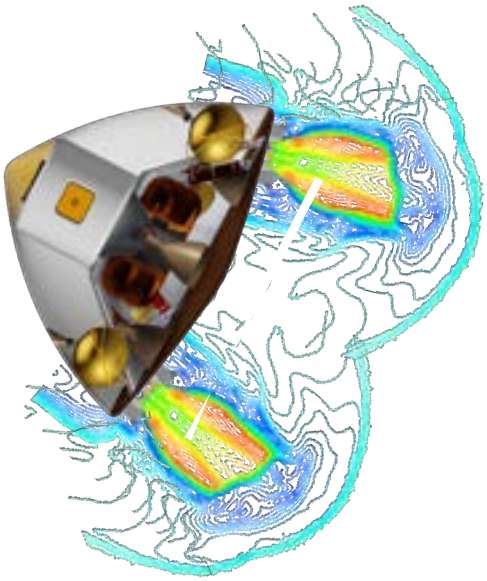
I felt, however, it wasn't quite right to have a "robotics" person in charge of creating a human landing roadmap. What did I know about piloting landers? What did I know about what it felt like to fly to and from outer space? All I knew was it would scare me to death. I knew just how hard it was to be certain these complex systems would work because, well, that was my job. Needing to reach out to the human side of NASA, I contacted two people.

One was a quiet engineering legend from the home of human space flight, NASA's Johnson Space Center. Claude Graves had worked on both the Mercury and Gemini entry systems at an early age. He later designed Apollo's entry system which enabled a direct return from the moon to select areas on the Pacific Ocean where the astronauts could land near Navy vessels. He also led the design of the Space Shuttle's elegant automatic flight from space that allowed it to fly halfway around the Earth at hypersonic speeds before making a precision subsonic landing on a runway at the Kennedy Space Center in Florida.

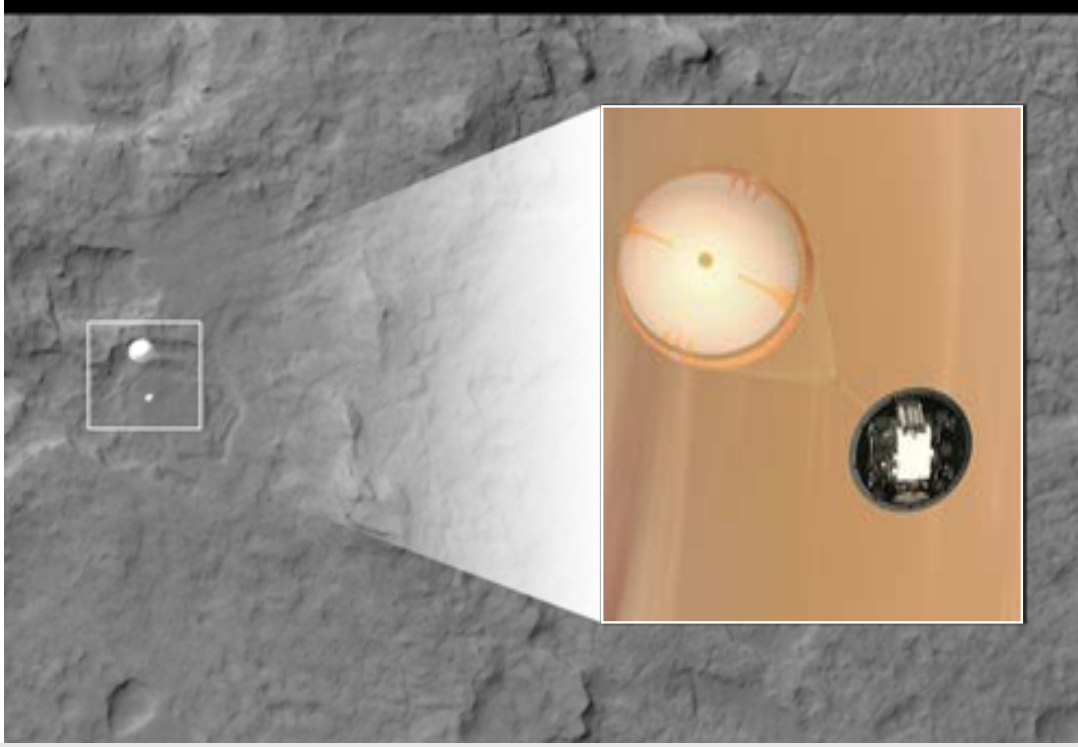
The second person was a former Apollo astronaut named Harrison "Jack" Schmidt. We had recently enlisted his help to review the new "skycrane" landing architecture designed to land a one-ton Mars rover that was later named Curiosity. The only geologist ever to walk on the moon (as part of the Apollo 17 mission with Eugene Cernan) Harrison would be an amazing addition to the leadership of my team.

We rounded up as many past, present and future moon and Mars lander designers as we could find from around the country, both with NASA and from industry and universities. In late 2004 and early 2005, we scheduled a series of fascinating workshops. For the first time, both robotic and human lander designers (and astronauts) were together under one roof. I scheduled our first three-day workshop at Caltech in Pasadena, California, the next at NASA Ames Research Center in Mountain View, California, and the last at NASA's Johnson Space Center in Houston. It was an eye-opening experience for all of us.

As I had felt years earlier, the group conceded that landing on Mars was really hard compared with the moon. We essentially (and perhaps arrogantly) believed we understood what it took to design human landers for the moon. Mars, on the other hand, was another matter. Graves, Schmidt and



RENDERING OF A POSSIBLE LARGE, HUMAN-SCALE "BLUNT BODY" LANDER USING ITS ROCKETS SUPERSONICALLY AFTER ENTERING MARS' ATMOSPHERE FROM SPACE.



CURIOSITY ROVER INSIDE ITS ENTRY CAPSULE WHILE SUSPENDED UNDER ITS SUPERSONIC PARACHUTE ABOVE MARS ON AUG. 6, 2012. THIS AMAZING, VERY LONG-RANGE IMAGE WAS CAPTURED BY THE MARS RECONNAISSANCE ORBITER'S HIRISE CAMERA AS IT WAS FLYING OVERHEAD DURING LANDING. COURTESY OF NASA, JPL/CALTECH, & UNIV. OF ARIZONA. (COLOR INSET PHOTO): ARTIST'S CONCEPTION OF CURIOSITY ARRIVING TO MARS INSIDE ITS ENTRY CAPSULE.

NASA Administrator Sean O'Keefe was looking for someone to lead a NASA study that would identify the technologies and capabilities needed for NASA to land people once again on the moon and then onto Mars. "Would you be interested?" My old curiosity returned. "Of course! Why not?"

the astronaut crowd felt that a Space Shuttle-like design that dropped in for entry from a Mars-orbiting space station would be best. It would use retro-rockets (rockets that push in the direction opposite the lander is moving) to gradually slow to a landing either on its tail, legs, or belly.

One other important detail: No one knew if it was possible to fire retro-rockets backwards while flying supersonically "into the wind." Moving several times the speed of sound in the thin atmosphere of Mars feels like flying into the face of a Category 5 hurricane or worse. We had no idea if it would work. The rocket plume could blow back onto the lander and cause the vehicle to be heated by hot exhaust or, even worse, buffeted by the unsteady plume and even tumble out of control. For all our robotic landers, we use parachutes to slow down to a speed where we can safely fire our descent rockets (solid rockets or otherwise), a speed well below the speed of sound, which on Mars is around 540 MPH.

I asked our group, "We can enter the atmosphere like the shuttle, but how would we slow this lander to subsonic speeds?"

"We'll use supersonic parachutes like the robotic landers do," the human lander crowd responded.

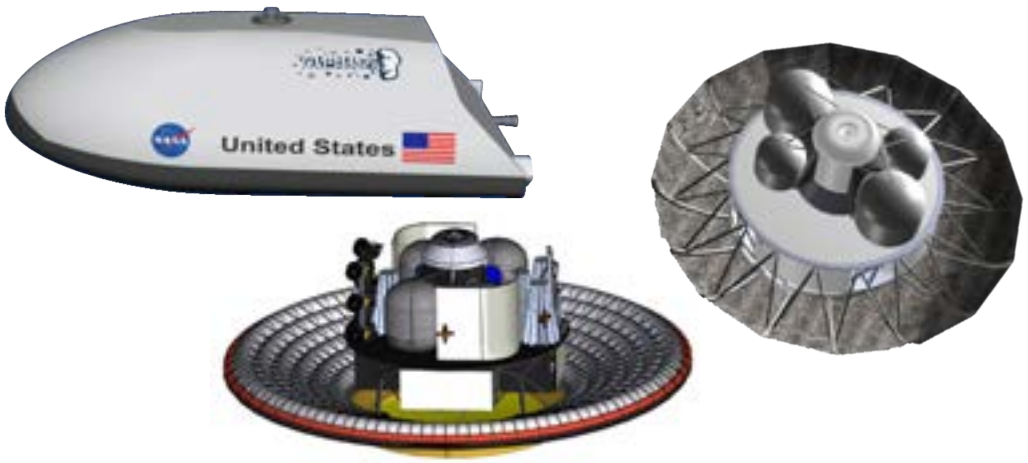
That's when the parachute experts in the room started howling. They had learned a lot about the Mars parachutes we had been using for our robotic landers and they had developed a deep respect for, and perhaps a bit of fear, of them. "Seriously?" they asked. "And how big would the parachutes have to be in order to slow to 200 MPH?"

"Big. 80 to 120 meters in diameter—between six and nine times bigger than your robot's parachutes. We probably need a cluster of them," said the human lander group.

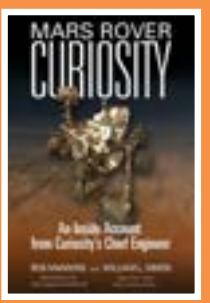
"But we don't know how to inflate clusters of parachutes supersonically," the parachute experts said.

"Well then, we'll start with a smaller one and then inflate a cluster once it slows a bit," (a trick that works well in Earth's thick and deep atmosphere).

"But you need to be subsonic before you inflate the clusters of parachutes, otherwise they tear each other to pieces! Just getting this beast down to a safe speed requires a huge supersonic parachute. Not going to happen," responded the parachute experts.



THREE OTHER MARS ENTRY CONFIGURATIONS THAT MIGHT ALSO WORK. THE UPPER LEFT IS A SHUTTLE-LIKE ENTRY VEHICLE (MINUS THE WINGS). THE RIGHT-HAND LANDER USES A MECHANICALLY DEPLOYED HEATSHIELD. THE CENTER LANDER USES A HYPERSONIC INFLATABLE AERODYNAMIC HEATSHIELD TO SLOW DOWN TO SUPERSONIC SPEEDS. IN ALL CASES, THESE WOULD HAVE TO USE FIRST A HEATSHIELD AND THEN A SUPERSONIC RETRO-PROPULSION IN ORDER TO SLOW DOWN FOR EVENTUAL TOUCHDOWN. COURTESY OF NASA



Rob Manning is the chief engineer for NASA's Jet Propulsion Lab (JPL) Engineering and Science Directorate. For more than 35 years, he has designed, tested, operated and managed robotic spacecraft, including Galileo to Jupiter, Cassini to Saturn, Magellan to Venus, and Pathfinder and Curiosity to Mars. Manning has received four NASA medals, is in the *Aviation Week* Magazine Space Laureate Hall of Fame at the Smithsonian Air and Space Museum, has received two honorary PhDs, and has a minor planet named after him.

"OK then," said the human lander experts. "We'll use some other type of inflatable drag device, like a huge inflatable donut bolted to the periphery of the lander—or something."

The great thing about assembling a diverse group of people with different perspectives is that you get these sorts of conversations and debates that would never happen if everyone were alike and shared the same background. Clearly the folks who had thought about a human landing on Mars had not been talking to parachute experts. I was delighted.

We had stumbled onto what I called "the supersonic transition problem" for Mars landers. We knew how to do Earth-like entry with either a space capsule or a Space Shuttle entry system, but on Mars we somehow needed to get below the speed of sound before we could transition to a rocket lander that resembled a lunar lander. How would we do that? We didn't know. It was a little bit embarrassing. Here we are in 2005 representing NASA's best and brightest, yet we were all suddenly unsure if it was even possible to practically land people without some new invention.

For the next 10-years, NASA took this problem seriously. Supersonic and hypersonic inflatable drag devices were built and tested, as were massive mechanically deployed umbrella-like heatshields. New huge supersonic parachutes were attempted (and failed—I was the chief engineer for those tests). The one obvious trick of attempting to fly rockets backwards while flying at hyper- and supersonic speeds looked too expensive to try. We called this last trick Supersonic Retro-Propulsion (SRP). Although studied for decades, especially in the 1960s, no one had ever seriously attempted SRP. Simulating it was notoriously difficult due to the chaotic flow, and small-scale tests were not useful. We would need to spend a good deal of money to be able to answer our questions, so we never did.

A decade after we had our "aha" moment, almost out of the blue, we got wind that Elon Musk's SpaceX team was interested in testing SRP. In order to recycle the first (and second) stages of the Falcon rockets, their stages would have to fire their engines while traveling backward at supersonic speeds at altitudes where the air was as thin as on Mars. No one had done this before, and it was an amazing opportunity to answer our questions about SRP. We eagerly piggybacked on their tests with a NASA observational aircraft. We soon learned that the dynamics and heating, although complicated and very difficult to simulate on computers, were apparently not as bad as we had feared in real life. With every SpaceX success, we began to realize that SRP would be the solution to the supersonic transition problem. Big supersonic parachutes would not be a part of the long-term solution for landing humans on Mars.

After decades of learning and struggling to land robots on Mars, I think I can say I have a better idea of how people will eventually land on and return from Mars. But there are other difficult problems to solve: How will people work on Mars? Will they be able to stay safe and survive? How will we prevent large numbers of Earth's micro-organisms from escaping onto Mars and contaminating Mars' micro-organisms if they exist there? How will we make going to Mars economically feasible? Will humans ever actually be able to live on Mars?

None of this is easy, but perhaps some of you will find answers to these questions.

FROM LEFT TO RIGHT: RANDY TENNISON, TED NAHAS, TONY PAUSTIAN AT 5:00AM ABOUT TO BEGIN THEIR JOURNEY.

BY ANTHONY PAUSTIAN, PH.D.

WHAT I LEARNED AT MILE 32

Of My 50-Mile Walk

Each week I meet with a group of local business leaders for coffee. On one particular morning, we got on the topic of President Teddy Roosevelt, and after Googling him, we discovered that in 1908 he laid out a specific directive for soldiers, a mandate requiring soldiers to be able to complete "a march of 50 miles, to be made in three consecutive days and in a total of 20 hours, including rests, the march on any one day to be during consecutive hours." The directive resulted from Roosevelt's description of "the condition of utter physical worthlessness" into which soldiers had "permitted themselves to lapse, and the very bad effect this would have if ever the army were called into service." The directive remained in effect for the rest of his time in office, but fell into obscurity shortly thereafter.[1]

BOBBY KENNEDY HAVING HIS FEET RUBBED BY HIS WIFE AFTER HIS 50-MILE WALK. COURTESY OF THE NATIONAL ARCHIVES.

But it wasn't just Roosevelt who applied it. In 1963, John F. Kennedy, along with the Council on Physical Fitness, rediscovered Roosevelt's directive and decided to use it to get Americans moving, since in Kennedy's estimation, people had once again descended into slothfulness. However, before Kennedy could even initiate the program, Robert F. Kennedy, JFK's brother and the country's attorney general, set out one morning at 5 a.m. wearing leather Oxford dress shoes and began walking along the Chesapeake and Ohio Canal towpath. With no training or preparation, he walked through snow, slush and below-freezing temperatures to complete the 50-mile march in 17 hours and 50 minutes.[2]

During coffee, our conversation slowly transitioned from discussing the historical aspects of the march to throwing down a group challenge to actually complete it. Why not? If Robert Kennedy could do it in leather Oxfords, then we all should be able to complete it with ease. Everyone agreed to participate, and we set a date in late April.

As the date approached, members of the group began to drop out for various reasons, such as previous commitments to work or family. Ultimately, three of us persisted, and I was by far the oldest member of the group (by about 10 or so).

Not one to back down from a challenge (so as to avoid the long-term digs and humiliation that come with "wimping out"), I began to train for the long walk. First, I researched walking long distances and found that frequently changing socks and shoes was one of the keys to success. I would then take frequent walks of 6–10 miles with the thought that if I could successfully do those on a regular basis, what's another 40–44 miles.

When we began the adventure, I made a number of assumptions:

- The weather (late spring, cooler temps with forecasted sun) would work in our favor.
- The course would be pretty straightforward, as we were following an established, paved bicycle path from the city of Jefferson in northwest Iowa to Des Moines.
- Food would be available at 5:00am in Jefferson prior to beginning the journey.
- Amenities (food, water, restrooms, etc.) would be supplied along the path.
- Lugging a backpack with 25 pounds of shoes, socks, cold-weather gear, a bottle of water, a couple of energy bars, and walking sticks wouldn't be a big deal.
- GPS is always correct and efficient.
- My body would hold up fine for the requisite 16–18 hours, especially considering I felt good when we started and we were only "walking" (we weren't running the 50 miles, for crying out loud).

We began the journey at 5 o'clock in the morning, just like Robert Kennedy, in the cold, windy darkness of northwestern Iowa. There was nothing open for

DEALING WITH THE WIND, DUST AND COLD AFTER HAVING GOTTEN OFF-COURSE.

breakfast except an old Casey's gas station, with food options consisting primarily of packaged junk food. I bought and ate an energy bar. As the sun rose, we found ourselves walking into sustained 20–30 MPH winds throughout the entire day.

As we progressed, I began to think the trail was taking us off course, so I fired up the Maps app (GPS) on my trusty iPhone. However, I didn't realize I had the "automobile" icon selected instead of the "hiking" icon, so we ended up walking about ten miles alongside dusty country roads—a deviation made worse by deep treads in the road from heavy farm implements. Farmers were out en masse that day, plowing and spraying fields, as the wet spring had delayed planting. The winds blew a constant stream of dust, dirt and chemicals into our faces and ultimately our lungs.

Without any amenities during the first 20 miles, I had to rely on the one bottle of water and two energy bars I had brought. As a result, I slowly became dehydrated and weaker due to lack of caloric intake. It also didn't help that I hadn't slept the night before. I had just laid in bed awake all night, thinking about the task ahead while listening to the soft snoring of my brothers-in-walk.

With the straps of my backpack digging into my shoulders, the 25 pounds of extra weight also caused some lower back pain. While that was bad in and of itself, the most dreadful pain had started to rear its head in the worst place possible—my feet. My plantar fasciitis, stemming from playing basketball years earlier, made a resounding comeback. By mile 28, my feet felt like someone was smacking them with a wooden spoon. By mile 30, the wooden spoon had changed into a hammer. And by mile 32, the hammer had grown spikes.

I then remembered something Jill Heinerth had said during her presentation at Celebrate! Innovation Week (ciWeek 9) a couple of months earlier. Jill, one of the best underwater divers in the world, has dived inside Antarctica icebergs and within some of the deepest water-filled Amazon caves. When discussing how this form of diving required specially designed rebreathers, she said, "Despite your natural desire and drive to keep exploring, to go further and deeper, to reach your goals, you have to pay close attention to your indicators and know when to call it. If not, you won't have enough oxygen to get back so you can live to fight another day."

At that point, something hit me (besides what felt like the spiked hammer hitting my feet). Other than the personal pride of accomplishing a goal, there was nothing waiting for me at the end—no crowds to cheer me on, no marching bands, no cheerleaders, no trophies or medals, no prize money, and no fireworks . . . only a car with an empty gas tank left by the wife of one of my marching partners (she had told him that when she parked it, the gas light was on). I realized I still needed to be able to walk the following days, as I

JUST BEFORE THE END WHEN I CALLED IT.

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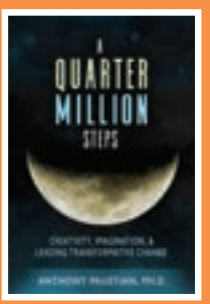

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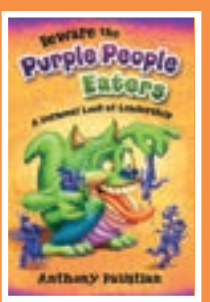

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had work to do and other projects of significance to finish—things that mattered more than accomplishing this walk. Also, the last thing I wanted to be was the dead weight, the injured person often seen in movies dragging down everyone else and thus reducing their chances for survival.

At mile 32, I called it.

In 1897–99, during Roald Amundsen's first expedition to the South Pole, his ship became locked in sea ice. His team had to call it and shift to survival mode. Using lessons learned from his initial attempt, Amundsen would return and become the first to successfully reach the South Pole in 1911.[3]

After the explosion on Apollo 13, Mission Control knew landing on the Moon was not worth the risk, so they called it. Despite many obstacles, the crew successfully returned to Earth. NASA learned from the experience and went on to have four successful Moon landings free of any major problems.

In 2008, during an attempt to climb the Shark Fin, a 1500-foot blade of granite at the top of the 21,000-foot Mount Meru in the Himalayas (and a route widely believed to be unclimbable), Conrad Anker had to call it only a hundred meters short of the summit because he realized they lacked the safety margin to make it to the top and survive the return. Later, using what he had learned, Anker and his climbing partners, Jimmy Chin and Renan Ozturk, returned to Meru and successfully summited the peak in 2011.[4]

In each case, everyone's gut feeling was to press on and succeed despite the obstacles. However, their rational and realistic thought process won out, and they lived to fight and succeed another day. While I didn't achieve my goal of 50 miles, I learned from it. Aside from the obvious—better preparation by training for longer distances, bringing additional food and water, making sure the GPS is set correctly, and getting plenty of sleep the night before—I learned that making the trip with friends is essential. Fifty miles and 20 hours is a long time to spend with people. And while my friends ultimately achieved the goal (but not without massive pain of their own, including blisters covering the entire bottoms of their feet), we have planned to attempt the "adventure" again in the fall. That said, if and when I realize at any given point I've reached my limit, I'll know to call it, so I too can live to fight another day.

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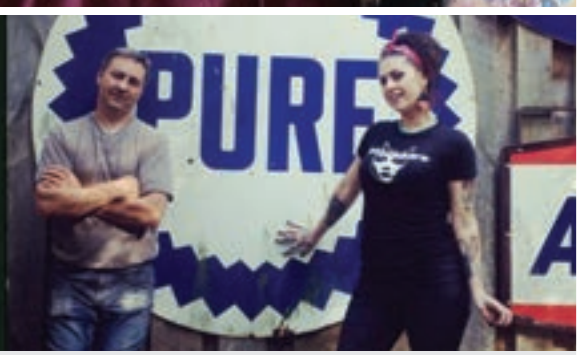
AN OLD CAR NOW USED AS A SIGN FOR ANTIQUE ARCHAEOLOGY IN LECLAIRE, IOWA, THE HOME OF THE PICKERS.

RUSTY TREASURE

As Martin Luther King Jr. Said, "We Are Not Makers of History. We Are Made By History."

BY ROB WOLFE

I am associated with the television show **American Pickers**, *a series about picking through people's junk and finding lost pieces of history. My job is to preserve history one step at a time, one story at a time. We seek out and tell the stories of forgotten American landscapes. Where did this come from? Who invented this? What is the story behind this piece?*



WOLFE WITH CO-HOST OF *AMERICAN PICKERS*, DANIELLE COLBY-CUSHMAN

WOLFE ON AN OLD HARLEY DAVIDSON MOTORCYCLE OUTSIDE ANTIQUE ARCHAEOLOGY IN LECLAIRE, IOWA.

We find history one piece at a time in our grandparents' attics, in the neighborhood corner store, in farmers' barns. We've come to realize that the people who have collected and saved these pieces are also part of the history, and that these people are a breed of their own. We forge relationships between history and the people who have saved it, and sometimes their stories are more important than the pieces themselves. Everything begins with a story.

One specific story that comes to mind was when my brother called me to retrieve a rare Volkswagen split window from a barn in Pennsylvania. When I arrived in Pennsylvania, little did I know that the car, minus the wheels, was on the top floor of a hundred-year-old barn! I met with the son-in-law of the owner, who had passed away. As is often the case, the relative was left to clean up the property and to retell the stories.

The story he shared was unbelievable. His grandfather, worried about thieves in the area, put the Volkswagen on the top floor and removed the wheels, so no one could ever steal it. The car sat up in the barn for 50-years, only to be preserved. I can just imagine his grandfather laughing that no one would be able to steal his car. Now we had to figure out how to get it down.

We spent the day shoring up the floor before I found four rims and tires and then lifted the car up and installed the wheels. Eventually we were able to roll the car back into an area where we used a skid steer to pick up the car and lower it to the ground. When the car reached the ground, I had the biggest smile on my face. I was thrilled to watch the car roll into the trailer and witness this piece of history being preserved—all because this one man had feared thieves were going to steal his car. Little did he know he was preserving history.

My favorite part of picking is always the story revealed when I dig just a little deeper. I once received a call to go look at a 1940 Indian four-cylinder motorcycle owned by a retired Air Force pilot. When I arrived at his home, he told me the story of collecting parts to build a motorcycle. He never got around to building the motorcycle because of his passion for airplanes. His daughter took me downstairs, and I saw airplane parts everywhere. Apparently, when her father came home from World War II, he began a career in plumbing but never lost his passion for flying. He began a twenty-year-long endeavor of building his own airplane in the basement of his home. He never thought the project would be finished, nor did he think about how to remove the plane once it was built!

In the late 1980s, his business took a hard turn, and he was forced to sell the plane. When a man came to buy the airplane,

WOLFE WORKING ON AN OLD MOTORCYCLE ENGINE

he asked where it was, so the seller took the man to the basement. There sat a single-engine airplane. The buyer asked how he was supposed to get the plane out of the basement, and the seller responded with a chuckle, saying, "We'll just remove the back wall of the house." He wasn't kidding. The next day, that plane was on a trailer heading south. When I heard this story and met his children, I knew that life with this character had never been boring.

When I was a child, my grandfather owned a huge barn full of junk where I would spend my free time. I loved to go through all of the objects and think about the mysteries they held. I would imagine the story behind each item and try to figure out how all the mechanics worked. Thus began my love of junk, history, engines and automobiles. As I grew older, I would find myself digging through old junkyards. I spent my summer days wondering how so many cars ended up stacked on top of each other. My brother and I started going on adventures together, and our favorite thing to find was a bicycle. If we found one, boy did we go to town trying to fix it up.

I'm sure you've found a piece of history and never looked twice at it because it had rust or something broken off. Those are the most valuable pieces, yet we often don't even think about them. I have found many things in my lifetime but have not yet found a perfect piece of junk because there is no such thing as a perfect piece. If you see an old car on the road, take a minute and admire it—it may be the only one left of its kind. We often fail to realize there is history all around us, like the little schoolhouse down the road, the building on the corner, or your neighbor's 1936 Ford. If we don't preserve history and its artifacts, who will? Where will the stories go?

Some people build their own stories by repurposing pieces. The repurposing craze has taken the industry by storm. People use barn wood in their homes and make everything from lights to pallet furniture. Life is a cycle where we go back to the way we used to do things. This is just another one of the many ways can be preserved.

I wake up every day looking to find stories and pieces of history to help save and retell. My job is to try to put things of the past in the right hands, so the past can live on. We find history one piece at a time, and in the process form many special relationships with the people we meet along the way. We all need to take a good look around us and cherish the history we see everywhere and every day.

Rob Wolfe is a lifelong "picker" of antiques and original paint cars and trucks. He is the brother of Mike Wolfe, of History Channel's hit reality show *American Pickers*. Rob can often be seen on the show traveling the country and digging through old barns and garages looking for what he calls "rusty gold."

WOLFE WITH BROTHER MIKEWOLFE WHO CREATED *AMERICAN PICKERS*.

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The scholarship support provided by the DMACC Foundation helped Dalia Kyi enroll at Urban Campus and begin work toward her dream of becoming a social worker focused on helping the immigrant community.

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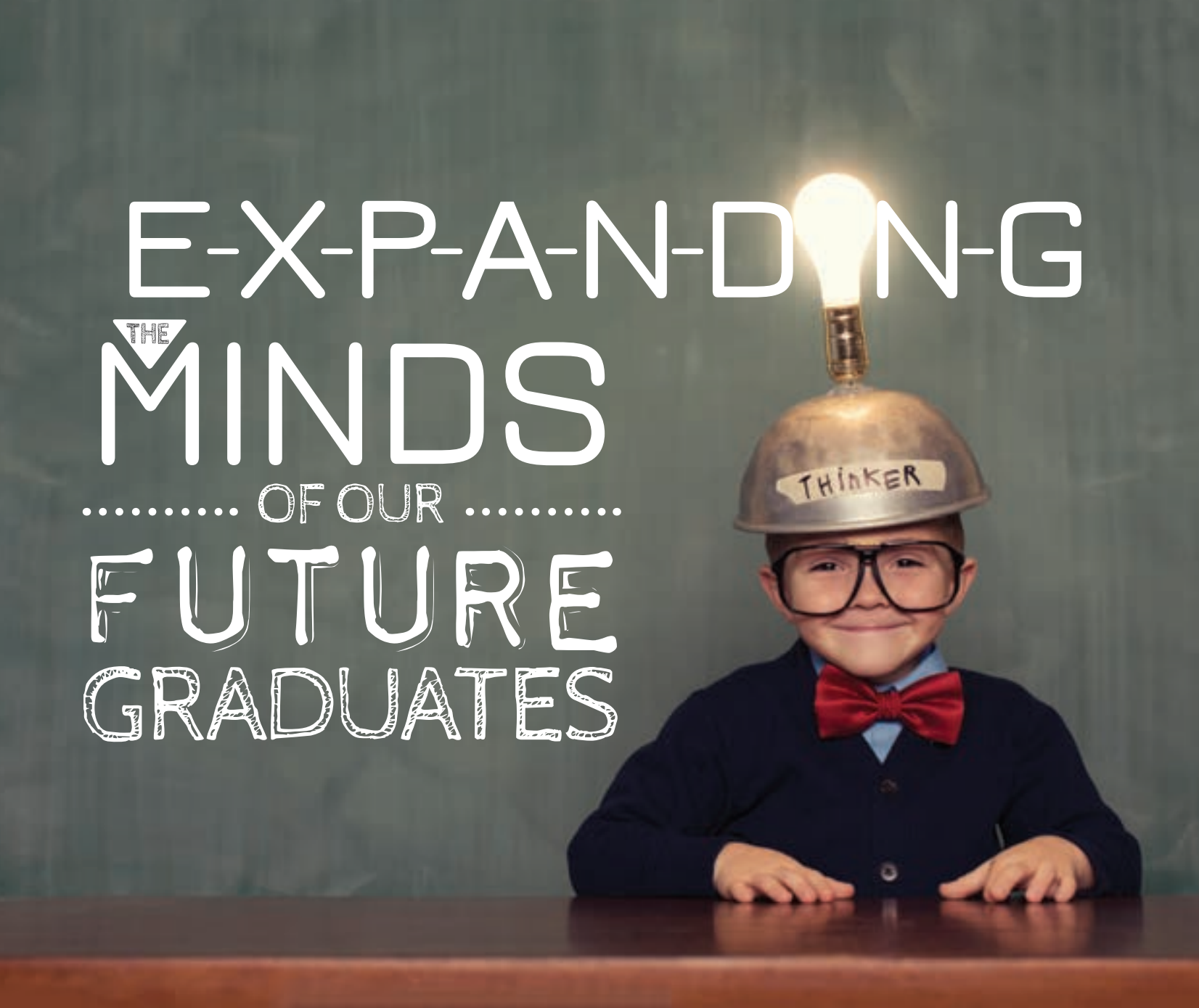

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