### Listening Transcripts of Units 1&2

### Unit 1

### Task 14

Who was the greenest president? A recent survey of green groups aimed to find out which presidents had the most environmentally friendly policies. The top two spots naturally went to Republicans, teddy Roosevelt and Richard Nixon. Roosevelt dominated the survey for his championing of the nascent idea of conservation more than a century ago. Nixon garnered support for his passage of landmark legislation, like the Clean Air and Clean Water Acts, as well as the establishment of the Environmental Protection Agency. Rounding out the top three was Jimmy Carter, who gained points for actions like putting solar panels on the White House. Who came in fourth? Barack Obama, thanks to often overlooked steps like raising car fuel efficiency standards and making alternative energy projects a big part of the federal stimulus package. Of course, the modern Republican Party, including candidate Mitt Romney, has turned against conservation. If Romney likes coal, then he must love air pollution and global warming. The original Republican president, Lincoln, may have created the 1st national park, but his heirs today are more interested in opening such public lands for fossil fuel exploitation.

### Task 15

If you wanted to read in 1875 at night, you needed to have an oil or a gas lamp. They created pollution, they created odors, they were hard to control, the light was dim, and they were a fire hazard. By 1929, electric light was everywhere. We had the vertical city, the invention of the elevator. Central Manhattan became possible. And then, in addition to that, at the same time, hand tools were replaced by massive electric tools and hand-powered electric tools, all achieved by electricity.

Electricity was also very helpful in liberating women. Women, back in the late 19th century, spent two days a week doing the laundry. They did it on a scrub board. Then they had to hang the clothes out to dry. Then they had to bring them in. The whole thing took two days out of the seven-day week. And then we had the electric washing machine. And by 1950, they were everywhere. But the women still had to shop every day, but no they didn't, because electricity brought us the electric refrigerator.

Back in the late 19th century, the only source of heat in most homes was a big fireplace in the kitchen that was used for cooking and heating. The bedrooms were cold. They were unheated. But by 1929, certainly by 1950, we had central heating everywhere.

What about the internal combustion engine, which was invented in 1879? In America, before the motor vehicle, transportation depended entirely on the urban horse, which dropped, without restraint, 25 to 50 pounds of manure on the streets every day together with a gallon of urine. That comes out at five to 10 tons daily per square mile in cities. Those horses also ate up fully one quarter of American agricultural land. That's the percentage of American agricultural land it took to feed the horses. Of course, when the motor vehicle was invented, and it became almost ubiquitous by 1929, that agricultural land could be used for human consumption or for export. And here's an interesting ratio: Starting from zero in 1900, only 30 years later, the ratio of motor vehicles to the number of households in the United States reached 90 percent in just 30 years.

Back before the turn of the century, women had another problem. All the water for cooking, cleaning and bathing had to be carried in buckets and pails in from the outside. It's a historical fact that in 1885, the average North Carolina housewife walked 148 miles a year carrying 35 tons of water. But by 1929, cities around the country had put in underground water pipes. They had put in underground sewer pipes, and as a result, one of the great scourges of the late 19th century, waterborne diseases like cholera, began to disappear. And an amazing fact for techno-optimists is that in the first half of the 20th century, the rate of improvement of life expectancy was three times faster than it was in the second half of the 19th century.

So it's a truism that things can't be more than 100 percent of themselves. And I'll just give you a few examples. We went from one percent to 90 percent of the speed of sound. Electrification, central heat, ownership of motor cars, they all went from zero to 100 percent. Urban environments make people more productive than on the farm. We went from 25 percent urban to 75 percent by the early postwar years.

What about the electronic revolution? Here's an early computer. It's amazing. The mainframe computer was invented in 1942. By 1960 we had telephone bills, bank statements were being produced by computers. The earliest cell phones, the earliest personal computers were invented in the 1970s. The 1980s brought us Bill Gates, DOS, ATM machines to replace bank tellers, bar code scanning to cut down on labor in the retail sector. Fast forward through the '90s, we had the dotcom revolution and a temporary rise in productivity growth.

But I'm now going to give you an experiment. You have to choose either option A or option B. (Laughter) Option A is you get to keep everything invented up till 10 years ago. So you get Google, you get Amazon, you get Wikipedia, and you get running water and indoor toilets. Or you get everything invented to yesterday, including Facebook and your iPhone, but you have to give up, go out to the outhouse, and carry in the water. Hurricane Sandy caused a lot of people to lose the 20th century, maybe for a couple of days, in some cases for more than a week, electricity, running water, heating, gasoline for their cars, and a charge for their iPhones.

The problem we face is that all these great inventions, we have to match them in the future, and my prediction that we're not going to match them brings us down from the original two-percent growth down to 0.2, the fanciful curve that I drew you at the beginning.

So here we are back to the horse and buggy. I'd like to award an Oscar to the inventors of the 20th century, the people from Alexander Graham Bell to Thomas Edison to the Wright Brothers, I'd like to call them all up here, and they're going to call back to you. Your challenge is, can you match what we achieved?

Thank you.

### Task 16

**Broadcaster:** These days, the words lithium and battery are almost synonymous. Yet this is, by no means, the only use for this very special element. For elementary introduction to lithium, I turned as always to our own chemistry power house, Professor Andrea Sella of University College London.

**Andrea sella:** The really crucial thing is the fact that lithium is actually the third element of the periodic table after hydrogen and helium. And it's therefore the lightest solid. And I've got a jar of it here and the interesting thing you can see is that it actually floats. These beautiful silvery grey rods of lithium actually float in oil.

**Broadcaster:** Yeah does, doesn’t it?

**Andrea sella:** So this is lithium metal.

**Broadcaster:** Well, actually it's the way that you’d expect in a (sort of) jar of oil.

**Andrea sella:** And the lithium itself weighs extremely little. If you try picking it up with these tongs, I think you'll realize just how light.

**Broadcaster:** Well, it weighs anything at all?

**Andrea sella:** it’s incredible for a metal.

**Broadcaster:** Wow, it’s incredibly light!

### Task 17

**Steve:** Welcome to the *Scientific American* podcast, *Science Talk*, posted on January 25th, 2012, I'm Steve Mirsky. Last night President Obama delivered the State of the Union address. Here's a little more than six minutes of the sections dealing with research, technology and energy. Anywhere I have made an edit in the audio, you'll hear a musical interlude. And I have lowered the volume on some of the applause for the sake of all of our ears. I think science-interested listeners across the political spectrum can find points of both strong agreement and major disagreement in these few minutes of the talk.

**Obama:** Hundreds of thousands of talented, hardworking students in this country face another challenge. The fact that they aren't yet American citizens. Many who are brought here are as small children are American through and through. Yet they live everyday with the threat of the deportation. Others came more recently to study business and science and engineering, but as soon as they get their degree, we send them home, to invent new products, and create new jobs somewhere else. That doesn't make sense... Let's at least agree to stop expelling responsible young people who want to staff our labs, start new businesses, defend this country... Innovation also demands basic research. Today, the discoveries taking place in our federally financed labs and universities could lead to new treatments that kill cancer cells but leave healthy ones untouched. New lightweight vests for cops and soldiers that can stop any bullet. Don't gut these investments in our budget. Don't let other countries win the race for the future. Support the same kind of research and innovation that led to the computer chip and the Internet, to new American jobs and new American industries. And nowhere is the promise of innovation greater than in American made energy. Over the last three years we've opened millions of new acres for oil and gas exploration, and tonight I am directing my administration to open more than 75 percent of our potential offshore oil and gas resources. Right now, right now, American oil production is the highest that has been in eight years -- that's right, eight years. Not only that, last year we relied less on foreign oil than in any of the past 16 years. But with only 2 percent of the world's oil reserves, oil isn't enough. This country needs an all out, all-of-the-above strategy that develops every available source of American energy; a strategy that's cleaner, cheaper and full of new jobs. We have a supply of natural gas that can last America nearly 100 years, and my administration will take every possible action to safely develop this energy. The experts believe this will support more than 600,000 jobs by the end of the decade, and I am requiring all companies that drill for gas on public lands to disclose the chemicals they use*.* Because America will develop this resource without putting the health and safety of our citizens at risk. The development of natural gas will create jobs and power trucks and factories that are cleaner and cheaper, proving that we don't have to choose between our environment and our economy. And by the way, it was public research dollars, over the course of 30 years that helped develop the technologies to extract all of this natural gas out of shale rock reminding us that government support is critical in helping businesses get new energy ideas off the ground*.*Now what is true for natural gas is just as true for clean energy. In three years our partnership with the private sector has already positioned America to be the world's leading manufacturer of high tech batteries. Because of federal investments, renewable energy use has nearly doubled and thousands of Americans have jobs because of it... I will not cede the wind or solar or battery industry to China or Germany because we refused to make the same commitment here. We've subsidized oil companies for a century. That's long enough. It's time to end the taxpayer giveaways to an industry that rarely has been more profitable and double down on a clean energy industry that never has been more promising. Pass clean energy tax credits; create these jobs. We can also spur energy innovation with new incentives. The differences in this chamber may be too deep right now to pass a comprehensive plan to fight climate change. But there is no reason why Congress shouldn't at least set a clean energy standard that creates a market for innovation. So far, you haven't acted. Well, tonight I will. I am directing my administration to allow the development of clean energy on enough public land to power 3 million homes, and I am proud to announce that the Department of Defense working with us, the world's largest consumer of energy will make one of the largest commitments to clean energy in history, with the Navy purchasing enough capacity to power a quarter of a million homes a year*.*

**Steve:** For more on energy in the State of the Union, see Fred Guterl's article at [http://ScientificAmerican.com](http://scientificamerican.com/) titled "How Obama Plans to 'Double Down' on Clean Energy." For *Scientific American*'s *Science Talk*, I'm Steve Mirsky. Thanks for clicking on us.

### Task 18

*(lyrics)*

*Electric car, on roads so dark*

*To change the end, rewrite the start*

*Electric car, so good, so far*

*Electric car, on verdant green*

*Invent a turn, invent a dream*

*Electric car, the new machine*

*Let's take a ride in an electric car*

*To the west side in an electric car*

*How can you deny an electric car?*

*Won't you take a ride with me?*

*Come on and take a ride with me*

*Electric car beside the tree*

*Will past the dock, will past the sea*

*Electric car, roll silently*

**Speaker 1:** They are cheap to run, but the problem at the moment is that they're not cheap to buy. So even with the government subsidy, the price of it is still nearly double the price of equivalent car in the diesel reign. So they are prohibitively expensive to buy.

**Speaker 2:** Electric cars overprice, yet, underperforming, nerdy, and possibly not even as green as they're painted. Is that a stereotype founded in fact, or a slur well past its sell-by date?

**Speaker 3:** I was expecting a naughty car. I was expecting something that didn't have power, that looked a little bit naff. This car stealthily crept its way across the tarmac. And I'm thinking, is that freewheeling? or... because it is no sound as it stalled.

**Speaker 4:** Now, the next generation of electric vehicles will have a controllable noise.

**Speaker 5:** The people who make electric cars are raising their game, tickling our fancy with good looks and gadgets.

**Speaker 6:** It can identify when there are people around, and it will play a noise directly out that person. Now that noise can actually be louder if you want it to be than a normal car. You can actually phase in the noise of something like an old diesel car or a tractor if you wanted to. Just to. So they're aware of it. When that person's gone, you can fade that noise out completely again.

**Speaker 7:** Today I'm driving an electric car, but as such, I'm an extremely rare breed. I'm on the Westway just leaving London. And I'll be very surprised if I see another of my species. Sales of these vehicles have, frankly, been an abject failure. Despite a government sweetener of ￡5,000, the fact that you don't have to pay congestion charging, reduced road tax, they're just not firing people's imaginations. It's reckoned the only one in a thousand new cars sold in the last 5 or 6 years has been pure electric.

### Task 19

But the real key question I'm sure that's on your mind: Where is the hydrogen going to come from? And secondly, when are these kinds of cars going to be available? So let me talk about hydrogen first. The beauty of hydrogen is it can come from so many different sources: it can come from fossil fuels, it can come from any way that you can create electricity, including renewables. And it can come from biofuels. And that's quite exciting. The vision here is to have each local community play to its natural strength in creating the hydrogen. A lot of hydrogen is produced today in the world. It's produced to get sulfur out of gasoline -- which I find is somewhat ironic. It's produced in the fertilizer industry; it's produced in the chemical manufacturing industry. That hydrogen is being made because there's a good business reason for its use. But it tells us that we know how to create it, we know how to create it cost-effectively, we know how to handle it safely.

We did an analysis where you would have a station in each city with each of the 100 largest cities in the United States, and located the stations so you'd be no more than two miles from a station at any time. We put one every 25 miles on the freeway, and it turns out that translates into about 12,000 stations. And at a million dollars each, that would be about 12 billion dollars. That's a lot of money. But if you built the Alaskan pipeline today, that's half of what the Alaskan pipeline would cost. But the real exciting vision that we see, truly, is home refueling, much like recharging your laptop or recharging your cell phone. So we'repretty excited about the future of hydrogen. We think it's a question of not whether, but a question of when.

What we've targeted for ourselves -- and we're making great progress toward this goal -- is to have a propulsion system based on hydrogen and fuel cells, designed and validated, that can go head-to-head with the internal combustion engine. We're talking about obsoleting the internal combustion engine, and doing it in terms of affordability at scale volumes, its performance and its durability. So that's what we're driving to for 2010. We haven't seen anything yet in our development work that says that isn't possible. We actually think the future is going to be event-driven. So since we can't predict the future, we want to spend a lot of our time trying to create that future.

**Unit 2**

### Task 13

Christmas 2003 was bittersweet for Mars scientists. Because one gift they desperately wanted never arrived: The British-built spacecraft Beagle 2 was scheduled to land on the Red Plant, radio home the good news and begin a search for life. Instead, mission controllers heard nothing. They finally declared the Beagle 2 lost after months of silence. Many space scientists thought it crash-landed or broke up in the thin Martian atmosphere.

But now Beagle 2’s final resting place has been found. New images from NASA’s Mars Reconnaissance Orbiter revealed the spacecraft in its intended landing region, a massive impact basin near the Martian equator.

The two-meter-wide lander is little more than a low-resolution lump of pixels in the images. But investigators gathered enough information to piece together what probably went wrong: the probe’ solar panels seem to have only partially deployed, throttling Beagle 2’s power and preventing it from phoning home. Without contact with mission control, the probe was doomed to a slow demise before it could perform any science.

Nevertheless, the lander appears intact, and the remains of a parachute and an atmospheric-entry cover lie hundreds of meters away. Beagle 2 may now be considered a partial success, delivering the United Kingdom a very late Christmas gift: The nation’s first soft landing on another planet.

### Task 14

Is Mars red hot?

Mars may look hot, but don't let its color fool you -- Mars is actually pretty cold!

In orbit, Mars is about 50 million miles farther away from the Sun than Earth. That means it gets a lot less light and heat to keep it warm.

Mars also has a hard time holding onto the heat it does get. On Earth, much of the sun's heat gets trapped in our atmosphere, which acts like a blanket to keep our planet warm. But Mars' atmosphere is about 100 times thinner than Earth's -- so heat from the sun can easily escape.

How easily? If you were standing on the Martian equator at noon, it would feel like summer at your feet, but winter near your head!

At night, it's even worse: when the sun goes down, temperatures can plummet to negative triple digits! And beware of cold winter nights, when it could drop even lower!

So if you plan to visit, better bring a space suit to keep warm -- Mars really is a pretty 'cool' planet.

### Task 15

Hi, I'm Louise Jandura, sample system chief engineer and I'm here with your Curiosity rover report.  
 This was a great week for Curiosity. We got to see something we've all been waiting for quite some time: sample in the scoop confirming that our first drill on Mars collected as we had expected.  
 This was an important event as this is the first time the drill has been used on Mars to collect sample for analysis by instruments on the rover.  
 We use these computer-generated images to help us visually identify how much we've collected. We were able to estimate that we collected about 14 cubic centimeters of sample, or about a tablespoon, and this matched our expectations of what we would see in the scoop when we got to this point.  
 Our drilling capability gives us the ability to get inside this rock. The first thing you notice about the material is that it's a different color. Gray not the reddish orange color on the surface all around us. That reddish orange color is a sign of an iron oxidation. A kind of rusting process that's occurred all around on Mars.  
 Since we've been at Yellowknife Bay, Curiosity has done more than a 100 MAHLI images and more than 12,000 laser shots. You can see the telltale laser grid patterns from the Chemcam in this image. Additionally, you can see a fine grain structure of this rock indicating either a mudstone or a siltstone.  
 The next steps for the team are to finish processing the sample with Chimera and then put small portions into the SAM and Chemin instruments for analysis of chemistry and mineralogy.  
 This has been your Curiosity rover report check back soon for more updates.

### Task 16

**What is NASA's Commercial Crew Program and how is it different from other human spaceflight programs?**

**Tom Simon/NASA's Commercial Crew Program:** The Commercial Crew Program is really approaching human spaceflight in a brand new way. For years and decades, we've been approaching it as a government-managed, government-owned processes to set up systems to meet the government's needs. Now we're working with industry to help industry to be able to develop their own systems to meet our needs and the needs of other users of those systems. So, this means that we'll be able to get our people to space, but also other people will be able to get to space on those same systems.

**What is the goal of NASA's Commercial Crew Program?**

**Tom Simon/NASA's Commercial Crew Program:** For the last few years, NASA has been investing in industry to develop the capabilities for companies to be able to, with their own systems, take people to low-Earth orbit. And now we're beginning a phase where we're looking to reap the benefits from that investment and be able to take our astronauts to the International Space Station.

**Tell us about what's going on aboard the space station.**

**Tom Simon/NASA's Commercial Crew Program:**There's a lot of exciting research being done on the International Space Station. I like to think about it as two different groups. The first group of being of looking in a microgravity environment at the kind of things that happen when you mix different chemicals or you look at different materials forming and crystals, to help us really understand the fundamental science behind a lot of the things that we use every day and the things that we use to build the things that we need. And by that fundamental science, it will help us to make new medicines, be able to make materials to make lighter products or stronger things that we can use in airplanes, cell phones, anything. And the other group of the things that we're doing on the space station is related to getting ready to explore beyond low-Earth orbit. It is studying the effects of microgravity on our astronauts and also trying out new technologies that we can use for years in space before we venture all the way to Mars or something like that.

**What's the purpose of certifying commercial systems for NASA's use?**

**Tom Simon/NASA's Commercial Crew Program:** Going to space is not like walking down to the park. It's a dangerous endeavor, but with brave astronauts and working with the companies' innovative solutions that are making the systems good enough to meet our needs that are not pushing the envelope in either reducing safety or making things so fancy we can't afford it anymore, so the balance we're striking right now gives us a lot of confidence that we'll be able to make this work.

**What's your confidence level that the certification approach will work?**

**Tom Simon/NASA's Commercial Crew Program:** I'm very confident we're going to be able to not only produce these systems to meet our needs, but they will be safe. We've worked to come up with our safety requirements to help set what it is we needed in terms of safety. And we're allowing industry to address those needs in whatever ways they can come up with. We're unleashing American ingenuity to come up with the right ways to meet those safety requirements.

**What do you see as the primary benefits of the Commercial Crew Program?**

**Tom Simon/NASA's Commercial Crew Program:**The Commercial Crew Program has the near-term benefit of helping to allow us to get our crews to and from the space station. But it fits into the overall big picture for NASA's exploration plans. By allowing industry to take the lead on a lot of the getting cargo and crew to and from low-Earth orbit, it's going to allow NASA to be able to push beyond low-Earth orbit and to accomplish exploration objectives, whether it's to the moon, to asteroids, Mars. With industry helping to shoulder the burden and take advantage of a lot of the work NASA and industry has done to date in low-Earth orbit.

### Task 17

**Host:** Hi, welcome to NASA's kitchen. We are here today inside the NASA space food laboratory here at NASA Johnson Space Center. While everyone here is getting ready for this Thanksgiving holiday complete with the perfect Turkey and all the trimmings. We are here today talking to Vickie Kloeris, our NASA food scientist, who is going to talk a little about how the crew aboard the International Space Station...we have three who are living in space now including NASA astronaut Kevin Ford who are going to be celebrating their Thanksgiving, there aboard the International Space Station flying about 230 miles above earth. Vickie, thank you for being here to come talk to us about how they're going to celebrate their Thanksgiving and the food system there aboard the space station.  
**Vickie Kloeris:** Well you're welcome and I'd like to start by wishing everybody a happy Thanksgiving. We have several options in our food system for the crew members to choose from. So they can (kind of) select what they want to have for their Thanksgiving meal. But we do have some of the traditional items available, so we have smoke turkey, we also have a dressing, a cornbread dressing, that is rehydratable. They can add hot water to that. We have green beans and mushrooms, we have broccoli al gratin, we have mashed potatoes, we have bread products, and for dessert we have cobblers. So we have a cherry blueberry cobbler, apricot cobbler that they can choose from. So we have many of the traditional, we also have yams. We have many of the traditional items that we think of as being a traditional Thanksgiving. So they can choose from all of that to make up their Thanksgiving meal or their Christmas meal coming up next mouth as well.  
**Host:** Right. So a number of items for the crew to actually choose from. And from what I understand, Suni, just before she left, had left some fluffy marshmallows or marshmallow fluff. For Kevin so he can add to his. So perhaps he'll be whipping up some candy yams...  
**Vickie Kloeris:** Yes.  
**Host:** this Thanksgiving?  
**Vickie Kloeris:** Uh-huh.  
**Host:** So first before we even get into more talking about the space food, I would like to talk to you more about your role as a NASA food scientist. In fact we had polled Twitter and asked them some questions and had them send us some questions and one of those questions there are from Joshua Stern: what does it take to become a NASA food scientist?  
**Vickie Kloeris:** Well food science is, you know, there food scientists typically work in the industry and do product development and quality assurance for food companies. I started here with one of the contractors who was working on the shuttle food system actually. I started quite a few years ago, 1985 and so I worked here for several years for a contractor before becoming a civil servant and I actually started as civil servant manger of the shuttle food system.  
**Host:** Okay.  
**Vickie Kloeris:** And eventually transitioned over to managing the space station food system.  
**Host:** Okay.  
**Vickie Kloeris:** So we actually have several food scientists here. On the NASA side we currently have three food scientists. Myself, and then we have one food scientist who's working on what we call our Advance Food Technology Program so that's our research arm, if you will, of our future food systems. And then we have a new food scientist who came on board recently and she's working the O'Ryan and the exploration class food systems, the operational systems of the future because myself and the AFT food scientist Michele Perchon, ok, we're not ready to retire yet but we're getting closer and so Grace is going to be our food scientist of the future after Michele and I are gone.  
**Host:** Okay. Great. So I want to talk to you a little about...talk to me about the ISS food system, what exactly is that? What does it entail?  
**Vickie Kloeris:** Okay. Well we have to start with people have to understand that we have an all shelf stable food system meaning that we have no dedicated freezers or refrigerators for food, so that requires all of our food processing to last...our food has to last a long time at room temperature. It's called... that's what they call shelf stable, so it has to be stale on the shelf for a very long time. The only refrigeration we have on orbit, they do have a small chiller where they can actually chill a beverage. So the water that we have on station, they either have hot water, ambient water-- room temperature water. So they when they prepare a beverage if they want it to be chilled they're going to have to put it in this chiller and let it chill for a while. It's small it's about the volume, internal volume, of a typical home microwave, so not very large. But it does allow them to have a chilled beverage after they exercise and for about the first 10 years on space station they didn't even have that option. The chiller was added when we went to crew six on space station and we added a second food preparation area, so the chiller has only been there a relatively short while compared to the life of the International Space Station.  
**Host:** Sure.  
**Vickie Kloeris:** But they really appreciate having a chilled beverage when they have to exercise a lot every day and they get hot and sweaty and so they like the idea of having a chiller now.  
**Host:** Sure. And I understand, you know, food while it's important to our bodies to sustain our lives, but it's also... there's a psychological aspect to it.  
**Vickie Kloeris:** Yes.  
**Host:** And can you talk to me a little bit about that?  
**Vickie Kloeris:** Yeah, when I first came to work here and all we were flying was short shuttle flights. Food really was low on the totem pole as far as priority because, you know, most crew members that flew on shuttle felt like, well it's a camping trip, no big deal, I can find something to eat. So very few of them were, you know, very concerned with what was on the menu or available to them to eat. But as we went into the phase one program and our crew members went and began to stay on mere for extended period of time, they began to realize that food -- the longer you're there the more important it becomes. Because it's one of the few creature comforts that you do have on orbit and so those first crew members who transitioned to long duration space flight, they quickly spread the word among the rest of the astronaut that food becomes more and more important the longer you're staying on orbit. And so for our International Space Station crew members who are now staying typically about six months at a time on orbit, the psychological aspect of the food is extremely important. And so they pay a lot of attention. Our basic menu on space station is a standard menu and it includes all of the foods and beverages that we have. And we have about 200 different foods and beverages on the U.S. side, so it's a pretty big selection. But we do allow our crew members to augment that standard menu with nine what we call bonus containers. And those are of their own choice. They can choose more. They can choose their favorites from our food system, or they can also choose commercial off-the-shelf products that meet our shelf life requirements and our microbiological requirements. And so the crew members focus a great deal of time on what to put in those bonus containers because that is their...  
**Host:** It's kind of their snack pack in the pantry.  
**Vickie Kloeris:** Yeah, yeah. And it's a big part of the psychological aspect of the food because that's what they get to choose and that's going to be the little special things that they have. Sometimes it could be dessert type items but often it's commercial entrees that they want. Like maybe a thermal stabilized Indian food or something, you know, of that nature. So ethnic foods are often part of what they choose for their bonus containers.  
**Host:** Sure.  
**Vickie Kloeris:** We have a lot of anecdotal evidence from crew members that some foods, not all foods, but some foods taste different to them when they get on orbit then they did on the ground. And it works both ways. We'll have crew members select something thinking they're really going to like it when they get on orbit and then they don't. Or we'll have crew members come back and say, “I didn't like this on the ground but, boy, when I got on orbit I tasted it and I was really sorry I hadn't taken more”. And so and we really feel like that a lot of that has to do with the change in the aroma that they're getting from the food. So most of the way that you and I perceive the taste of the food, a big part of that, is the smell, the aroma that you get from the food.

### Task 18

NASA scientists routinely use lasers to track the position of the Lunar Reconnaissance Orbiter's laser altimeter as it orbits the moon. Recently, however, they also tried something a little...different. In addition to tracking the instrument, they used the laser to send a picture of the famous Mona Lisa in the first demonstration of laser communication with a satellite at the moon. To do this, the LRO team used the existing laser tracking signal -- sent by the Next Generation Satellite Laser Ranging Station at NASA's Goddard Space Flight Center. The image was divided into pixels, which were then sent to the spacecraft one at a time by re-timing the regular tracking pulses. By delaying the tracking pulses by specific amounts, LRO scientists could use the difference between the expected arrival time and the actual arrival time to indicate the brightness of an individual pixel. Once the image was sent, scientists corrected for transmission errors caused by the Earth's atmosphere using common techniques used in CDs and DVDs. They also studied signal fluctuations due to Earth's atmosphere. The final image was verified when it was returned to Earth using LRO's radio telemetry system. This test -- and the data obtained from it -- sets the stage for future high data-rate laser communication demonstrations that will be a central feature of NASA's next moon mission, the Lunar Atmosphere and Dust Environment Explorer. So, while lasers are currently being used to track NASA satellites, in the future they may also be used to communicate with them, sending not only data, but perhaps images that one day will be as famous as... the Mona Lisa.

### Task 19

**Broadcaster:** You are listening to Discovery from the BBC and I'm Kevin Fong. This is the last leg of our trip around the planet Mars and this time we are following the water visiting Martian landscapes that may lie today and the dramatic terrains that water created in the past. The final moment before touchdown of the robotic explorer Curiosity last year. You can hear the excitement and tension in the voices of NASA technicians as the robot rocket jet pack brought it down towards the floor of a huge crater. Curiosity’s mission is to discover whether Mars was ever a place where life could have flourished. It’s analyzing the ancient rocks that form the base of the crater, and climbing a terrain mountain that rises from its center. Already, it’s found evidence that billions of years ago fresh water gushed across the landscape and may have even collected in a lake. But as we all hear, this is not the only water in Martian history. Some of the planets may have spectacular terrains created by vast and violent quantities of it.

**Speaker 1:** Imagine, you know, a hundred of Amazon Rivers all cutting loose at once, roaring across the surface.

**Speaker 2:** The chasmata. The chaos of landscapes. Huge pointy mountains. It’s like Tolkienist landscape. We have, on this scale, no analog on Earth.

**Broadcaster:** And in some places, water might still be shaping the surface today.

**Speaker 3:** We see that goes either for me today, so it's gotta be something going on right now.

**Broadcaster:** This is a remarkable possibility, because water isn’t stable as a liquid on the Martian surface. The combination of subzero temperatures and an extremely thin atmosphere means that weirdly a pond of water will simultaneously boil and freeze. Mars would be a tough place to visit. Pescal-Lee of the Mars Institute and Steve Squyres of Cornell University in the United State:

**Pescal-Lee:** Mars today is a cold and dry and desolate place. If you went there, you would hate it. It's really miserable.

**Steve Squyres:** It's a lethal planet. If your space suit is upon to leak, you would die within moments because of the low atmospheric pressure. Your blood would boil. The gases that are dissolved in your blood, like the oxygen and nitrogen, would essentially boil out of your blood. It really is a lethal environment.

**Broadcaster:** Before the first spacecraft got close to Mars in the 1960s, we had little idea about the conditions and landscapes there. Astronomers with earth-bound telescopes could do little more than a squint of the planet. What they saw was blurred patches with darker swathes? and apparently straight lines streaking across its face, but this glimpse was enough to let their imaginations take flights. Melissa Rice, a scientist on account of the Curiosity mission.

**Melissa Rice:** Earlier in the last century, people took it for granted that there was vegetation on the planet, that there was intelligent life on Mars building canals, that there were beings who might eventually have some direct interaction with us. This was something that people accepted as plausibility.

**Broadcaster:** But the space race and its robotic eyes reached the planet. And ever since it’s been a world in which hopes and dreams have soared and fallen. Bill Hartmann of the Planetary Science Institute in Arizona and Chris Mckay of NASA's Ames Research Center:

**Bill Hartmann:** The first glimpses of Mars came from the Mariner flying by.

**Chris Mckay:** 1965, Mariner 4, who simply flew past the planet, snap, snap, snap, took a few pictures on the way past.

**Bill Hartmann:** and by chance we flew past those regions of Mars that that showed no evidence of water.

**Chris Mckay:** ...pretty much nothing but craters and scientists at that time were saying, “Oh, Mars is just like the moon, with just a little bit of air to blow the dust around. But that's the end of the story. Mars was dead. Then Mariner 9 went into orbit.

**Bill Hartmann:** 79, Mariner 9 gets there, the dust storm clears what we see but...

**Chris Mckay:** ...evidence of volcanoes and ancient water channels,

**Bill Hartmann:** ...dry river beds all over the place

**Chris Mckay:** Mars suddenly came alive. It was called a new Mars.