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## 2018 Inamori Ethics Prize Speech: Groundwater for Thirsty Lands

Dr. Farouk El-Baz

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# Groundwater for Thirsty Lands

Dr. Farouk El-Baz

2018 Inamori Ethics Prize recipient

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**BARBARA SNYDER:** I am honored to welcome you to the 2018 Inamori Ethics Prize Ceremony at Case Western Reserve's Maltz Performing Arts Center. This award and the Inamori International Center for Ethics and Excellence are made possible through the visionary philanthropy of Dr. Kazuo Inamori and the foundation that bears his name.

I would like to begin by recognizing our title sponsors for helping us to make this important event possible. Representing the Callahan Foundation, our vice chair of our Board of Trustees Tim Callahan and his wife Nancy. Longtime and dear friends of Case Western Reserve University, and wonderful supporters of our university in so many ways. Tim and Nancy, thank you.

And Deborah Severs representing Eaton Corporation, one of our most consistent and generous partners. We thank you and your board members for helping us continue our tradition of honoring global ethical leadership. Thank you Eaton.

And, as you will see in our program, tonight's ceremony has several other sponsors as well. We are grateful to each of them for recognizing the significance of this event and helping us make it even better.

I also want to recognize several members of our board of trustees for being here tonight, for their continued leadership, and support of efforts such as the Inamori International Center for Ethics and Excellence.

In addition to Tim Callahan, our vice chair, and his wife Nancy, I want to acknowledge vice chair Don Richards and his wife Marianne—they're out there in the audience—thank you.

And emeriti trustees David Hunt and his wife Diane, and Dick Pogue and his wife Pat. Thank you all for being here.

It is a special pleasure to welcome Dick and Jan Davis, who join us from San Diego, California. They are among the key organizers of the North American Kyoto Prize Symposium, and we see them often when we go to Kyoto. Dick and Jan, thank you for joining us.

We have for our honoree tonight a very special guest. He came as a surprise to Dr. El-Baz, and it is Colonel Al Worden. Al, will you please stand up and let us acknowledge you. Colonel Worden is a retired NASA astronaut and was the command module pilot for the Apollo 15 lunar mission. He is one of only twenty-four human beings ever to have traveled to the moon. Colonel Worden, we are delighted you could join us tonight.

This is a special celebration because this is the tenth anniversary of the Inamori Ethics Prize, which honors global ethical leadership. Since 2008, our remarkable recipients have included leaders in genetics, in business, in the environment, in philosophy, and human rights. All have dedicated their careers to driving their respective fields to embrace exemplary ethical practices, whether leading the Human Genome Project, founding ethical and successful companies, defending the human rights of some of the most vulnerable people in the world, providing free health care services, promoting sustainable ecology and climate justice globally, advancing the scholarship of ethics and philosophy, or fighting global corruption and advocating for children.

I am saddened to acknowledge the recent passing of our 2010 Inamori Ethics Prize Recipient, Mr. Stan Brock, the founder of Remote Area Medical, which delivers free health care services to communities in the United States and in remote areas around the world. We extend our deepest sympathies to Mr. Brock's family, friends and colleagues, and express our great hope that the important and meaningful work of Remote Area Medical will continue.

This year, joining the esteemed group of Inamori Ethics Prize winners, is Dr. Farouk El-Baz, internationally renowned geologist and leading scientist in NASA's Apollo space program. It is not often that one has the opportunity to hear from such a prominent individual, who has not only helped astronauts set foot on the moon, but has also used the same expertise to identify scarce water resources in some of the earth's most arid regions. Dr. El-Baz's life's work is emblematic of Dr. Inamori's philosophy that people have no higher calling than to serve the greater good of humankind.

We are able to give this annual prize at this exceptional celebration due to the outstanding leadership of Dr. Kazuo Inamori. We have enjoyed a long-standing, productive, and warm relationship with Dr. Inamori and with the Inamori Foundation, which began with Dr. Inamori's friendship with Arthur Heuer, Distinguished University Professor Emeritus and Kyocera Professor Emeritus of ceramics material science and engineering, here at Case Western Reserve.

That friendship began in the 1980s. It continues to this day, and we are so pleased that Professor Heuer is with us tonight. Art, thank you for being with us.

Our faculty, our staff, and our students have benefited immeasurably from the superb work of the Inamori International Center for Ethics and Excellence, and to advancing Dr. Inamori's philosophy of pursuing what is right for humankind.

While Dr. Inamori is unable to join us, we are honored that three very distinguished representatives of the Inamori Foundation traveled from Japan to be with us this evening. We welcome the executive vice president of the Inamori Foundation, Dr. Inamori's daughter, Mrs. Shinobu Inamori-Kanazawa. Welcome.

She is visiting Case Western Reserve University in Cleveland for the very first time.

We also have with us Mr. Shoichi Himono, Executive Managing Director of the Inamori Foundation, and Ms. Sayaka Hiroki. I ask all three of you to please stand up so everybody can acknowledge and thank you.

We are so grateful to you and all of your colleagues at the Inamori Foundation for all the help and support you provide to make this celebration possible.

I am now pleased to introduce the director of the Inamori Center for Ethics and Excellence, philosophy professor and globally acclaimed ethicist Shannon French, who serves as our Inamori Professor in Ethics, and also as a General Hugh Shelton Distinguished Chair in Ethics for the US Army Command and General Staff College. Professor French also leads Case Western Reserve's graduate degree program in military ethics, which is the first of its kind in the nation. Dr. French.

**SHANNON FRENCH:** Thank you. Thank you so much, President Snyder. And thank you all for joining us here for this special celebratory evening, where we celebrate ethical leadership.

When President John F. Kennedy declared that "We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard; because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone." He laid down an ambitious goal, and it happened. Can you believe that? We made human beings travel safely to the moon and, just as importantly, back again.

We've only lately truly come to appreciate the incredible mosaic of unique people who toiled together to meet that goal. It turns out that the tremendous effort needed for such a historic achievement—what is a better reflection of what is best about this country—was not even fully understood or celebrated at the time. It took profoundly dedicated, hardworking, creative, and extremely smart people from diverse backgrounds coming together as a single powerful team to get the job done.

They fought for a common cause, pushing past obstacles that included ignorance and bias. They harnessed their prodigious skills and brilliant imaginations to do what had once seemed impossible, together. We would not have gotten to the moon without the African American female computers, as they were called, such as Catherine Johnson, Dorothy Vaughn and Mary Jackson, whose story was so beautifully told in *Hidden Figures*. We would not have gotten to the moon without NASA's first ever software engineer Margaret Hamilton. We would not have gotten to the moon without Larry Miranda, who worked on the Saturn V rocket and was later honored as Hispanic Engineer of the Year.

We would not have gotten to the moon without Egyptian-born immigrant Farouk El-Baz, who taught the astronauts what to expect when they took those famous first steps on the lunar surface.

Our nation's motto is *e pluribus unum*: out of many, one. Even the sky is not the limit when we set aside our differences, respect what each person brings to the table, and work together in the service of the common good. Sometimes, I think we lose sight of the simple beauty of that idea. We focus instead on trivial differences, things that divide us, things that shouldn't matter at all—like where we were born, or the color of our skin, or how we express ourselves, or whom we love.

We allow these divisions to grow into hatred and distrust that drive us further apart. All of that is based on the irrational fear that the flourishing of someone else and the full exercise of their human rights will somehow restrict our choices or cause us harm. That is the big lie that we must all reject.

Because the reality is that we all do better when every person has the chance to be the best that they can be, and no one's possible contributions are lost because their genius is stifled or their voice is silenced. We need all of us, every scrap of talent, every fresh insight, every unrecognized great mind to be welcomed out of the shadows.

We face many challenges that affect us all—from climate change to conflict resolution to cancer. Like reaching the moon, it will take the best of our energies and skills to surmount them, and leave a better world for our children.

As our 2015 Inamori Ethics Prize Recipient, philosopher Martha Nussbaum, reminded us, living an ethical life is about unlocking the potential in all of us. When we achieve our true capacity and help others achieve theirs, we can become greater than the sum of our parts. We can do great things that inspire and lift us up, making contributions that serve all humankind. We can improve life on this planet, even as we continue to reach for the stars.

Each year, through the presentation of this Inamori Ethics Prize, we celebrate individuals who've made a lasting, positive impact on the world. We're truly delighted to be able to bring these global ethical leaders right here to Cleveland to share their wisdom and experience with us.

For this tenth anniversary, we held an essay contest where we asked students to tell us how the first decade of prize recipients inspired them. It was wonderful to read through those essays and to feel the impact of these events. And I have the privilege here of introducing you to the winners. The first place for the undergraduate category was Grace Zhang. The second place was Jack Zhao. The first place for graduate students was Elizabeth Shea, and the second place went to Joshua Gerlick. Congratulations to all of our winners and thanks to all those who submitted essays.

In recognition of Dr. Farouk El-Baz's work from the earth to the moon, on behalf of humankind, the Inamori Foundation has sent a traditional Japanese doll that symbolizes the timeless values of altruism, compassion, and kindness. This unique Kyo-Ningyo doll named Celebration was commissioned by the Inamori Foundation to accompany the Inamori Ethics Prize in 2015. It was also adopted the following year as a gift to accompany the Kyoto Prize. Each doll is handmade with the highest degree of skill and precision. The textiles are custom made for the dolls, and all the designs are hand painted and tailored to create a sense of movement. Each hair, made of dyed silk, is placed individually. The dolls are made by a master artist whose patrons include the Thai Royal Family and the Dalai Lama, and whose works are lauded as national treasures in Japan and throughout the world.

This doll here was presented to Case Western Reserve University for display in the Inamori Center. And another doll like it has been shipped directly to Dr. El-Baz—you will find it when you get home—as a special gift and reminder of this evening.

Now please join me in welcoming our Executive Vice President and Provost, Ben Vinson, to tell you more about our outstanding honoree, the ethics prize winner for 2018, Dr. Farouk El-Baz.

**BENJAMIN VINSON:** Thank you, Shannon. Good evening everyone. It is my pleasure to introduce to you our 2018 Inamori Ethics Prize Honoree, Dr. Farouk El-Baz.

On July 20, 1969, the NASA Apollo 11 space capsule touched down on the lunar surface. Commander Neil Armstrong announced to the world that “the eagle has landed.” And soon he took “one small step for man, one giant leap for mankind” as the first human being to walk on the moon. Before that historic moment could inspire the whole planet, many people worked for years to prepare Commander Armstrong and the other US astronauts for what they would experience on their lunar mission.

One of those vital NASA team members was a young Egyptian American named Farouk El-Baz. In his late twenties after studying geology and earning his PhD, Dr. El-Baz was recruited to help NASA with the planning and training for the Apollo lunar missions, including choosing the landing sites for the first manned mission to the moon, Apollo 11.

Dr. El-Baz, nicknamed “The King” by the astronauts, was a great teacher who allowed the Apollo crews to visualize in advance what they would eventually see on their missions. While circling the moon for the first time during Apollo mission 15, Command Module pilot Colonel Al Worden—who as you heard is with us here tonight—said, “After the King’s training I feel like I’ve been here before.”

Dr. El-Baz also reminded the astronauts that their historic missions were not only on behalf of America, but were for all humanity. Later, while still working with NASA, he supported cooperative international missions in space involving the US and the USSR, and the US and China. In the early 1970s, Dr. El-Baz shifted gears to establish and direct the Center for Earth and Planetary Studies at the National Air and Space Museum at the Smithsonian Institution, where he later helped pioneer the use of IMAX movies.

Until his retirement this spring, Dr. El-Baz served as the director of Boston University’s Center for Remote Sensing, a NASA-recognized center of excellence that studies earth’s environment using technology created for space exploration, including in the search for groundwater sources in some of the world’s driest places. If we could search for water on the moon and Mars, he reasoned, we could also use some of the same techniques to look

for it here on earth, particularly in places where the lack of fresh water has led to violence.

Dr. El-Baz has advised leaders all around the globe, especially in Africa, on how they can work together to decrease their dependence on strained water resources while opening up new sources to relieve suffering populations, such as cooperating to raise water hidden underground in conflict torn Darfur.

Dr. El-Baz has encouraged more people to study in applied scientific fields to continue to look for innovative solutions to the world's problems. He has especially noted the importance of recruiting more women, girls, and other groups who have been historically underrepresented in STEM fields. He has also established scholarships for both men and women in the sciences. His scientific and historic achievements have not escaped the notice of popular culture.

There was a portrayal of Dr. El-Baz training astronauts in the Tom Hanks-produced HBO series, *From the Earth to the Moon*, in a segment called "The Brain of Farouk El-Baz." And there was a space shuttle that bore his name in the long running TV show, *Star Trek: The Next Generation*.

The leadership and faculty of Case Western Reserve University understand that one of our core roles as educators is to graduate individuals who are engaged with the wider world and who are responsible global citizens. It is with this in mind that we are taking the opportunity to learn more about Farouk El-Baz's work this evening. Dr. El-Baz, with a deep knowledge of the sciences, has helped transport humankind to its furthest reaches and provide new access to such life-giving forces as water and education. We are proud to honor him with the 2018 Inamori Ethics Prize for his outstanding global ethical leadership.

Farouk El-Baz, we recognize your ethical leadership in the field of science and technology. Your work has improved the condition of humankind in the present and provided a beacon for the future. Thus, on the recommendation of the Inamori Ethics Prize Selection Committee, it is my pleasure to present to you the 2018 Inamori Ethics Prize Medal.

**FAROUK EL-BAZ:** Thank you very much everybody, thank you. It is delightful to be here. I'm delighted to have my wife and four daughters with me today. And then I was absolutely stunned when my friend and colleague Colonel Alfred Worden walked in unexpectedly, the Apollo 15 command module pilot, the great astronaut, who was also my best student. Thank you Al.



When I was asked to prepare a talk to give to all of our guests tonight, I thought I would say that basically I took all of the knowledge that we gained from preparing for the Apollo missions to the moon, and by looking at pictures that we took with unmanned missions before the astronauts went, or before the astronauts got anywhere near the moon. We looked at these pictures and interpreted them, selected landing sites, selected photography sites, and did everything based on photographs.

Therefore, when I began at the National Air and Space Museum, I began to say that we should really apply that knowledge. We gained a lot and did plenty. We should begin to look at the earth in the same way as we looked at the moon. Because we were preparing to look at Mars and so on, we decided to look at the earth from satellite images.

Then we had the mission called Apollo—the first American-Soviet mission. I became responsible for the photography on that mission. Because it did not fly very high out in latitude, we covered a great deal of the middle section of the earth, which included most of the deserts of the earth. Then I began to look at the deserts in Egypt, because I had an interest in looking at the deserts in Egypt as a Boy Scout. Then I began to look at these photographs brought in by the Apollo mission, and I learned all kinds of things.

From that time on from 1975 onward, I began to slowly relate my research or concentrate at looking at deserts of the earth to figure out how they were formed and how they evolved over time. So I will show you some of that. Next slides please, we'll start.

Here we're looking at the earth, the whole full earth, and we're looking at the globe as seen by the Apollo 11 astronauts on their way back to the earth from the moon. When they finished they took this picture of the earth.

This is a magnificent image of the earth. The thing that sticks out immediately from that view in the middle is the whole desert belt, which includes all of North Africa, the Arabian Peninsula, and West Asia. So this gives you an impression that the desert belt can be vast, and that is the really vast desert belt. That's what we're looking at with other satellite images. You can see very clearly that the land that we see is very bright, because there is absolutely no vegetation in this whole strip.

We started to measure the aridity of places on earth. Here is a picture of the aridity of the desert, that desert belt that we looked at a minute ago. The yellow section exactly in the middle is the place that includes all of the western desert of Egypt, all of Libya, and a little bit of northern Sudan. So that's a big chunk of Northeast Africa. This aridity index is two hundred,

which means that the received solar radiation in any part of this world is capable of evaporating two hundred times the amount of rainfall.

So look at the rest of the territory in Africa and in the Arabian Peninsula. The numbers grow to one hundred, and then fifty, and twenty-five, and so on. Just to get the feeling of how arid this aridity is in these places.

The most arid place in North America is Death Valley in California. The aridity index of that is seven. The aridity index in here is two hundred. So this is how arid this is. When visiting some of these places, there's absolutely no memory of any rain.

I was once in a place called Siwa, an oasis in western Egypt at the border of Libya. I wanted to find out what the rainfall amount here was. So I went down one evening with the elders of the family, the village, and other people with us. I asked, "When did it rain here last?" I asked anybody, and they said, "We don't remember." Then I asked the elders, "When did it rain here last?" They said, "Ah, the last time it rained was the day Akmedh was born." So I asked Akmedh how old he was, to which he said he was forty-seven.

This kind of terrain is totally vegetation free. You can drive with a jeep for five hundred, seven hundred miles and not see a single blade of grass. Then, you go out and see that in any place that rises, any plateaus, anything that's high enough, there are all kinds of meandering structures. These meandering structures and the edges are only indications of water passage. Because only water is the one thing that makes these look like rivers or that bends. Which means that these features on the edges of any high plateau are made with running water.

Then you can see that there are thick deposits of clay within these meandering features, meaning that there was water here in the past and there was a lake in here, because there's twenty-four feet of dry mud. Meaning that there was water here, and that mud deposited in this huge thickness. You can see all kinds of hints of previous human habitation.

You can see remains of houses. Anything around in the old times before six thousand years ago, human remains were all around for some peculiar reason. Humans in the past made round things, so the remains and the things that they made from their houses are all round. Only the Egyptians started making things in rectangular shapes to preserve the amount of land they used, because they lived over fertile soil along the river.

But you see in the desert, all of the things that we see—indications of habitation, previous habitation—would be round like that. We can see things

in this area where there was human habitation, and we can see core rock, very hard solid quartzite, that previous human inhabitants of the area would strike it and chip pieces to form their hand axes and knives and so on to skin animals.

This was dated by association anywhere from six thousand years ago to two hundred thousand years ago. Meaning what? Meaning that there were humans here. And if you say humans were here, it means that there was rain here. Humans could not have lived here without it. You see a grinding stone and a milling stone, and you know that there were green crops, and they made flour out of it, and these kinds of things.

Then we came across some real indications of ostrich eggshells. Once we drove for about eleven kilometers, like eight miles, and could see that the land was completely covered by ostrich eggshells, meaning that there were vast numbers of ostriches and these were the remains of them. There must have been people that lived around here because of these ostrich eggshells.

And then we saw that somebody had taken the ostrich eggshell pieces and made them into a round shape—round like that—and then drilled holes in them. We actually saw an example of this where he had made a necklace out of these beautiful round ostrich eggshells for his girlfriend or his wife, or somebody—a necklace. This meant that there was quite a bit of human habitation. People lived there in a place where no life could exist, meaning there was much more rain in the past than today.

In cavities along large holes in the desert, you see petroglyphs, meaning that humans were artistically doing these things. This particular one is a fascinating petroglyph or a painting. On the upper right, you see a view of a giraffe. Then you see three cows, but between them in the scene is an ostrich and a baboon, meaning that there was a change in the habitation.

First, there were giraffes, meaning there were lots of trees with leaves for the giraffes to eat. Then we have an ostrich and a baboon, meaning a Savannah-like environment with lots of grass, but not many trees. Then the three cows, meaning that then most of the green disappeared, there were few things that remained for the cows to survive, meaning that there was a lessening amount of the water from nature, from rainfall, until there was none. There is none today.

Today, then, you see only sand and sand dunes, and absolutely no hint of any vegetation whatsoever, which means that the land dried up, and there is no more rain, and this is it.

So we looked at the potential of where this water went where it used to rain. Where did it go? Some of that water must still be there. Eventually,

the shuttle imaging system that was radar was able to penetrate through the sand and give us a view or a picture of the land surface beneath the sands, and that's when we began to see hints of the valleys or the rain collectors—meaning the streams of the past—that are now totally covered with sand. We don't see it in the desert because everything is covered with sand.

But below the sand there are all kinds of geographical things. In Libya there were a few wells that were drilled for oil, and then they found water, and they started these circle irrigation farms. From satellite images, we could see this kind of structure by all the circle irrigation farms in this design. Then we looked with the radar so that we could see the reason for that design, the good looking design here, all these little circles. Because there were two rivers going out this way into what's called today the Kufra Oasis in Libya, an area that was fed by two vast rivers.

One came from Chad in the south and one came from Western Egypt. So this meant that there were quite a bit of rivers. This river is twenty-five meters wide. So we asked about similar structures like that in Egypt. Where would the bed be?

I took this to the Minister of Agriculture in Egypt, and they said that we should start to drill a well in here to see whether there is water here left over, the way we have water from the Kufra Oasis. And he said, "We asked our engineers, and there is no water here." But I said, "Just one well to explore." He said "We'll ask the Ministry of Water." And they asked the Ministry of Water, and he said, "No there is absolutely no water in here."

Anyway, it took me about thirteen years to try to convince this man, who was a good friend of mine that I liked and everything. But it took me thirteen years, from '82 to '95, finally. I walked into his office once, and before I even shook his hand, he said, "I will drill two wells to shut you up." And they did. And lo and behold, water came out at twenty-five meters deep, and there was plenty of it, and now it is an area where there is quite a bit of agriculture. Right now we can see it from the sky. They produced one-third of the wheat that is produced in Egypt is from this locality. They have lots of little things there.

Similarly, when the problem in Darfur started, we saw similar things in the area of Darfur. See these things beneath the sand, you see the lines that indicate water passage. Here it is, the water passage from this one. We began to figure out that there was an enormous lake of water. When the problem started in Darfur, I felt that this needed to be told. The people from the United Nations had been worrying about the problem in Darfur, which was basically a water shortage problem.

I took this directly to the Secretary of the United Nations, Ban Ki-Moon, to explain the whole story to him. He was very kind and said, “If you get there, we’ll get you a helicopter and we will do the things for you.”

I went to meet with the president of Sudan, and then went to Darfur to meet with the governor, and then explained to them where this lake might be, and therefore, where water would be. I took the UN helicopter and flew over this area to suggest potential sites. We talked it over with all of the engineers there, so they could understand what we were talking about and where water might be to resolve this problem. They drilled thirty wells, and here came very nice, cold, and clean water. The unfortunate thing is that the water could only be transported from whatever well to the villages by donkey cart.

The most interesting thing that happened after we did all of this was the fact that Boston University students got together and were excited about the whole notion of water in Darfur, resolving the problems there. They started a drive to collect money for a water well in Darfur, and they called it 1,001 Wells For Darfur. They actually collected ten thousand dollars, one by one, for a water well in Darfur. As far as I’m concerned, this might have been the most wonderful thing I did, because I just basically enticed students to get together and do something, and then all of them felt accomplished.

To this day, many of the ones that started that initiative call me up and ask about how the water is doing there, how the well is doing there. They talk to me about what they’re doing. So in many ways, one of the things that I consider most valuable in my life’s work of science was getting all of these students so excited about doing something wonderful for people that they had never met and will never see, but they felt great about it.

So thank you very much.

**VINSON:** Seems appropriate. Thank you Dr. El-Baz. We are honored to have you on our campus to recognize and learn from your ethical leadership. Everyone, please join me in a heartfelt congratulations to Dr. El-Baz.

Everyone, thank you for attending tonight’s celebration. We hope you can join us tomorrow for a stimulating discussion of Dr. El-Baz’s work during the academic symposium. It will take place at 12:45 in Severance Hall, and will also feature distinguished panelist Dr. Marla Perez-Davis, from NASA Glenn Research Center, and our own Professor Alexis Abramson

This concludes the tenth anniversary Inamori Ethics Prize Ceremony. Everyone, have a great evening.