The transcript of the Earth Science Community Forum held on Nov 30th 2022. Times are given in parentheses correspond to the recording of the Forum. The slide numbers refer to the slide deck and both the slide deck and the recording are available at https://science.nasa.gov/earth-science/esd-community-forum For the introduction and question and answer sections speakers are identified by name (in bold).

4:10

Wendy: Hey everyone this is the ESD Community Forum. I still see the numbers are climbing, the number of participants is still laddering up so we're going to give it just another couple of minutes and then we'll get started

4:57

Introduction

Wendy: So, it looks like our participant numbers have started to level off, I just want to welcome everyone. Hi everyone my name is Wendy Mihm. I'm the new Communications lead for the Earth Science Division I'm going to be serving as the MC for today's Community Forum I'm going to hand the mic over in just a moment to Dr Karen St. Germain but just want to get some housekeeping things out of the way first, just noting that today's meeting is being recorded So that folks who can't join us live can view it later. I also wanted to point out that there is closed captioning available if you'd like that if you look closely at your screen there's a tiny little bubble that looks like a quote bubble you can click on that and get the closed captioning.

So our last Community Forum was back on April 21st, it's really good to gather the Earth Science Community together again. Karen's going to be sharing some important updates today. Here's what she'll cover She's going to go over NASA's response to the Earth System Observatory Independent Review Board report, she's going to talk through the cancellation of the GeoCarb mission, and then she'll cover a handful of additional miscellaneous ESD updates.

We anticipate there may be some questions we're going to hold those to the end you'll also see there's a Q&A box at the very bottom right-hand side of your screen. It's a little box that has a question mark in it. If you've got a question, click on that box and you can type your question into the box and we will try to get to as many of those as we can once Karen is done presenting. So without further delay I'm going to hand over the mic to Karen St Germain

Karen: Hello everyone let me just do a quick soundcheck with you Wendy is that sound okay? Loud and clear

Right. Well good afternoon everyone. It's great to be with you this afternoon. It's actually been an exciting day here at NASA headquarters. We hosted Vice President Harris and the President of France, President Macron, here at NASA headquarters to celebrate over 40 years of partnership between the U.S and France in space and look ahead and anticipate the fruit of the partnership as we continue forward. So it's been an exciting morning here.

All right I'm gonna do my best here to share a briefing. All right can anybody let me know if this is clear, if the presentation is being shared?

Not up yet I'll let you know

Oh all right. Let me try it again. Okay well, hang on folks, perhaps send those to Kate? Oh wait here though we're here, something's brewing. There they are, okay and let's see if I can put it in presentation mode. Is that working now? Yes? Okay fantastic all right. Always an adventure

Title slide (8:48)

Slide 2 agenda, slide 3 logistics

Alright so Wendy walked through the logistics and a bit about the agenda so let's go ahead and jump right in.

Slide 4 (8:56)

So, I'm going to spend the majority of the time this morning on the Earth System Observatory and the Independent Review Board that we chartered early in the year and that just gave us a report a few weeks ago. We're rolling out both the report and our response this week. You may know that NASA charters Independent Review Boards under two different kinds of circumstances. The first kind of circumstance is when a mission is seeing or experiencing real challenges or where there's a problem, or a perceived problem, that NASA wants in an independent set of eyes on. The other set of circumstances in which for which NASA will convene an independent review board is when we're taking on something that is large and complex. And it's that latter case that drove us to want to get an independent set of eyes onto the Earth System Observatory

Slide 5 (10:06)

I'll start with a very big picture view and then we'll dive in. Overall, the Earth System Observatory is the heart of NASA's response to the decadal survey and we believe that we can achieve the decadal survey threshold science requirements within our current Appropriations and the President's budget request. Of course, if critical issues arise that cause us to deviate from that we'll go back to the Committee on Earth Science and Applications of the National Academies.

Slide 6 (10:52)

Just a reminder what the Earth System Observatory is. That's not just the name but the approach we're taking to the missions that are responding to the decadal survey and in particular the designated observables. These, taken together, will provide really key information to understand everything from the open questions around climate change and the how the Earth system works all the way to applications of that information -whether it's fighting forest fires, disaster mitigation improving weather forecasts those sorts of things. So these are the elements, the major elements, again taken from the designated observables.

Slide 7 (11:43)

This was, again, designed to fundamentally address those designated observables. In summary< the AOS, the atmosphere observing system, is intended to address, in combination, the aerosols, clouds convection and precipitation designated observables. And really get to understand aerosol properties profiles, cloud profiles and the effects on everything from climate to air quality and to address one of the one of the most fundamental open questions about feedback mechanisms and climate change: the relationship between aerosols and the and the formation of clouds.

Surface Biology and Geology is a mission looking at the Earth's surface and everything from vegetation to snow reflectivity to active geological processes. So that'll be an extraordinarily capable system. Mass Change measures, of course, the large-scale dynamics associated with changing mass distribution. Often that's associated with water movement in any of its forms; ice, liquid and so forth. Surface Deformation and Change is looking at Earth's surface dynamics and that one we are we are keeping in an extended study phase because it really follows on to NISAR which we are still working on getting to launch

Slide 8 (13:31)

So, with that, there are a couple of really important key aspects of, not just what we'll do with the Earth System Observatory, but how we'll do it. Actually, let me let me back up one slide there, two slides actually.

Return to Slide 6

I want to make sure I say this explicitly. The Earth System Observatory, as I said, is a response to the decadal survey, but it, of course, stands on the shoulders of our program of record and of course two very important upcoming missions. I already mentioned NISAR but in two weeks we will be launching SWOT and down the line that we'll be launching PACE. Those two ocean missions really complement the new missions created in the Earth System Observatory

Slide 8 (13:34)

So now when we go forward, we get to how we're going to do the work. We will use the ESO data in conjunction with observations from other NASA and international systems and our missions to look at the interconnections in the earth system. What do I mean by Open Source science and the new NASA policy? I'll just give you some highlights of that what that means. All mission data, metadata, software databases, publications and documentation shall be available on a full free open and unrestricted basis starting in Phase B with no period of exclusive access. Also, science workshops and meetings will be held in an open way, to encourage broad participation and they will be documented in public repositories. In addition to that approach to the science we've also recently initiated, within the last year, two studies to inform how we handle data as an Integrated Observatory. So, we have a data processing study and this is to examine how we will set up the data system for this entire Observatory and promote open science principles. Of course, what we refer to as the latency study, that's more associated with getting data

down from the satellites to where it needs to be to be operated on in a timely way to support the broad range of science and applications. So again, we've got a latency study across the board to minimize the product latency. Those two are ongoing efforts to inform how we move forward with these missions

Slide 9 (16:30)

Okay so now back to the Independent Review Board. So Independent Review Boards are generally chartered at the AA level and we chartered this Independent Review Board in July of this year and the idea was to have them proactively assist us with the assessment of our current plans and objectives for the next generation of Earth observing satellites which are designed of course to propel us forward in terms of scientific knowledge. We had 12 members of the IRB and they spent something like 800 person hours on the review which was conducted over the summer between July and September. They reviewed all of the mission elements of the Earth System Observatory. They reviewed technical concepts that were developed during preliminary formulation for robustness and the ability to satisfy the mission's essential requirements, again traceable to the decadal survey. We also asked them to help us understand if we have appropriately adopted lessons learned from our experience with previous large and strategic science missions.

So the overall scope was to look at the requirements and the concepts and ask the following questions-

Is the architecture overall meeting the intent of the decadal survey?

And is it aligned with Agency needs in a broader sense?

There were a whole host of questions underneath that associated with cost alignment for the various missions and are those costs aligned with the with the cost targets that were established in the decadal survey and budgeted by NASA? Is the science for each element aligned to meet the threshold requirements or the threshold needs identified in the decadal survey?

We asked them to comment on the integration, and if there were any fundamental or obvious descopes that we should be considering.

Slide 11 (19:19)

So that was essentially how we framed up the IRB. To look at the whole set of missions not just what we're doing but how we're doing it and identify any issues associated with the content, the costing the programmatic approach, the science and data approaches. So, I'm going to walk through, at a high level, their findings. Now they had a lot of findings and recommendations and I'm not going to walk through every one of them. There were 33 different recommendations. What I'm going to do is highlight the nature of those findings and our response to them. So this is a little bit of a distilled version just for the sake of presentation.

Overall the IRB found that the missions are positioned to deliver important science and it's a combination of advanced capabilities making use of very mature partnerships and in particularly in certain cases providing critical continuity. They recognized that there's an inherent tension between staying within cost targets and maximizing the science and that is always true for our missions. They

also identified, the decadal survey actually identified, mitigation strategies, really probably should say budget pressure mitigation strategies and they recognized in this review that many of those have already been exercised, in part because of course, when the decadal survey was released, we did not anticipate major perturbations like Covid. They advised us that we've got latitude in implementing the missions associated with the decadal but that if we deviate far in terms of the balance in in cost targets or in terms of the science we'll be able to accomplish, that we should ensure that we socialize that and go back to and talk with the academy about that.

Slide 12 (21:42)

So, our response to that is that we concur and we agree that the program of record has seen some real challenges: Covid, inflation and so forth have strained the budget and you all know delayed the start of decadal missions. We're still working to get some missions from the prior decadal off the ground. We've endeavored to put together a program that achieves, at least, the threshold science anticipated in the decal survey but we do agree that the upcoming NASA midterm review will provide very valuable feedback on those targets.

Slide 13 (22:27)

So, in terms of alignment with the decadal they found that the science priorities are met by the current plan, but again recommended we collaborate with CESAS. We concur and agree and we will plan to do that through the midterm.

Slide 14 (22:43)

All right. Then they had a series of what I'd call cross-cutting kinds of observations and recommendations on how we're structured and resources. Overall, they thought that our approach of prioritizing early involvement and integrated science and applications teams with data management teams is the right way to go and generally one of the things that they highlighted. You see it really called out in various ways in the recommendations. Here, although they think this is the right approach they recognize that there's more work to do in this area. So they recommended an ESO-wide effort to define data system and software requirements for integrating across Mission science, developing stronger programmatic integration, stronger science integration, stronger applications integration as well as the data management, and that that we put in place a programmatic structure to drive the integration forward.

Slide 15 (24:08)

NASA's response to that is that we concur with their recommended approach of prioritizing this early involvement and deep integration across the missions and we concur with their recommendation to designate a set of leadership roles focused on that integration and we will expand that coordination

across program management, data management, science and applications and ensure that that that that happens right now as we're moving into Phase A.

Slide 16 (24:39)

Then they had a series of mission specific recommendations I'll start with Mass Change. Overall, they thought that the plan, which is essentially like a GRACE follow-on, follow-on, meets the threshold recommendations but they were concerned that, to meet the cost target we had identified an approach that was fairly high risk and they recommended that we look at opportunities to enhance the redundancy in certain elements of the mission and drive to a longer lifetime for this mission. They also recommended that, because we know this is going to be an observation that will be needed on a sustained basis, that we work with International Partners to develop a plan to ensure continuity of the measurement. In other words, they recognize that a single mission solution is not a long-term solution. We concur with these recommendations, and we're developing plans to address and assess, in particular, the accelerometer and redundancy concerns and we'll do that in Phase A. We recognize that there may be costs and schedule implications for how quickly we can get that to orbit and gap risk as well as that may cost more than the decadal told us we should dedicate to this mission. Depending on those outcomes of Phase A we'll socialize that through NASA. We are engaged with our European Partners on a longer-term strategy for Mass Change observation and we agree that that is an important thing to do.

Slide 17 (26:44)

On to AOS, the Atmosphere Observing System. So overall, they found that the current plan actually exceeds the decadal science recommendations at the threshold level but they also said they think it's going to cost significantly more than the cost target identified in the decadal survey. They recommended implementing AOS as a single integrated project, and also considering descopes to bring costs into better alignment with the cost targets. In other words, they were concerned that we had more content in this program than we can afford in this project. They wanted us all to also investigate opportunities for aligning launch dates. So the NASA responses is that we partially concur with these findings and are taking the following steps; we are going to work to bring the costs into alignment with resources through adjustments of scope that will be probably moving closer to the threshold science identified in the decadal in order to save both costs but also cost risk. Cost risk is related to the fact that there are a couple of elements in the AOS architecture that were at a lower TRL level and they said that's a -well my words- a bit of a dangerous thing to do as part of a larger program such as AOS. They made some specific recommendations on how to continue to meet the decadal threshold science but eliminate the need-to-mature technology in the program. They also said that we should assess options for efficiencies in the approach to buying the spacecraft for the AOS mission. Where we differ from the IRB is that we don't actually think combining these into a single program is necessarily the right way to go because it's so complex. Just the two core missions that we're developing here in the U.S have seven instruments, four international Partners, two different spacecraft. It's very complex. We're concerned that that'd be a real challenge, especially once we get into implementation where the focus has got to be on execution. We do agree that integration across those missions is critically important, as it is across all of the ESO

missions. So we're going to work this in the context of the larger cross-cutting ESO program management

Slide 18 (29:46)

Okay Surface Biology and Geology. Generally, the IRB found that the SBG capabilities, are as they're planned, meet the decadal survey threshold recommendations. They wanted to make sure that we are paying attention to the alignment. Again, with SBG there are two different capabilities, there'll be two different spacecraft and they asked us to pay attention to the alignment, in time, of those launches. They also had some specific technical recommendations and in particular ensure that we're procuring some long lead parts and developing backup solutions for key technologies. Those are more engineering issues I would say. Then they also recommended that we expand validation efforts across the board. NASA agrees with these recommendations and we'll take action on them as we move into formulation for the Surface Biology and Geology mission.

Slide 19 (30:48)

A couple more cross-cutting kinds of findings. One of the things that the IRB really focused on was the importance of collaborative partnerships both within NASA across Centers, and they particularly noted the depth of the collaboration across NASA Centers ,but also with international partners and you see our international partner Flags or logos down at the at the bottom of the page. The IRB recommended that we continue to explore opportunities both with traditional partners and non-traditional domestic and international partners, including ESA in particular they called out with a focus on future mission sustainability. That's something that we're also very focused on here. With regard to the Centers, they suggested that we take a another look at the work assignments and the workforce availability across the Centers just to make sure that we've achieved the best balance of technical capabilities.

Slide 20 (32:09)

NASA concurs with these recommendations we're taking steps to review the Center work assignments. We're always open to additional new partnerships and of course evaluating the workforce because we want to make sure that when we when we lock in these programs that we're going to be able to execute them. We want to execute them on the currently planned timelines and that's really critically important. It's important to get these missions up this decade because in 2028 we will see the rollout of the next decadal survey and we don't want to have the NASA Earth Science budget heavily encumbered trying to finish these missions. So we really want to get them moving through so the next decadal isn't in the position that we were in.

Slide 21 (33:06)

All right, a few other lessons learned. In the general comments they recommended that we should should charter a review of past lessons learned with a particular eye on how to apply them to the Earth

System Observatory. They thought that we should engage more broadly in in cross-cutting science and improve the word is ‘morale’ but I think it's really, improve the connections and the depth of partnerships across the science community. One way to do that that they mentioned is through science lectures associated with the science we're going after in media. They suggested we assign an SRB chair for each mission and do that soon so that they can hand over what they found to those SRBs and then establish an understanding of the Rules of Engagement for those SRBs. They also talked about the importance of a communication plan and keeping communication with the community current, making sure that folks really understand what it is we're trying to do and how we're trying to do it so that the the overall missions could be successful and sustained

Slide 22 (34:32)

So our response to these is that we concur with these recommendations and we'll take the following steps. We are establishing a staff review of Lessons Learned and it says ESD and ESM program staff - what it really should say there is the entire ESO team -will review the Lessons Learned with an eye toward how we can better implement the ESO. Those are Lessons Learned from previous larger or complex missions. We are taking to heart their recommendations about holding science lectures and establishing other ways to improve the interactions in the science community and we are in the process of establishing SRBs as we speak, as well as the communication plan. So we concur with those recommendations and with that that was a speedy high level review of the IRB and their major findings. As I said I didn't try to walk through every detailed finding here because there would have been 33 of them. It would have taken a while but think this this sort of roll-up captures the essence of what they did.

Before I move on, I would like to just send a real shout out and word of deep appreciation for the entire IRB team, but in particular to Waleed Abdelati and Geoff Yoder who agreed, under some pressure from me and my boss, to accept this assignment and do so over the summer, probably at the expense of some vacation time with their families. They did so because, they, like we, believe it's really deeply important for us to get off on the on the right foot with these ESO missions and deliver the missions and deliver the science and deliver the applications that the ESO promises. So again, thanks very much to Geoff and Waleed. I don't know if you're listening today so folks, if you see either one of them give them my thanks.

Slide 23 and 24 (37:15)

Let's go ahead on to the next topic and we did announce yesterday the decision to cancel the GeoCarb mission, in conjunction with expanding our greenhouse gas portfolio. The driving factors were technical concerns, particularly associated with the payload development. The payload's been very, very challenging all along the way. Of course, associated with that, when you have technical concerns, you also have cost and schedule performance concerns associated with them and these were, I'll say, well outside of family in SMD missions. Then the other thing is, that the landscape for greenhouse gas observation is different now. There are more data sources coming online and that affords us the opportunity to take a step back and assess the best path going forward. There's one other part to that, I

mentioned the cost performance. NASA is really committed to being good stewards of the taxpayer dollars and part of that is sometimes having to make really tough decisions about how to move forward. So that's where we are there but the thing I want to emphasize to the community is, that this doesn't in any way represent a backing off of our commitment to continue observing greenhouse gases and understanding how they are changing over time and are driving climate and driving the Earth system.

I'll talk a little bit here about a couple of new things. One is we of course launched EMIT to the International Space Station and although EMIT is a mineral mapping mission intended to identify the composition of aerosols in the atmosphere, another important climate related and Earth Science related area of investigation, we also now clearly see that EMIT can identify, in particular, methane plumes and also large carbon dioxide plumes and I'll show you a little bit of that in just a minute. We're also continuing the Orbiting Carbon Observatory 3 on the ISS. We're going through program review now and we believe that that will be extended. We also, in our community announcement on the Earth's System Explorers that we posted about a month ago identified greenhouse gases as an area of focus in that first solicitation. So you'll recall Earth System Explorers, that's a new program tied to the decadal survey and there were seven observables that the decadal survey identified as candidates for Earth System Explorers. Greenhouse gases was one of them and we've decided to emphasize that in the first announcement. Through a whole of government approach, we're advancing in deep collaboration with EPA and NOAA and other U.S agencies. We're working hard on the integration of greenhouse gas data to inform decision makers at all levels and to advance science. We have an intensive effort that will be starting up very soon and then ongoing continued collaboration of course with our team in Oklahoma.

Slide 25 (Additional ESD Updates) and Slide 26 (41:52)

Let's go ahead to the rest of the ESD updates. We've got a lot of great stuff going on. The OMPS-Limb launched on November 10th. It's hitching a ride from our NOAA Pals on JPSS-2. The OMPS-Limb will continue to provide high resolution ozone and aerosol profiles. We're continuing that contribution in the future for JPSS-3 and 4, so that's a sustained observation.

I mentioned EMIT launched to the ISS. That was our EVI 4 Mission and it was launched aboard SpaceX CRS 25 on July 14th. As I mentioned, that's a mineral dust mission and what you see over to the left is the spectral first light. So you're looking at an image on the top panel but an imaging spectrometer like EMIT measures the spectrum associated with each one of those pixels. Every surface on Earth or atmospheric constituent has its own spectral fingerprint and EMIT's ability to measure the spectral fingerprint in every one of those pixel areas really allows us to distinguish different aspects of the Earth’s surface as well as different atmospheric constituents. Oh, and thanks to my team, they sent me a note in the chat - the J2 Ops activation and on-orbit functional tests were successfully completed for both the nadir and the limb just about a week ago on the 22nd of November. So great news there.

Slide 26 (43:59)

I promised you a little bit of a look at what we're seeing from EMIT. Again, this is not part of the primary science mission but it's an augmentation element that we're that we're going after here. What you're looking at there are methane plumes and over on the left-hand side you see in the red curve the

modeled signature of methane and then over on the right the blue is the measured. So those two plumes that look purple, yellow and orange on my screen those are methane plumes. In this case probably coming from buried pipelines, I think that's right on this one. That's been a really exciting new capability that's that we're just beginning to understand and exploit.

Slide 27 (45:06)

All right upcoming launches. Super excited about the upcoming launch of SWOT. It's now scheduled for the 15th of December. Unfortunately, that happens to land right on the same day as our Earth Science Town Hall at AGU so we're going to have to divide and conquer there. But we're really really excited about the SWOT launch. For those of you who are not following SWOT as closely, there are a couple of really exciting things here. SWOT will provide the very first global inventory of Earth's surface water. The thing that's unique is that it's an Imaging altimeter and that the spatial resolution is improved dramatically from our legacy altimeters. I think it was maybe Nadya Vinogradova- Schiffer who came up with this analogy. She said for ocean altimetry and satellite oceanography this will be like going from Hubble to Webb in terms of the clarity and the increased fidelity of what we're able to observe. In particular eddys and currents that we think are really important in the role that oceans play in climate, transporting heat and also carbon vertically in the oceans as well as around the world. Inland SWAT will be able to see inland water bodies; lakes, reservoirs, rivers that we've never been able to see with an altimeter before. That's going to allow us to monitor water levels and address flooding. For example, today from space we can see extent of flooding. SWOT will allow us for the first time to understand how deep that flooding is. So, a lot of incredibly exciting new capabilities coming out with SWOT. Again that launch is coming right up.

With TEMPO the launch is targeted for March of 2023, probably late March and it will be the first ever space-based instrument to monitor air pollutants hourly across North America during the daytime. It'll be hosted on a commercial geostationary spacecraft. This is another extraordinarily exciting capability and also, of real interest to our sister agencies in the Federal government and at the state and local levels. This will provide incredible insights into human health but also it's related to other issues that we're dealing with like wildfires and the air quality issues that are attended to those. So really important mission coming up.

Slide 29 (48:38)

We've got a couple of recent and upcoming Tech demos. In July we launched the CTIM-FD. This is demonstrating carbon nanotube bolometers. The idea here is to demonstrate a technology to measure total solar irradiance, an important climate and Earth system science variable but to do so in a 6U CubeSat. This could help us make this measurement far more affordable. Also the multi-band uncooled radiometric Imager MURI-FD that will launch sometime, I believe, in December. Again demonstrating a two band, long-wave, infrared, radio radiometric imager using an uncooled focal plane array. This is really important because the cooling is one of the drivers of cost, complexity and life in a long wave infrared imager. So we're trying to see if we can get performance that is comparable to the Landsat tiers. So really exciting new tech demos. Thanks very much to our ESTO team.

Slide 30 (50:11)

Let's go on to the Earth System Observatory. These are the Explorer missions, I mentioned these earlier. It's the same graphic in the middle, but it's different words around the edges. Previously I talked about the five Earth System Observatory missions that we're building and that are part of the core Earth System Observatory. I mentioned the Earth System Explorers, this is the competitive layer to the Earth System Observatory. These are the Explorer observables that the decadal identified. There's seven of them and we're really very excited to be moving out on this announcement as well.

Slide 31 (51:09)

We released a community announcement on October 4th. It'll be open to all observation types recommended by the decadal but, as we indicated in that announcement, greenhouse gases will likely be one area of emphasis. The idea is to launch these by the end of the decade or at the beginning of the next decade. The idea here is to bring that innovation to augment the core missions. Over on the right, you see our approach to how we're going to implement the Earth System Explorers. These will be PI-managed cost cap missions at 310 million dollars in Fiscal Year 24, exclusive of the launch services. In other words, NASA will provide launch services separately. These will be a two-step selection. In the first announcement we'll select up to four proposals to go into Step 1. Those will be approximately 9-month Phase A concept studies. Then we'll have a down select to go into Step 2 which is actually building out the mission and we'll select up to two missions. The idea is that likely one will focus on greenhouse gases. Those two missions will have a slight stagger in the phasing and funding and that's why you see a slight stagger in the launch dates

Slide 32 (52:45)

Landsat Next. The plan is a constellation of three identical observatories and they're approximately equally distributed in orbit so 120 degrees apart. That constellation provides the full nine-day Global revisit frequency that today we get from the combination of Landsats 8 and 9 with expanded spectral bands, 21 in VSWIR and five TIR. And again, we're driving to launch by 2030. We held the KDP program management council yesterday and we have upcoming a Community Forum on December 8th. That Community forum is specifically focused on the Landsat Next Instrument Suite RFI that we released on November 3rd and I believe the RFI closes today. On December 8th we'll have a Community Forum that is focused on that RFI. The RFPs for the instruments would be then anticipated in the spring of 2023.

We arereally excited. Many of us got to attend the Pecora conference and celebrate 50 years of of Landsat continuity. We're just as excited or even more excited about what Landsat Next is going to allow us to do across the board in science but also opening up a host of new applications areas because of the increase in the spectral bands and having them all in one platform, the improvement in the spatial resolution and the signature accuracy and measurement quality that has made Landsat Next the gold standard for all of those years. So really excited to be moving forward with Landsat Next

Slide 33 (55:35)

2023 is NASA's year of Open Science and kicks off a Transition to Open Science or TOPS to energize and uplift open science across the Scientific Community. This is an investment in increasing the visibility of open science and integrating open science into themes at large-scale events and conferences.

Capacity Sharing will be producing a lot of online free and open science curriculum to teach, across our community, not just the principles of open science but provide really practical information on how to do it. They are creating a small certification process that people can go to to get really trained on how that's going to work. We're also tackling the incentives associated with Open Source science because it is a change in the way of doing business. We'll be looking to work from NASA and with partners on establishing ways of recognizing great contributors to the community who contribute through the open sharing of their work and then you know just moving the whole the whole Community towards openness. We think this is going to be critical for increasing the pace of discovery and use of our scientific knowledge, for welcoming more participation in science in a variety of ways, for sharing that knowledge that today is hidden, locked up in individual teams around the world. This is a really important SMD wide effort that Earth Science is leading. And we're leading for two reasons; one because of the sheer volume of data that we have and two and probably the larger element is the demand from a wide variety of users of our data that makes Earth Science the logical lead for this effort.

Slide 34 (58:18)

Earth Action strategy. I think this is my second to the last slide. This is something that our Earth Science Leadership team has been working on for well over the last year. It's really about driving the impact that we get from the about a billion and a half dollars that we invest every year in observations and research and making sure that we're delivering that impact to meet the needs, not just of Federal agencies, state local and tribal governments, but also individuals. We often express this as a pyramid and let me start at the bottom because when you're talking about Earth Science everything starts with observations. Of course, in a forum like this we tend to focus on the space-based observations but also the airborne observations, the networks of ground observations are critically important and the foundation for what we understand about how the Earth System works today and how it's how it's changing and what it might be in the future. Resting upon that is our investment in research analysis modeling and applications incubation. That's a lot of the work that we have historically done in extracting the meaning and the value and the science out of our observations. As we move up the pyramid we're looking to develop what we're calling Earth Action Solutions. These are efforts to scale NASA's science and tools for a broader reach in enabling climate response through National and International Partnerships. Then at the top of the pyramid not because it's most important but, because it can only happen if everything underneath it happens, is the Earth Information Center. EIC is a physical and virtual place for engaging with our observations and Earth Action Solutions. Another really important thing I want to draw your attention to is over at the left. We think there are lots of benefits for science enabling decisions and that's that circulation you see over on the left. We often think about science informing action and, of course, that's critically important but, we actually think that when individuals, when agencies try to make use of our data they learn things or they can tell us where we got it right and where we don't yet have it right. They can feed their data that they collect on the ground back into our science. So, we think that feedback loop from the users of our information back in to inform the research that we fund,

maybe the observations that we make, certainly the applications and the actions solutions that we develop that that's a really 3important feedback mechanism to energize. I don't say that to imply that it doesn't exist today. I know that there are a lot of people working in that space, but we think that it could benefit from more attention there. At the bottom there are major applications and themes that that we're focusing on. Again often in partnership. I don't have a lot of other agency logos on here but that should not lead you to believe that there that we aren't really working those connections. I mentioned earlier greenhouse gas monitoring- it's not quite fair to say that's new- but it's a significant increase in our emphasis. Wildfires, health and air quality, sea level, energy efficiency and infrastructure, agriculture and crops, disasters, water resources and biodiversity these are all thematic areas that that will come to life through this pyramid. This strategy will broaden our partnerships across the range of government and non-governmental partners, and actually this is traceable back to the decadal survey. I recall that the decal survey talked about the importance of continuing to invest in the synergy of science and the use of science. I could go on about examples here but I won't. I will just close this slide with one really important announcement. Today we just announced a new senior executive position, the new Associate Director for Earth Action within the Earth Science Division. That's a new posting, available today. It's open through January 3rd and I hope some of you on the line will consider applying for that position. We are really excited that this will be the senior leader on our team that's driving this strategy forward.

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We shouldn't have done it this way. I don't want to end on a sad note. It's sad for me but, of course, deep congratulations to Pam Millar. She has been named the Laboratory of Atmospheric and Space Physics First Deputy Director for Strategic Development and Communications. So Pam is heading to LAST. Of course, you all know Pam and love her as the Director of ESTO, the Earth Science Technology Office. She's been in that position for the last five years and just done incredible work. She's received two Goddard Space Flight Center Director Awards and has been recognized for exceptional achievement for diversity and equal employment opportunity. Pam has been part of the Bedrock of my team here at Earth Science so I'm Really Gonna Miss Her! Pam, deep appreciation for your leadership over many years most recently as the Director of ESTO. Your contributions to NASA and to Earth Science did not start just five years ago. It's been a long career so we wish you all the best as you head off to LAST with deep appreciation. I think that is where we'll wrap up the formal remarks here

Karen: There we go stop sharing and so Wendy, back over to you.

Wendy: Excellent we've got a lot of questions in the chat we probably won't be able to get to them all we'll try to get to as many as we can and also lots of thank you's in there for you Karen

Question and Answer Session

Karen: Yes sorry. I forgot to do something really important and I wouldn't mind if before we go to questions, because I'm so proud of them and I love them all. If our NASA Earth Science Leadership team

is on the line right now, and I know you're not all in a place where you may be able to turn on your cameras. But if you can turn on your cameras. So we've got Katie Boggs who is our Acting Flight Director, Julie Robinson, who's joining us from France, from our R&A team we've got Jack Kaye and David Considine, from Applied Sciences Lawrence Friedl and Emily Sylak- Glassman. From ESTO we've got Pam, who I just carried on about. Pam if I'd known you were on the line I don't know maybe I would've attempt to temper my comments. I'm teasing, I'm teasing, I meant every word. Mike Seabloom there from ESTO as well and representing our data side of the house is Katie Baines and Kate Becker's hiding. She is our executive officer and co-host and of course you all met Wendy who is our new, new since last we spoke, head of our Communications efforts here in Earth Science.

So with that I know we're going to questions now. Team be prepared because it may be appropriate, I don't know yet what the questions are, this is always the fun part, but we may either ask you to take on a question or you may volunteer to take a question all right. Thanks Wendy back to you

Wendy: So scrolling back up into the top there was a question posted by either George or Jorge, I don't know how to pronounce your name, Vasquez asking whether there was any discussion concerning the balance between continuing support for current missions versus the development of new missions

Karen: The decadal survey took on that question explicitly when it sought to balance the Investments that they that they thought that we could make in the new decadal missions. They had in mind the program of record and the competitive lines of our budget. So yes the decadal survey originally gave that a lot of thought and the IRB team also took on this question. I'm going to actually offer the mic over to Katie Boggs who is, as I mentioned, our Acting Flight Director

Katie Boggs: Yes, like Karen said, the Decadal survey had taken on and said that if we had financial or yo budgetary constraints that we should first delay the big missions and to get the new one started in the competitive area. In the in the IRB report you'll see that they found that we actually already made all the adjustments that have been recommended in the decadal survey, including you know things like having to push out a couple things because we we've had some challenges due to Covid in our in our bigger missions. That was the high level finding, that we've already done everything that decadal survey has said to do as far as concerned getting the balance

Wendy: Let's pivot to the next one. There is a question from Russell about whether there has been any thought been having been given to repurposing the GeoCarb scientists and he cites some very real human impacts there.

Karen: First let me say that decisions like this one are decisions that that are that are really challenging, not challenging, they're hard. They're hard for us to make, they're hard for everyone involved because we all believe so deeply in what we do and we're all personally invested and I want to say, some of you may know my personal history I have this experience in my background as well from the early days, from the NPOESS mission which was restructured as JPSS. So I know how personally difficult it is when there's such a substantial change, cancellation or restructure of a mission. That said you know this information is very new and now that it is out in the open, we can work with the team to talk through all of these issues. I think the one thing I would say is that we're just starting the discussions with the Oklahoma

team to understand the implications and assist them in any way possible to work through the implications.

Wendy: Thanks for that Karen and also a follow-on question, also from Russell. He is asking about collaborating with Oklahoma partners asking specifically what does that mean? From what I understand the instrument team and research team are being defunded could you respond to that?

Karen: So again, it's really early days. Our our team is in communication with the Oklahoma team to again work through work through those issues. We do care very much the people who've invested time and energy we know that there are real human impacts here but we are just starting that conversation and of course we'll follow and support Oklahoma's lead on that. I should also say that that while we're bringing the GeoCarb project to a close, the full contract value will remain with the university there so that we can do this in an orderly way.

Wendy: Excellent. Thank you. Another question in the queue comes from Kevin who is asking about what role do International Partners missions and information systems such as EU CO2M, Merlin c22 etc play in NASA's greenhouse gas strategy?

Karen: Absolutely. International greenhouse gas observations are a key contribution to the strategy both in terms of the science and actually making data more broadly available as well as collaborating on the science, the tool development and so forth. International Partners, National Partners are all very important to that strategy and I see Julie has her hand up.

Julie: Sure, I was just going to say that that's why I'm here I in Europe at CEOS, the committee on Earth Observing Satellites because we're working with International Partners on everything from what are the most interoperable ways of combining data from different satellites, talking about the commercial sector and a large portion of this meeting is really focused on how do we best cooperate in climate change measurement and greenhouse gas measurement in particular

Wendy: Thanks Julie I also noticed that Jack has mentioned he could add something that might be useful as well to the conversation Jack

Jack: Thanks. I do want to be sure that folks are aware of certain opportunities that we have that that support International cooperation. Every other year we run the solicitation for U.S participating investigators for people to be involved. It's a small solicitation but we've been doing this for a while and I think we did one selection in ROSES 22 the next would be ROSES 24 and those are for five years so that's something that we do. There's also are certain things like in the land cover land use change area the Multi-Source Land Imaging a program where we specifically support people to be able to look at the investigations from different providers and try and figure out how to integrate them together because that's especially for Landsat and Sentinel-type observations. There's a variety of other things that we do and we should note that um there's really no solicitation that we do that limits people to only look at NASA data. There may be some where we'll say you should look at NASA data but it's always in the context of other data and if there's science benefits to be gained by looking at integrating non-NASA data with NASA data that's fair game for people. There are some things that we try to look at what they'll call cooperative calibration validation and there are things that that we do especially with that field programs where it can be mutually beneficial. So there's a long history of cooperation with the European Space Agency on integrated calibration validation for ESA10 , ICEsat in cryosat and a variety of