Transcript of Q&A Session #2
September 27, 2022

OPENING SLIDE

- **Robin Ford (RF):** All right, well, thank you and good afternoon. Welcome to the second Q&A session for the FLOATing DRAGON Balloon Challenge. My name is Robin Ford, and I will be your meeting host. We are excited to host the first ever FLOATing DRAGON Balloon Challenge and can't wait to see what types of concepts you will propose. NASA is strategically looking to engage universities as partners in its mission. The end desire is to incorporate some of the technology from this competition into future balloon missions as early as 2023. As a reminder, this session is being recorded. Kindly, mute your mic if you aren't actively speaking. Thank you.

AGENDA SLIDE

- **RF**: Today we'll go through introductions; the Challenge itself, both technically and programmatically. We'll go through the questions you've submitted. If time allows, we'll answer additional questions.

NIA PROGRAM TEAM SLIDE

- **RF**: Throughout the Challenge, I will be your main point of contact. However, with us today, we have Stacy Dees and Janice Kurbjun Miller. We are with the National Institute of Aerospace. FLOATing DRAGON is managed by NIA on behalf of NASA's Wallops Flight Facility's Balloon Program Office.

NASA SPONSORS SLIDE

- **RF**: So now I'm gonna turn it over to our sponsors so that they can introduce themselves. Sarah, would you like to start?

- **Sarah Roth (SR):** Sure. I'm Sarah Roth and I'm the Chief Technologist for the Balloon Program Office here at Wallops Flight Facility.

- **Andy Hynous (AH):** I'm Andy Hynous. I'm the Mission Operations Manager for the Balloon Program Office. So, uh, I focus on our launching operations.

- **Chris Yoder (CY):** And my name is Dr. Chris Yoder, a former NASA Pathways intern and current Balloon Technologist here at the Balloon Program Office.

NASA SUPPORT SLIDE

- **RF**: Thank you so much and next, I'm not sure if they were able to join us today, but a couple of the subject matter experts from NASA are Joseph Jones, Robert Salter and Chris Shreves.

FLOATing DRAGON SLIDE

- **RF**: Chris, why don't you go ahead and tell us about the Challenge.

- **CY:** And so, like I said, I'm Dr. Chris Yoder and I've worked with NIA before. They are a lovely group and so I'm glad to have them along for this Challenge specifically. And so, I want to give a brief overview to everybody who missed the first Q&A, about the FLOATing DRAGON Challenge as we go forward. So next slide, please.

BALLOON PROGRAM OFFICE SLIDE

- **CY:** So, just briefly to talk about, uh, the agenda, we're just going to go over kind of what we are, the balloon sizes, the challenges of data sets and then specifically to DRAGON itself. First off, speaking about the Balloon Program Office so we are managed out of Goddard Space Flight Centers, Wallops Flight Facility. For those of you who don't know where we are, we are on the Eastern Shore of Virginia. It's the little bit that kind of hangs out in the Atlantic, south of Delaware, um, above Norfolk and only a few hours from DC. What we do is we launched 10 to 20 scientific ballooning missions every year, from all over the world. We are the NASA branch of this, and we, we work with our prime contractor down in Palestine, Texas to do so. We launch from everywhere, including Texas and New Mexico; our long duration balloons (LDB) out of Sweden and Antarctica; as well as our ultra-long duration balloon (ULDB) missions out of New Zealand. Specifically, we have two types of balloons. The first is a zero-pressure balloon. The second is a super pressure balloon. Both of them, are buoyed by helium gas, [which is] lighter than air. They're zero pressures are open at the base and that's limited by diurnal cycles. The super pressure balloon is a closed volume and provides good altitude stability over those diurnal cycles, and thus providing longer duration. Next slide, please.

BALLOON SIZES SLIDE

- **CY:** Just to give kind of some points of reference, about how large these balloons are. Most people ask us if these are weather balloons, in which they are not. These are scientific balloons carrying telescopes, high altitude science payloads, um, physics, astro, atmosphere, chemistry experiments, et cetera, et cetera. Um, as such, they are quite a bit bigger. Volumes range from 1 million cubic feet to 60 million cubic feet, altitudes from 90,000 to 160,000 feet, which is 27 to roughly 49 kilometers, if you prefer SI. Payload weights range from about 500 pounds to 8,000 pounds, depending on the type of telescope or payload, et cetera, et cetera. Um, you can see here a balloon, right when it's about to launch from the pad here on the left and then a balloon at float, both compared to the Washington Monument to scale. They are quite large, if I do say so, myself. Payloads are designed and delivered by the science groups themselves. We, specifically here in the program office, focus on the vehicle. That would be the balloon, the parachute, the cable ladder, the interfaces to the payload, the telemetry things of that nature. Next slide, please.

DATA COLLECTION – THE ISSUE SLIDE

- **CY:** So, with a couple of our missions that are coming up, um, we have a lot of data that we need to suddenly get down to the ground. Um, some of the proposed missions that are coming up are proposing 100 terabytes or more of data. We're talking very high-resolution images of star fields and galaxies and that's great. I mean, it's cutting-edge science that we really want to promote. However, it poses a problem to the program. Uh, fundamentally, we can only telemetry down so much data over our satellite links and things, and this type of data is really going to bog down that telemetry. We physically cannot get it down fast enough. Um, and because, we cannot guarantee recovery of all the balloons, every single mission, we want to propose an alternate method for data retrieval, which is essentially to drop data vaults from the balloon to the ground in known safe locations, for recovery by the science team or essentially a physical telemetry system. This would generally be used for an LDB or ULDB mission out of either Sweden, Antarctica or Wanaka [New Zealand] and in terms of some of the other continents we overfly. This type of system is coming. It's not a question of when, it's a question of if. And so, our program, and NASA specifically, want to get out ahead of the need and develop a proactive, we want to be proactive and develop the design, the testing, the

implementation of such a system so we can do it in a safe way. One that is easy to interface by science groups and one that's reliable. Next slide, please.

CHALLENGE OVERVIEW SLIDE

- **CY:** Now, the problem is, this is a quite a technical challenge, and there's a lot of different avenues we can go from a design perspective. And this is really where we want your help. Um, we created the FLOATing DRAGON Challenge with the goal of to design and prototype ideas for just this such data vault recovery system. Uh, essentially, our desire is to have a guided system, which can gracefully fall to a predetermined safe way point for recovery by the ground team. If you want more information, you can go to www.FLOATingDRAGON.nianet.org. My guess is if you're already here, you already know about it. So, student groups have a heritage of flying on our missions. We fly Cubes in Space every year above New Mexico, we fly HASP every year. Uh, both are great programs. We've had a storied heritage with both those programs. And so, we're looking to leverage the design freedoms that student groups have, to really make this DRAGON Challenge bring that to fruition and give us a good mature product. Next slide, please.

CONOPS – ALWAYS FLY WITH SAFETY IN MIND SLIDE

- **CY:** Now, since we are NASA, we always need to fly with safety in mind. Um, so, the way this is gonna kind of work, we're gonna have every, all the student groups propose, we're going to down select to four (4), based on design, performance, creativity, et cetera. And then we're gonna have review teams that are gonna be, um, with BPO, our engineering groups here, Wallop's Safety, et cetera, et cetera um, just make those selections and then go forward, uh, with the, with the proposed solutions. We're going to down select the four (4) teams, and then those teams are going to be invited to actually fabricate and deliver on both, um, their concepts. Both with a deployer and a node. Essentially the solution has to have two pieces: a deployer system and a node system. The deployer is what mounts to what we call a HASP style gondola. Essentially a standard issue gondola that we fly. It receives a signal from CSBF to drop a node at a fixed time. And it houses all of the hardware that the science solution needs in order to operate successfully. The node is the thing that is actually released from the deployer. This is the data vault that's going to be taken to the ground. It's the capsule that it's in, or the vehicle, or whatever the solution looks like. It must autonomously select the way point, and travel to the ground within a certain distance. Now from a CONOPS perspective, balloons take about two and a half hours to go from a set and insert into float. We would then expect you have one-hour post-float, to release the node and then hit that way point target that you've identified um, that are that are, um, set up for the course of that day. Next slide, please.

SCHEDULE – ORGANIZED AROUND THE SCHOOL YEAR SLIDE

- **CY:** So, a brief outline in terms of schedule, um, it looks like we've got PDR coming up here, with some review packages sooner, rather than later. Um, we've also got the down select starting in the early spring semester. We've got some SDRs and some MRR and INT activities here in, uh, in both, um, here and at Ft. Sumner. And then we have a completed flight by 10/16/2023 and close out the following December. [This is] a rough schedule, going forward. Some of these dates may need to be shuffled around as we go forward. But these are our general targets that we're trying to hit. Next slide, please.

REQUIREMENTS – GIVEN AS DESIGN REQUIREMENTS

- **CY:** In terms of the requirements, these should be the same as what we're given, um, in the initial solicitation. Uh, we can go into some of these in more depth as we go through some of the questions that you guys had. But this is basically the kind of the high-level guidelines about how we're going to interface with you guys; the weights, the masses, the volumes, things like that. Next slide, please.

TRIDENT TRIG TRACKERS

- **CY:** Uh, and then this is some information about some trig trackers. These are what we use, um, essentially, we have a requirement from flight safety that we have to verify that we can always go and collect. The nodes, even in the event of a failure, the unlikely event I should say. Um, and so this is going to be part of the data vault package that we'll have you carry down in the ground. We can talk about these a little bit more as we answer some of these questions as well. Next slide, please.

TRANSITION SLIDE

- **CY:** Right and I believe that's it for my introduction, I'll hand it back over to, you.

- **RF:** All right, great, thank you so much. So, let's go ahead and start answering some of the questions I will read them out. And then, um, Chris, Sarah, or Andy, feel free to jump in with the answers. Next.

TECHINCAL QUESTIONS – SLIDE 16

- **RF:** The guidelines prohibit excessively large magnets. What is the threshold for when a magnet or electromagnet become excessively large? Would a generic DC electric motor of 40 x 30 millimeters exceed that threshold?

- **AH:** So, we did get some more recent guidance this morning from our ground safety office. And the limitation for magnets coming out to the field ifor our facility is two Teslas. Right now, the answer that you see on the page, it shows up as a much smaller value, which is .01 Tesla. But as far as for what our guidance from our safety office was, the limitation will be 2 Teslas for any magnets, brought out to our field. Did that answer your question, Robin?

- **RF:** Yes, and so. I believe that's the answer for the second question as well. Under the prohibited items – "Excessively" is a relatively vague term describing magnets. It is describing the force due to the magnet or the overall size of the magnet?

- **AH:** So, it's the, it's a, it's the, the field strength of the magnet that's setting the limit so that's two Tesla.

TECHINCAL QUESTIONS – SLIDE 17

- **RF:** Great Thank you. All right, next question. Designs are required to be able to survive a 10g shock or higher without yielding. What is the upper limit that the node and deployment system should be designed to survive?

- **SR:** So, 10g's is the upper limit. I think the 10g's or higher was, uh, just, um, a little bit of a misprint. So 10g's is definitely the upper limit.

- **RF:** Okay, is there a specific orientation the allotted space should be in? Or is that up to the teams to decide.

- **SR:** So, the long access to the deployer should be vertically oriented so that the, the node will be dropping straight towards the ground. So, using, you know, gravity to drop it out of the, um, deployer rather than some sort of propulsion to get out of the, the deployer.

- **RF:** Okay. Will the node system be required to qualify for the FAA beyond visual line of sight waiver or the BVLOS?

- **AH:** So, the, the Wallops flight safety office will, uh, review all of all of the proposals and submissions and we self-certify via that organization that internal to NASA. So no, no one will have to interface directly with the FAA or apply for waivers.

TECHINCAL QUESTIONS – SLIDE 18

- **Stacy Dees (SD):** I'm going to jump in here. Everyone this is Stacy and we're getting a little bit of feedback from Robin, so I'm gonna try to take over asking some of the questions to start. So, we are on to the next slide please. If and how, and when will predicted balloon trajectory, be given to the teams prior to flight? What is the typical accuracy and resolution of that information?

- **CY:** That's a that's a great question. So, whenever we do our trajectories, they're highly dependent on the winds that we're seeing from meteorology group. Realistically, we're going to provide what we call an L -1 or a launch day -1 trajectory. This will go for the safety analysis and then we anticipate the travel into float, the insertion into flow will be accurate to within, about 10 kilometers. Obviously, if the winds are highly variable, then that becomes harder. But we, we estimate about 10 kilometers.

- **SD:** Great. And how will real-time balloon location, give it to the team in order to time release of the payload? What is the latency on that information?

- **CY:** So CSBF already publishes real time data on all of their flights. It's available through the standard CSBF website. Um, you can go and look on the flights that we have currently. Latency is on the order of about 10 seconds. It's a little less than that, but that's a good number to use.

TECHINCAL QUESTIONS – SLIDE 19

- **SD:** Oh, thank you. Next slide please. If (and how, and when) will wind data (speed and direction by altitude) be given to the team prior to flight? What is the typical accuracy and resolution of that information?

- **CY:** So, we get all of our data, our wind data from the GFS model, which is publicly available. Um, I encourage all the teams to go to the Nomads tool that NOAA provides. It's a great tool. It's just in general, it's the same information that goes to your local weather forecast. Uh, that's where we get it from. It's available on hour-by-hour forecast, published 4 times a day. Um, we will give you basically a sounding file, a vertical survey and make that available via email, probably as a text file or a CSV, um, it's our standard output. However, if you don't want something that's in that format, or you want more regular updates, we encourage you to go ahead and pull that data directly as well.

- **SD:** We have another wind question. Does the attachment detachment mechanism need to endure any high winds while in its high-altitude position?

- **SR:** Since the balloon is floating with the ambient wind at altitude, there will be little to no relative winds, while attached to the balloon gondola.

TECHINCAL QUESTIONS – SLIDE 20

- **SD:** Next question please. Will, more information be given about the dimensions of the items in the standardized equipment and hardware package. We received a number of questions that are kind of in the similar vein, requesting data sheets or CAD models for that data vault. Um, if you could go ahead and respond to that question.

- **AH:** So, we're going, we're efforting getting the drawings made up as soon as we can. So, there's these two questions here and another one that's talking about historic flight data that we will be providing in sometime early October. Um, as of right now the, the data vault dimensions that work, that were provided as part of the challenge, we're going to create a drawing, essentially just detailing what those dimensions are. And then we're going to, we also have information in the challenge guidelines stipulating what the mounting features are supposed to look like. But we will provide

drawing sometime in the next week, maybe week and a half on what those on what those dimensions look like, and how that mounting is going to take place.

- **SD:** Thank you. So, I think we can skip the next question.

TECHINCAL QUESTIONS – SLIDE 21

- **SD:** Will modifying a UL compliant battery cell to create a multi-cell battery disqualify its UL compliance?

- **SR:** Yes.

- **SD:** Pretty easy.

- **SR:** There's a, I mean, there's a longer answer. So, there are ways to use multiple batteries in a series of parallel that doesn't require actually modifying the battery itself. Which is a route that they should look at if that's needed. You just cannot open and modify the battery as is from the manufacturer.

- **SD:** Thanks, Sarah. Does the weight limit include the payload?

- **SR:** Yeah, the weight oh, sorry, the, the node weight limit does not include the NASA provided payload. Um, so it's just the weight limit is just for the components the students are providing. So there. Yeah, so there's no weight limits on the individual subsystems. It's just on the total package.

- **SD:** Good deal, thank you. And before we jump to that. For our folks at BPO, um, at I think we're getting the feedback because we can have all of your mics in one space. Is that a possibility to shut off any of the open mics?

- **SR:** We just have one microphone open.

- **SD:** Oh, really? It's just picking up really bad feedback. We're going to have a bit of an echo. Robin, would you like to ask the questions?

TECHINCAL QUESTIONS – SLIDE 22

- **RF:** Sure. What exactly is considered a thruster? Are propellers allowed? And similar question, what does no thrusters mean? Does an electric motor with a prop count as a thruster? Or does this imply something like cold gas propellant or pyrotechnics?

- **SR:** Can you guys hear us.

- **RF:** Yes.

- **SR:** Okay, so we lost you for a second there as we tried to mess with our system to get rid of the echo. Um, so thrusters are defined as any kind of pyrotechnic rocket motors. So, there will be no pyrotechnics allowed. Um, so that that even includes things like compressed gas.

- **RF:** Okay, is black powder for parachute deployment allowed?

- **SR:** No. No, no explosives of any kind.

- **RF:** Okay, can we detach components during the fall?

- **SR:** So, you can release or deploy certain components, um, you know, things like reef chute or drogues, but they have to stay attached somehow to land with the nodes. So, you can't actually cut

away a drogue chute, you'd have to just deploy your main and, um, and let the drogue continue to fall with the rest of the chute. We have to account for all components of the of the payload.

TECHINCAL QUESTIONS – SLIDE 23

- **RF:** Okay, what is the interface for data transfer between the balloon system and the vault?
- **AH:** So, as of right now, there is gonna be no data. There's going to be no data interface with the NASA provided payload. The payload is going to be just a, essentially a black box that's turned over to the student teams prior to the campaign. Prior to they're doing the integration.
- **RF:** Okay. And so, with the drift of the balloon, is the target destination of all landings on land, or are some on sea?
- **AH:** So, all of our, all of these, uh, student teams will be landing in, uh, western New Mexico maybe eastern Arizona. So, it'll all be on land. We'll be targeting land landing points.
- **RF:** Okay. And so, how will landing site information be relayed? How soon will our team know of the predetermined landing site?
- **AH:** So, what we're going to be doing, is we're going to be providing the trajectory as Chris said earlier. We will be assigning is targeted points along whatever the pre-determined float, whatever the actual float or float location or float trajectory of the balloon is, within 15 to 45 kilometers from that targeted from that balloon, uh, trajectory. So, all of the, uh, predetermined targets will be essentially be in 15 to 45 kilometer arcs away from the balloon.

TECHINCAL QUESTIONS – SLIDE 24

- **RF:** Okay, thank you. How will the balloon trajectory and wind data be delivered to our team, and relayed to our node?
- **CY:** So, via email, or you can pull it off the website. If we email anything to you, it would be either via CSV, KML, TXT format, something that is ASCII readable and processable and something like that.
- **RF:** Okay, um, what is the maximum distance between the potential landing points?
- **CY:** So, it's not fixed yet, because it depends on what the L-1 trajectory looks like. However, Andy did just cover that. It's anywhere between 15 and 45 kilometers
- **SR:** And L-1 being launch minus one day. So, one day before launch.
- **RF:** Okay.
- **SR:** I think we refer to that several times in this document.
- **RF:** Okay, thank you. Where is the target in relation to the balloon?
- **AH:** 15 to 45 kilometer arc out away from the, uh, away from the position of the balloon at, at point of launch, point of departure, point of flow, there we go.

TECHINCAL QUESTIONS – SLIDE 25

- **RF:** And can we modify the target area?
- **SR:** No. No, that's going to be fixed.

- **RF:** Is there a maximum distance that the target landing point will be from the balloon when we have the authority to drop the node.

- **AH:** So, we will have a designated release zone over the state of New Mexico. That's going to essentially dictate where we, when and where we can drop. That's going to be provided by the flight safety team. Um, but once again the student teams will have to tell us when to command their, uh, their subsystems to deploy, um, to reach the designated targets.

- **RF:** Okay, and I, I think you answered this part before, uh, what is the farthest distance in which the designated landing spot will be away from the initial launch coordinates.

- **AH:** And it'll, it'll be equal to or less than 45 kilometers.

- **CY:** Well, and just to, to kind of put a specific point on it. It's not the initial launch coordinates that really matters. It's the perpendicular deviation from the nominal balloon trajectory. So, you know, if we, if we pick up and launch and move half the state away, before we insert into float, that's not going to hinder any of the teams. It's all about where we insert into float and then along that next predicted hours path.

TECHINCAL QUESTIONS – SLIDE 26

- **RF:** Okay. And what are the predicted landing conditions for the predetermined landing site? Uh, similar question is the target point in a nominally flat and unobstructed area? And will the landing way points be at different altitudes?

- **CY:** So, this is a pretty good question. The target points are all gonna be very flat open areas. Think wide open fields, or patches of dirt. They're ground level, but obviously ground level varies. There's significant variation in altitude, because we are in the high plains in New Mexico. So, I guess relative to above ground level, yes, there will be changes, but you can always think of it as just ground. There's no like midair targets or anything.

- **RF:** And is there a temperature control requirement that we need to implement for the data vault that we are given.

- **CY:** No.

TECHINCAL QUESTIONS – SLIDE 27

- **RF:** If there are known icing conditions that our vehicle would have to traverse on the way down, will we still perform the drop or would you drop another day?

- **SR:** That's not really a concern we have. So, all the moisture will sub eliminate during the ascent. At the altitude that we fly at, there's little to no atmosphere, atmospheric pressure, um, so there was no moisture. Um, we don't launch unless it's a clear day so it's not a, an issue.

- **RF:** Okay, and does the gondola frost while at target altitude? If so, how much weight and frost does the gondola gain while at sustained altitude?

- **SR:** And so it goes back to the last one. But there won't be any, any moisture on the gondola at its float altitude. It'll, it'll subliminal during ascent.

TECHINCAL QUESTIONS – SLIDE 28

- **RF:** Thanks. Does the data vault start out in the gondola, or in our vehicle? If in the gondola, how is it to be transferred to our vehicle? If in our vehicle, are there any USB, or other cables to disconnect before dropping?

- **AH:** So, for all intents and purposes for this Challenge, the students are going to be provided, like I said before, a black box. So, prior to them integrating their student payloads onto the gondola, so there will be no removing of the of the hard drive and migrating it from the NASA provided gondola, to the student provided systems. It'll all be done prior to the launch of the balloon.

- **RF:** Okay, and regarding the "GPS tracker" supplied by NASA – is this for NASA's use to monitor our flight or is there a data stream available to us in real-time from that tracker? If data stream is available, is the GPS unlocked to operate up to the balloon's float alt?

- **AH:** So, this is a little bit of a complicated question. So that the NASA provided gondola and balloon will have a GPS system on board. Um, we can talk about providing that GPS data to the student teams. But, um, as far as for what's being provided to their onboard systems, it'll likely not be open for use just because we don't have the ability to replicate that data across so many different packages.

TECHINCAL QUESTIONS – SLIDE 29

- **RF:** Okay, and so next we're back to, um, the question that you referenced before talking about historic data, um, being provided by early October.

- **AH:** Yeah, so we can provide, uh, several years' worth of, uh, uh, similar nominal flights, uh, to the student teams prior. So, they can get a look at, uh, essentially a temperature pressure, altitude curves and that kind of stuff. And we'll provide that in that same data dump with the drawings that we mentioned earlier.

- **RF:** In terms of atmospheric conditions, do we need to consider abnormal environmental hazards such as hurricanes, tornadoes, and such, um, as a possible environment throughout flight performed by this device.

- **SR:** Since we're not studying, weather, like, um, some of these other balloons, we're really only doing things like astrophysics or heliophysics, we only launch during optimal conditions. So that'll never be an issue for us.

- **RF:** Okay, and does the attachment/detachment mechanism need to endure any high winds while in its high-altitude position?

- **SR:** No, the balloons floating with the ambient wind, so there'll be little to no relative wind at altitude.

TECHINCAL QUESTIONS – SLIDE 30

- **RF:** Is there a preferred software that is to be used for the deployment of an autopiloting feature of the vault?

- **CY:** Uh, there's no preference, however, whatever software you choose, you have to justify in your design review package. It is a consideration, but there's no, no strict preference.

- **RF:** And how long is the flight time of the test mission? Uh, worried about battery life.

- **CY:** That's a good question. So, in general, the flight won't be that long. It should be about 2 hours to insert into float, an hour for float, and then about an hour for termination and dissent. However, [for] battery life, there is a significant lead up process to that. There's probably going to be about 5 hours where we will go through the process of rolling out, preparing for flight ops, confirming weather is go, things like that. So, the battery life should be at least able to handle those 5 hours ahead of time, +4 hours of flight. And then any other margin you need, you'll either have to carry with you, or have a recharge plan and somebody on-site that will recharge the batteries for you. So, for

example, if we scrub and you need to recharge your battery, that needs to be in your plan for how you would take care of that.

TECHINCAL QUESTIONS – SLIDE 31

- **RF:** And do foldable wings that extend past the deployment dimension constraints, fail that said constraint?

- **AH:** So, we, we tried to, hopefully this answer that we put on here makes sense. We tried to extrapolate from the question what was being asked and what we believe. The answer we believe we've answered the question, which is that if the node that's being provided by the student teams has deployable wings and if they're in a stowed folded position, while they're inside the deployer attached to the gondola, they will not violate the dimension constraints. So, um, once the node has deployed and the wings have deployed, and if they're larger than the overall area, that is not an issue. I'm hoping the people that put in the question are on to make sure that we answer that question to their satisfaction.

- **RF:** Thank you. How far will the vehicle be expected to glide to get to the target zone?

- **CY:** So, that's dependent, they are determined by the student team. I mean, the intent is to have several waypoints that are at various distances from the trajectory, but again falls into that 15-45 kilometer range. I should say that the 45 kilometer is the uppermost extent, and should be considered improbable, but not unrealistic. If that makes sense.

- **RF:** And will there be any equipment for videography or special coordination, supplied to document the test drops? Or is that all reliant on the group selected?

- **CY:** So, we, we will have cameras on the gondola to verify that the student payloads have dropped.
- I'm not sure if, I don't know if we're gonna be able to share that as, during real time during the launch, or during the flight. We might be able to provide, we'll more than likely be able to provide it after the, after the flight to the student teams.

- **AH:** The other thing I'll add to that is, that the video feed we're providing is for our safety to verify a positive drop. So, if the question is really asking about publicity or capturing video, that's high quality for other reasons, you should plan on having something on board or deployer to record that drop for your own attention effort.

TECHINCAL QUESTIONS – SLIDE 32

- **RF:** Okay. Are there any requirements regarding any motor being used?

- **SR:** No.

- **RF:** I'm sorry, go ahead.

- **SR:** No, that it's up to the student teams.

- **RF:** Okay, and can the node be remotely guided from the ground by an operator?

- **SR:** That's another no. The node has to be self-guided, so it's completely autonomous through descent.

MISCELLANEOUS QUESTIONS – SLIDE 33

- **RF:** Okay, now that answered all of our technical questions but we did receive some other miscellaneous questions. So, in Item, 9, in the "prohibited items", what are the specific FAA regulations that you have in mind in this statement?

- **AH:** Yeah, so all of those items are essentially declared as being hazardous by our ground safety, um, office. So, if we're essentially putting a blanket statement out there that we're not doing any sort of ground safety exceptions for these student payloads. So that that's where these prohibited items are coming from. And why, and why they are prohibited.

- **RF:** Okay, and are there any FAA requirements that need to be adhered to?

- **SR:** Uh, so I think we talked about this one a little bit already. The individual teams will not be required to coordinate with the FFA. So, through the design reviews that we have throughout the entire process, we NASA, will ensure that the student systems meet with all of the flight requirements to be safe.

- **RF:** And the same for the next question, with the remote ID.

- **SR:** Yeah, and the only addition there is that transponder that we are providing, the node that we're providing, has the transponder tracker built in, um, it takes care of that requirement.

MISCELLANEOUS QUESTIONS – SLIDE 34

- **RF:** Okay. Item 11 in "Requirements and Constraints": Can you spell out what you mean by "verify operation post compatibility test"?

- **AH:** Yeah, so, um, what we call, uh, we got a lot of words there in the answer, but I'll try to explain it. So, as part of our process in the field, all of our balloon missions go through what's called compatibility. Um, that's an end to end test of the entire flight system, from the balloon all the way down to any sub system on the gondola. So, the student teams that are awarded the chance to fly, they're gonna have to go through this compatibility test. And so, what that means is, that once they've declared that their, that their node and deployer are "flight ready", they're going to be attached to the gondola and they're not going to be accessible. You're not going to be able to take the thing off of the gondola and tinker with it. So, once we've declared flight ready, you got to be ready to go. So, if the, if the student needs, if the student teams need to provide data or need to check things on their instrument, they need to have some sort of access point, either wirelessly or some sort of dongle on the side of the side of their deployer they can get access to. We're not going to allow them to open it up and poke around to the insides of their of their deployment systems.

- **RF:** Okay, and is there an example of premature mission failure from the gondola or balloon?

- **AH:** So, we have had, uh, premature failures of balloons in the past. Um, we have a very, very good success record as far as when it comes to launching and flying, um, large balloons of this size. Uh, typically, if we do have an issue in flight, it's usually from a leak that we that we can't overcome. So, what happens in that situation is that we will not, we will not launch any of the student missions.

- Um, but we will terminate the balloon early in a safe location. Uh, in, in that kind of event, we will probably, depending on what happens, will probably re-invite the student teams to come back the following year to try again.

- **CY:** Just, um, just know that, I mean, we are NASA and failure is not an option.

MISCELLANEOUS QUESTIONS – SLIDE 35

- **RF:** Very true! All right. Is there a certain kind of imaging documentation that you seek in this project for those selected, if applicable? Like a video log, photo album, et cetera?

- **SR:** So, we're definitely requiring a technical report and a scientific or engineering poster that describes the system. And, of course, pictures and videos are greatly encouraged. We love social media as well. Not required, but definitely encouraged.

- **RF:** Okay, and what is the overall budget for the program?

- **SR:** There's no cap, uh, but the winning teams will only receive the $5,000 stipend from us, and the, and the standard hardware that each team will be getting.

MISCELLANEOUS QUESTIONS – SLIDE 36

- **RF:** And can the team gain funding from other sponsored sources for the development of the deliverables?

- **SR:** Yeah, absolutely. Um, go run your car washes and bake sales.

- **RF:** I like brownies. Is there a certain range that the system needs to stay in while it is in the air?

- **AH:** We put no, um, as far as for the flight profile of each of the individual missions, that's truly up to the different student teams. I mean, we want to capture as many types of, uh, technology. We're essentially wanting these ideas to, to tell us what's the best kind of technology moving forward so. We were definitely encouraging that the student teams bring us different systems that we want to compare and contrast.

- **SR:** Accuracy on the target is the most important.

MISCELLANEOUS QUESTIONS – SLIDE 37

- **RF:** Okay, and I think this is our last question. At what height does GPS turn on and become available to use, or will it be available at any altitude?

- **CY:** So, again, the GPS from the tracker node is not going to be available in live stream. However, CSBF does provide GPS coordinates of all the balloons during launch, ascent, float and termination. So, if this is for GSE [Ground Support Equipment] support, then it's, you know, it'd be available from, from before launch. If this is GPS from the node, then it will not be available to you.

PROGRAMMATIC REMARKS (NIA) SLIDE

- **RF:** Okay, and so those were all of our questions. Now we just have a couple of programmatic remarks. Next slide, please. Just a few things to think about as you prepare to delve into the challenge. You know, make sure that you're meeting all of the eligibility requirements listed in the challenge guidelines on page 6. Um, a change was made allowing students attending foreign universities, um, they can participate only as team members or collaborators with a U.S. led collegiate team. The U.S. team's primary advisor and student team lead will be the main point of contact between the joint team and FLOATing DRAGON Staff. All foreign partnering universities must have a faculty advisor whose role it is to facilitate the relationship between the U. S. based university and the international university. However, foreign nationals are still not able to attend the onsite activities at Fort Sumner, New Mexico, due to security restrictions. Next.

PROGRAMMATIC REMARKS CONT'D SLIDE

- **RF:** So, as Andy or Chris mentioned before, the next deadline is October 20, when you're going to submit your Preliminary Design Review package. Um, you'll receive feedback on November 7. And then you're going to submit your Conceptual Design Review package by January 8. Selections will be announced on January 30. Next.

EXISTING RESORCES SLIDE

- **RF:** So please be sure to check out the FLOATing DRAGON website for information on the competition, including, you know, again, the full competition guidelines as well as the links to submit your proposal materials. Our FAQ page, um, is very useful for the teams. You'll find the previous Q&A session, a

recording of the, the previous session held on April 29 there, along with a summary of the questions asked and the presentation slides from that session. Today's recording and subsequent slides will also be posted there, uh, by October 6. Next.

QUESTIONS SLIDE

- **RF:** So, we have a couple minutes left so if there are any additional questions, go ahead and raise your hand, um, in Webex. Hover your mouse next to your name, and just raise your hand and then we'll call on you in order. Um, otherwise you can go ahead and submit a question in the chat and we'll read it out.

- **SD:** And Robin, it looks like there's some questions that are coming in, but one that came in a while back when we were talking about no compressed gas. The team from BYU asks, does no compressed gas mean no pneumatics or hydraulics?

- **AH:** So, um, we are willing to entertain compressed gas or hydraulic systems. There's just going to be additional steps, uh, that that team has to go through. Essentially, we need to get any sort of, uh, pressurize system reviewed by our safety office. So, it is not, it is not impossible to get through. Um, and we are willing to definitely help if, if that's the kind of system that you've developed.

- **SR:** Yeah, just keep it in mind that your system is operating at 7 millibars, not ground pressure. Yeah.

- **RF:** Okay, um, Michael Walach.

- **Michael Walach (MW):** Hi, yeah. One follow-up and then one question. Earlier, they had a group that asked about, uh, propellers and motors. Was the final decision on that that yes those are allowed or no?

- **AH:** Yes, yep we, we are gonna allow propellers and motors. When we say thrusters. . .

- **SR:** Fire. No, fire.

- **AH:** We very much do not want any pyrotechnics because that opens up a whole slew of additional requirements that we really don't have time for on this challenge.

- **SR:** So, electric motors yeah, but no fuel.

- **CY:** No liquid rocket engines, nothing like that.

- **MW:** Gotcha. And then one quick follow up. So we, we flown on HASP before. Is there really a requirement for our system to go through the environmental chamber at, uh, Palestine that HASP requires.

- **AH:** So, we've, we spent a lot of time talking about that kind of requirement for this system. I think what we decided on. Correct me if I'm wrong, was that if we'll make the chamber available, if requested. But we would prefer that the student teams, because we do have a lot of interest, do their own environmental testing if they can.

- **CY:** That that being said, I mean, it is advantageous for students to do some kind of thermal vacuum and thermal vacuum testing if possible. Now, I know that not every university has access to those resources.

- So, but I will say there have been quite a few hardware failures of computers, PCB cards, motors, things like that, that either freeze or jam or lock or if you have super high voltage, you can either get parking as well at low pressure. So, there are hazards, it's not a requirement, but we highly encourage thermal vacuum and thermal vacuum testing if possible.

- **AH:** And we, like I said, we will work to provide those facilities for everybody, but we're not gonna do what HASP does, which is drag everybody to the thermal vac back in Palestine at the same time. Does that make sense?

- **MW:** Yes, it does. Thank you so much.

- **SD:** We have a couple questions from the chat. Christopher Long wants to know, is it allowed to use an off the shelf computer to use and modify for flight control? Or are we expected to create a hardware and software package independently?

- **CY:** So, I highly encourage cuts off the shelf type items. Um, they are flown a lot more than you think. Um, so I encourage you and bring your Arduinos and your Raspberry Pi's and your whatever else you got. The only thing is, I'll say is, make sure that they can survive the thermal and make sure that they can they can survive the ascent.

- **SD:** Sounds fair.

- **AH:** And bring spares.

- **CY:** Yeah. Brings spares.

- **SD:** Good tip. Patrick Schwartz has a question, related to the gondola structured design requirements um, specifically requirement #13. He says, I don't see anything specifically pertaining to piggybacks. Is our system supposed to adhere to all requirements listed in that document? And if so, are all of the analysis outlined in this document, supposed to be included in the PDR.

- **AH:** Short answer. Yes. Um, once the teams have gone through PDR and have been selected and matched up with a mission manager and a technology manager from Balloon Program Office, uh, those specific requirements will be discussed at length. There is a subset of the analysis, that's not necessarily for piggyback, but for the design and implementation of these systems, the gondola structural design requirement is enforce.

- **SD:** Okay, you have another question and I apologize if I say your name wrong, Taher Telfah, I'm hoping maybe that's close. Actually, has two questions. Is there a way to view, in detail, the HASP gondolas power interface capabilities or schematics? And follow up question, can power be drawn from the gondola during ascent, or must it be drawn internal to the system throughout the flight?

- **SR:** So, we can get something in writing regarding the power interface capabilities, but it essentially pigtails off the 28 Volt battery. Um, but we can, we can get some, some details and put that up. Um, but they can get power from that battery up until the moment of deployment. It's going to be up to the team to decide what works best.

- **SD:** Good thanks. We'll definitely post the updated answer onto the FAQs whenever we put all of these out there in writing for you later in the week. Um, BYU has another question. Is it possible to place beacons at the landing sites?

- **AH:** What do they mean?

- **SR:** Yeah, no, it's gonna be, so since we won't know the exact landing sites until the day before and it. . . Sorry, short answer, no.

- **SD:** No, suffices. Um, Eric Johnson would like to know, uh, clarification on the battery question. Will spot welding and adding wires or balancing cables to form a battery from individual UL rated battery cells, disqualify the UL rating?

- **AH:** So that's essentially, we cannot allow anyone that's bringing loose battery packs and modifying them onto our facility. That's going to violate our ground safety rules. So long story short, all batteries need to be commercial off the shelf.

- **SD:** All right, and one final question that I can see in the chat from Yohan. Is the dissent time a hard limit? Would a system that lands successfully at landing point, but in 1 hour and 50 minutes, instead of 1 hour and 30 minutes get disqualified?

- **CY:** So, we put in the 1 hour, 30 minutes as just, we have to tell the FAA and surrounding ATC's how long we're going to be in the air. We would, we need it to be under that hour and 30 minutes. However, if there is a really unique system that, for some reason, you just really can't get down under that that 90 minutes, reach out. Let's chat. I don't see any system that would take more than 90 minutes, but like I said, maybe we haven't considered it. And so if you've got something, um, reach out and let's talk.

- **SD:** And we just received a question about where, uh, any suggestions on where we might find UL rated batteries? And Andy has responded in the chat that battery retailers will state whether or not a battery is UL certified or not.

- **SR:** I know one, that's been used in the past pretty successfully is Saft. You can also search for things like space flight related batteries. Um, even places like DigiKey and Sparkfun and Adafruit, you know, they carry batteries with, um, with those certificates.

- **CY:** Just be mindful. There are certain battery chemistries which are prone to structural failure at low vacuum or vacuum pressures. So just be mindful that when you do spec out a battery, excuse me, you'd be mindful of what can fly and what cannot.

- **AH:** We could also provide, if the teams are interested, we have a list of batteries that's been flown before. We can make that available to the student teams as well.

- **SD:** That would be great.

- **AH:** So, we'll, we'll add that to that list of deliverables for early October.

- **SD:** I think that's all the questions we have right now in the chat. Are there any other hands that are up?

- **RF:** No, there's not.

- **SD:** Well, we'll let Robin continue on with a couple of additional things that she has a share. If you think of any questions in the meantime, feel free to drop those right in the chat.

FUTURE QUESTIONS?

- **RF:** All right, next. So again, a transcript of today's call will be available on the FAQs page of the website, uh, by close of business October 5. This will include all of the questions in the chat as well. As we move forward, if you have any further questions, please send them to me directly at robin.ford@nianet.org and any questions received will be added to the FAQ page for the benefit of all. Reminder, the Preliminary Design Review is due on October 20. And if there are no other questions, which it does not appear, that is it for today. Thank you for attending today's Q&A session.

- **SD:** I just want to say. On behalf of the NIA program team, just the questions that came in were really well thought out. It's very obvious that you're thinking through this strategically. And if there's a lot of good ideas, I can already hear, just in the questions, some of the wheels that are turning in your brain. So we are very, very, very excited to see the PDR submissions that you all have. And so I want to thank you for your time and effort from the teams, and the advisors participating also, from our Balloon Program Office; Sarah, Chris, Andy. You guys have been phenomenal to work with

and invested a lot of time and effort into making this challenge a really wonderful experience all the way around. So, thank you guys for all the wonderful answers and the ones that are yet to come. And we wish you off a lot of luck. Good luck to you.

- **SR:** Yeah, we echo that. We are really looking forward to this. Um, we love working with students, um, and we definitely love the fresh ideas, and challenging us when it comes to our requirements. Bring it on!
- **SD:** Love it.
- **RF:** Alright, thank you so much. We are dismissed.