Eclipse Activity Report (EAR)

Nationwide Eclipse Ballooning Project

Issue #18
8/1/2017

http://eclipse.montana.edu

EAR Issue 18 Summary

This and all previous issues of EAR can be found at: http://eclipse.montana.edu/news/

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Communication

Next Telecom 8/3/2017 at 11AM Mountain Time. Have as many members of your team present as possible as final thoughts and action items will be discussed. We will cover information for most of the hour.

- Call toll free 855-797-9485
- Pass code 921-692-445# then # again

Action Items

- **Action Items List Coming by 8/3**
- **Send Shane Team Photo**
- **Send Shane Team Website/Blog/Facebook Page**
- **Send Stream Team Video**
- **Telecom 8/3/2017, 11 AM Mountain Daylight Time**

Image compliments of the Pitt – Shadow Bandits (040j) during a recent test flight. What we are doing has never been done before. Be proud of your accomplishments and remember every image, video, stream and everything in-between on eclipse day is an amazing achievement in itself.

General Updates

T-Minus

2 Weeks 5 Days 20 Hours 16 Minutes (we are under three weeks folks!)

Last All Teams Telecom

Please make sure as many of your team members are present on the last all teams telecom Thursday August 3rd at 11 AM Mountain time.

Last Major Updates

Instructional videos and/or written instructions to accomplish all of the following tasks will be available by August 3rd.

Iridium

1. Iridium reporting setting: set to continuous – will get packets every 10 to 14 seconds - this can be done via an email SBD packet
2. Confirm correct commands to Iridium via email SBD packets for cutdown start and stop

Video

3. Video payload Pi code update: updated video settings for more reliable stream, automatic recording, and more
4. Ubiquiti modems (ground and air): firmware update and updated modem settings for more reliable stream
5. Video payload ground station code: new script for ffmpeg commands

Ground Station

6. Ground Station Hardware IMU Bracket: mounting the IMU off the bracket improves the pointing of the ground station
7. Ground station tracking code: improving ground station pointing
8. Re-zeroing servos: Once the tracking code has been updated, re-zero servos. Only needs to be done once if performed correctly.

Still Image

9. Still Image payload new image update

Avoiding Avoidable Mistakes: System Power Up Checklist

A "Eclipse Payload Power Up Checklist" template was shared last fall. This is a great starting point for you to make your own additions, notes, etc. to help make your setup go smoothly on eclipse day. Please note that some of these steps may have been tweaked since its creation and it does not include steps on setting up the live stream (instructions are available via PDF but it is your responsibility to implement them into your checklist). Download the checklist if you have not already done so here: http://eclipse.montana.edu/resources/

Your Eclipse Day Launch Time and Location Matter

MSGC's Flight Director has been communicating our efforts to the FAA and things are ramping up quickly. We will be reporting your launch window as the time indicated in the 'Launch Site and POC' spreadsheet +/- 5 minutes. Please verify any changes that need to be made to either your launch time or location and send an updated spreadsheet to Shane ASAP with all changes highlighted. It is important that these times and location reflect your actions on eclipse day!

Mission Notice:

We will be filing mission notices on behalf of each team on Friday, August 18 for the FCC weekly briefings and filing NOTAMS on the 19th. Each team will receive a "pre-copy" of their mission notice to look over and verify their launch location and time with Shane.

Reminders: Preparing for Eclipse Day

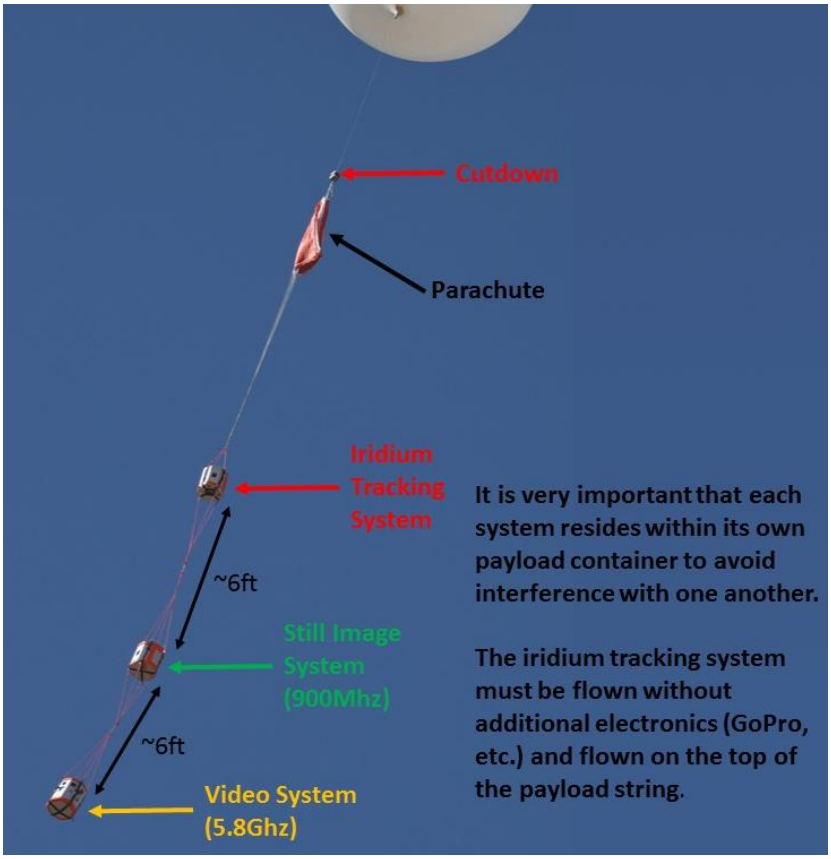
General Reminders:

- Complete all technical updates (large set available on August 3)
- Make sure you have your "Eclipse Payload Power Up Checklist" and that you have all your own individual additions included – a template is available here: http://eclipse.montana.edu/resources/
- Make sure your video and still image payloads are set to record footage on board – these images will be fantastic to share ASAP after payload recovery (instructions on uploading coming August 3)
- Make sure to perform all laptop updates before you leave for your eclipse site (make sure they are fully completed)
- Hardline internet is strongly recommended with at least ~3Mbps upload speed
- Video streaming range is about 20 miles – precise tracking is important at longer ranges
- Practice manual pointing as a backup (the signal strength can be seen on the back of the ground station Ubiquiti modem; make sure your servos are not powered when manually pointing)
- Be prepared for cellular network outages (texts will be more reliable for those without WPS)
- Have an eclipse day logistics plan; arrive at your site(s) early!
- When transporting helium tanks, make sure you follow the rules and make sure you have shipping papers should you be required: http://eclipse.montana.edu/participant-ballooning-resources/
- Double check you have all the resources on the FAQ/System Resources/HAB Resources pages that you may need
- Recommended to have multiple laptops running the ground station functions (one for tracking/RFD, one for video streaming)
- Perform your own long-range tests
- Update/Create your Checklist for payload power up, ground station setup, etc.
- Don't take things apart that don't need to be
- Be gentle with your equipment! You don't want things breaking at the key time

- Don't share your IMEI numbers on the ProBoards forum or any public place – people can hijack your feed
- Prepare in advance your ballast weight and predicted fill amount (see below)
- The MSGC leadership team will not be able to provide support after August 18th – please plan accordingly

Eclipse Day Reminders:

- Follow your "Eclipse Payload Power Up Checklist" steps carefully!
- Put in your IMEI number every time when using antenna tracker
- Make sure your batteries are fully charged
- Make sure to reset the timers on both OCCAMS boards – one in the cutdown and one in the tracking (Iridium) payload
- Turn on payloads 45-60 minutes before launch (no more than 60 minutes)
- Have a connection with your payloads before you launch
- Connect to the video payload Pi and begin recording video (this may be automated in final update)
- Pay attention to packaging (make sure all straps, packaging, lines, etc. are secure)
- Place biological coupon (if your team is participating) on the top of the video payload
- Make sure your payloads are flown in individual payload containers and are flown in the following configuration (from top to bottom): Cutdown - Parachute, Tracking (Iridium) Payload, Still Image Payload, Video Payload. If you are flying a GoPro, do not fly it near the Iridium Payload



- Make sure your memory cards are: 1) flashed with the most updated code, 2) “clean” of any old videos/images/files, and 3) are inserted into the Pis
- Cell service and communications: Remember that cellular wireless data services will be spotty at best. Do not rely on cellular data services for communication or streaming. For those who do not have WPS on their phones for the eclipse, please use texting as their main form of communication.
- The MSU server will have a scheduled outage on August 22nd (the day after the eclipse). If you are not able to recover your payloads on the day of the eclipse take a screenshot of your landing location with enough ‘zoomed-in’ detail that you can recover your payloads without the tracking website available. The website will come back online after the outage with all data archived available.
- You may not have access to data during recovery of your payloads making Google Maps on your phone potentially useless. It is strongly recommended that you download the google maps for your anticipated recovery area beforehand so you may enter the GPS coordinates of your landing site for retrieval and have an interactive map to aid in recovery.

Determining Balloon Fill: Ballast Weight and Helium Amount “Calculator”

The ballast works well for determining balloon fill unless it is windy. Attached in the EAR 18 email is a spreadsheet which will help you determine the approximate change in pressure of your helium tanks that is needed to fill your balloon.

Ballast

BOREALIS uses a container with water bottles. While BOREALIS does calculate the ballast weight by multiplying the total suspended weight by 1.2, one must also consider the weight of the fill valve. The actual calculation is the same as what James Flaten presented where we multiply the total suspended weight by 1.28, which is the amount of weight we want to lift. However, because the fill valve is already being lifted we need to subtract the weight of the fill valve from the ballast weight. Below is a sample calculation assuming 12 pounds suspended (payloads + parachute and riggings)

- Total lift = 1.28*12 = 15.36 pounds
- Fill valve weight ~ 1 pound
- Ballast Weight = 15.36 - 1.00 = 14.36 pounds
- In our case 1.2*12 = 14.4 pounds.

Change this color			
Do not change this color			
Output numbers (do not change)			Indicates Result of Input
	Typical Units	SI Units for Calculations	
Helium Purity	97	1.18641791	<-- density factor
Volume of Helium Tank (L)	43.42	0.04342	<-- tank in cubic meters
Balloon Type (1 for Latex, 0 for Zero Pressure)	1	0.105371392	<-- coefficient of drag
Mass of Balloon (g)	2000	2	<-- balloon mass in kg
Mass of Payload (lbs)	11.75	5.329706	<-- payload Mass in kg
Desired Free Lift (lbs)	3.25	8.80388	<-- lift
Ambient Pressure (mbar)	850	85000	<-- pressure in pascals
Elevation (ft)	4495	0.176048734	<-- helium density
Dewpoint (°C)	6	1.002498243	<-- air density
Ambient Temperature (°C)	21	294.15	<-- temperature in kelvin
Change In pressure Needed (psi)	3327.059733	20853881.19	
Ascent Velocity (ft/min)	1346.353176	6.839474134	
Neck Lift/Ballast Weight (lbs)	14.99996993	6.80388	
Balloon Volume (ft^3)	376.1952517	10.65265319	
Balloon Diameter (ft)	8.956495388	2.729939707	
Percent Error in Δp	1.000082798	1.000082798	
Relative Error in Δp	30.24850187	208556.0785	

Uploading Eclipse Day Video and Images

Instructions for uploading your eclipse day flight video and images will be shared August 3rd. Upon completion of everyone's flights, we would like to begin stockpiling images and video ASAP, the purpose being to share images/video that:

1) will be available for the public to view post-eclipse (since the live views will be gone)
2) to starting editing together a highlights reel
3) to share with the Eclipse MegaMovie project for their science.

Team Intro Videos and Team Websites

This project is a collaboration of 55 teams of universities, colleges, community colleges, high schools and independent groups. Nothing like this has ever been done before! We want to share this project with the world and that means you, the teams. Please prepare a website, Facebook page or blog and send to Shane so we may share it both on the EBP website and on the streaming page.

Also, please consider making a team intro video and sending it to Keith at Stream. Instructions can be found in the pdf attachment included in the EAR 17 email.

Technical Activity

ProBoards

http://eclipsedesign.proboards.com/

GitHub

https://github.com/MSU-BOREALIS

New FAQs

See answers at http://eclipse.montana.edu/faq/

Communication

- Points of Contact for eclipse path state hosts can be found from the FAQ page.
- The final group **telecom** will be Thursday August 3
- at 11 AM Mountain daylight time.
  - Call toll free 855-797-9485
  - Pass code 921-692-445# then # again
- There will be an eclipse ballooning session at the Space Grant Fall meeting in September. We invite you to share your results if you'll be at the meeting.
- Facebook page: https://www.facebook.com/EclipseHighAltitudeBallooning/
- Twitter: https://twitter.com/Eclipse_HAB

Action items

- Action Item List Coming by 8/3
- Send Shane Team Photo
- Send Shane Team Website/Blog/Facebook Page
- Send Stream Team Video
- Telecom 8/3/2017, 11 AM Mountain Daylight Time