# Eclipse Ballooning Project Preparation Milestone Guide

This milestone guide is broken into three parts:

Part 1: Overview and Explanations – Overview and explanations of the important tasks and milestones each team should complete to ensure a successful dry run in June. The overview suggests a chronological order for which teams may want to proceed which is reflected within the milestones.

Part 2: Milestones Timeline – A list of the milestones leading through the June dry run with completion dates and reports.

Part 3: Checklist – A broken up example of the Excel checklist spreadsheet. This will allow you to track the progress of your team and allow the leadership team to oversee the overall project readiness of all teams within the project.

An important aspect of tracking this progress will come in the form of reporting to Shane. This will come in two forms:

1) Updating your spreadsheet and sending the information to Shane for compilation.
2) Sending in a brief report to Shane (issues, successes, troubleshooting, etc.)

Reporting: What's the point? – Much of the reporting will come in the form of documenting issues you come across and how you overcame the issue. The goal is to compile as many troubleshooting encounters and their solutions into one resource that can be shared with all the teams come the June dry run and the eclipse. Another important aspect of reporting is to see where teams are at and what their confidence levels are.

This guide will be periodically updated as dates change, etc. Check here for revisions: http://eclipse.montana.edu/news/

# Part 1 – Overview and Explanations

### Determine your part in the Eclipse Ballooning Project

- You MUST fly the Iridium tracking payload and cutdown
- Will your team be streaming to the public website?
- Will your team be flying a secondary experiment payload of your own design?

### Ground Station Location Planning

- Need guidance? Check out the *Preparing Your Ground Station Location and Launch Location and Time* guide on the FAQ or Ballooning Resources page
- Primary Launch Location – Where is your team going to launch from assuming everything goes as planned?
    - Who is your site lead team?
    - Is there a clear, unobstructed, view of the sky?
    - Access to Power?
        - Generator?
    - Internet connection (hard line, WIFI, other)?

        - Upload Speed Check (Need 2mbps or better)
    - Cell Service (Hotspot – consider network outage from overwhelming network)?
    - Housing/lodging/camping?
        - Number of people that can be accommodate
    - Parking?
        - Number of cars that can be accommodated
    - Restrooms?
- Backup Launch Location – If your primary launch location must be scrubbed, where is a suitable backup (or backups)?
    - Who is your site lead team?
    - Is there a clear, unobstructed, view of the sky?
    - Access to Power?
        - Generator?
    - Internet Connection?
    - Cell Service?
    - Housing/lodging/camping?
    - Parking?
    - Restrooms?
- Use your primary and backup ground station locations to determine your balloon launch location

## Balloon Launch Location

- **Base your launch location on your ground station location**
- Is your launch location the same as your ground station location?
    - Consider the streaming range of ~25 miles – Should you launch "down-range" of your ground station?
- Use balloon flight prediction software (http://eclipse.montana.edu/participant-ballooning-resources/) to find launch location based upon ground station location.
- **Make sure flight path does not go directly over your ground station location**

## Safety

- Familiarize your team with FAR 101-part A
- Read, understand and adhere to the safety guidelines as part of the Eclipse Ballooning Project (provided by NASA Safety) to be developed and distributed.
- Team safety checklist
    - First aid kit, sunscreen, water, food, team general safety guidelines, project safety guidelines
    - Consider the safety of spectators as it pertains to your ballooning actions

## Flight Predictions and FAA

- Create flight predictions using software provided on website for the day of the eclipse using data from previous years
- Practice FAA pre-flight NOTAM

- Should the FAA need to get a hold of your team, who is your POC?
- Know the decent profile for the parachute you will fly (decent rates differ by size of parachute and payload weight for example)
- Consider poor PR landing sites (National Parks for example) to avoid

### Determine Setup and Launch Time

- What elevation to you want to be at during your totality?
- Predicting rise rates: What rise rate do you want and what is the corresponding helium balloon fill?
    - 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 this case 1.2*12 = 14.4 pounds.
- What time do you need to launch at to have the balloon at desired elevation/location at totality? (BOREALIS 60 minutes before totality)
- Understand rise rate transitions (atmospheric transitions) and balloon break points (burst)
- Ground station, payload and balloon fill setup time – practice setting up ground station and fill station
- Build in troubleshooting time

### Prepping/running individual systems

- Learn how to prepare and run each system individually
- Note all issues that arise with their solutions
- Setup your Stre.am accounts: https://stre.am/
    - Stream to the eclipse Stre.am page: https://stre.am/eclipse
    - Format your account like: state_teamname_registration#

### Prepping and Running All Systems

- Learn how to prepare and run all systems together
- Note all issues that arise with their solutions

**System Experts** – While it is important for teams to have a grasp on all systems, it may be worthwhile having individual experts for each system. Determine the student who will be the resident expert on a particular system (ground station, Iridium, video or still image).

- Two experts per system (recommended)
- Determine what the expectations are as a “system expert”

**Pre Flight Checklist and Troubleshooting Guide** – Take the pre-flight checklist and update it for your team

- Create flight and payload checklist
- Troubleshooting Guide – Continually update

**Flight String Order** – Order of your payloads on the flight string

- How are you going to rig your payloads to the flight string?
- It is recommended that you fly tracking (Iridium), RFD (image) and Ubiquiti in separate payloads. If you do combine payloads, make sure you test them thoroughly and that they do not interfere with the function of the other system within the payload. BOREALIS flight string from top (balloon side) to bottom payload sequence goes as follows: Iridium, RFD, Ubiquiti
    - Test payload string for interference with Iridium, RFD Ubiquiti
    - Test your additional payloads for interference with the rest of the flight string (Ubiquiti, Iridium and RFD)

**Launch Simulation** – Practicing a launch (without launching a balloon) by setting up the ground station and balloon fill station

- Do a practice launch 1 time per month (at least 5 before June, 2017)
    - Begin setup at the time you will on eclipse day
        - Set up ground station completely
        - Set up balloon fill station exactly as you would during flight (helium tank, balloon filling equipment)
    - Prepare payloads and payload string
    - Check that the ground station can link to payloads
    - Practice attaching payloads to flight string
- What issues arise during your simulation? What possible issues do you foresee?
    - Create troubleshooting steps for known and predicted issues
- Perform at least one Tethered Launch
    - Perform a launch simulation as described above and launch a tethered balloon to test ground station and payload connections
    - Note issues that arise or issues that are possible – what are the troubleshooting steps?

## Test Iridium/Cutdown

- Are you missing packets or are you getting (mostly) constant reporting?
    - "Continuous reporting mode for tracking" seems to work better
- Practice sending cutdown command.

**Run test** – Make sure you are charging your batteries correctly (such that they run your systems for ~5hrs) for individual systems

## Practice Flight

- This flight is to practice the procedures and actions of performing a full balloon flight. While you don't have to fly your eclipse ballooning payloads (although it is recommended to continue practicing with the equipment), make sure your flight performs practice flight goals below:
    - Totality Elevation Goal: What elevation do you want to be at during totality?
    - Totality Timing – How much ahead of the eclipse totality time do you want to launch (example: 75 minutes)?
    - How much helium did you use?

  - What was your rise rate?
  - What elevation where you at after your totality timing? (did you reach your elevation goal)?
  - Increase or decrease balloon fill to fine tune meeting your totality elevation goal
- Note issues that arise or issues that are possible – what are the troubleshooting steps?

### Other Considerations

The systems received during the workshop have been flight tested and shown to work for the duration of a flight in the configuration presented during the workshop. Secondary payloads or workshop payload/payload box modifications should have the following tests considered before flight:

- **Drop/Vibration/swing test** – Make sure payload will withstand the flight
- **Cold test** – Make sure your payload stays warm enough for constant operation during flight

## Part 2 – Milestone Timeline

### Milestone 1 – Individual System Practice by 11/4/2016

- Report back to Shane by emailing provided Excel spreadsheet of your teams' confidence with the operation of individual systems (example: Video – Strong Confidence, Still – Moderate Confidence, Ground station – Weak Confidence). **Continue to update your confidence levels as you update your excel spreadsheet as your confidence in the systems change**
- Set up Stre.am account for your team with the format **state_teamname_registration# (example MT_EclipseRockers_035mj):** https://stre.am/. Report to Shane what the account name is so it can be added to the stre.am/eclipse admin access by entering it on your Excel spreadsheet and email it to Shane
- Live stream content on the Stre.am eclipse page: https://stre.am/eclipse

### Milestone 2 – Determine and Report Ground Station Location and Launch Location and Time by 11/4/2016

- Send Shane ground station and launch location and time by entering the information on your Excel spreadsheet and email it to Shane

### Milestone 3 – Testing the Iridium Tracking System 11/11/2016 – SCRUBBED

- On 11/11/2016 at Noon MDT we would like to test the new server and tracking site by having ALL teams turn on their Iridium Modems for 1 hour. You can adjust packet send rate to 1 minute 30 seconds to lower data usage. Update spreadsheet letting us know how well test worked (work well, some issues, many issues i.e. not reporting at desired rate)

### Milestone 4 – Flight Prediction by 11/11/2016

- Create a flight prediction from the last three years' data at your launch location for August 21st – Send your map and updated spreadsheet to Shane

### Milestone 5 – Full System Practice by 11/18/2016

- Report to Shane with confidence in operation of systems together by updating and sending Excel spreadsheet

**Milestone 6 – Completed First Launch Simulation by 12/1/2016**

- Send Shane a short report of how your first simulation went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 7 – Determine System Experts by 1/13/2017**

- Determine your system experts and have them practice preparing/running their systems during the following launch simulations (Report to Shane by sending updated Excel spreadsheet)

**Milestone 8 – Completed Second Launch Simulation by 1/20/2017**

- Send Shane a short report of how your second simulation went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 9 – Completed Third Launch Simulation by 2/3/2017**

- Send Shane a short report of how your third simulation went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 11 – Completed Fourth Launch Simulation Completed by 3/17/2017**

- Send Shane a short report of how your fourth simulation went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 12 – Completed a Tethered Launch by 4/21/2017**

- Send Shane a short report of how your tethered launch went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 13 – Completed Fifth Launch Simulation Completed by 5/29/2017**

- Send Shane a short report of how your fifth simulation went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone XX – Testing the Iridium Tracking System TBD**

- Upon completion of the server transition, we would like to test the new server and tracking site by having ALL teams turn on their Iridium Modems for 1 hour. You can adjust packet send rate to 1 minute 30 seconds to lower data usage. We will contact teams to arrange the test date and time in an upcoming telcom or EAR.

**Milestone 14 – Full Balloon Flight Practice Completed by June 1st, 2017**

- Completed at least one full flight before June 1st, 2017 – This flight is to practice the procedures and actions of a full balloon flight. While you don't have to fly your eclipse ballooning payloads

(although it is recommended to continue practicing with the equipment), make sure your flight performs practice flight goals from the above descriptions.

- Send Shane a short report of how your flight went (issues, successes, troubleshooting steps) – MAKE SURE TO INCLUDE YOUR TEAM REGISTRATION NUMBER WITHIN REPORT

**Milestone 15 – Dry Run June 20th, 2017**

**Milestone 16 – Lessons Learned June 30th, 2017**

- What did your team learn during the flight?
- What does your team need to work on? What feedback does the project, as a whole, need to work on? Report back to Shane.

# Part 3 – Checklist

As you complete milestones, please update your EXCEL checklist and email the updated EXCEL file to Shane at shane.mayergawlik@montana.edu. To make the compilation of all this information as simple as possible, please email the original EXCEL spreadsheet with your updates.