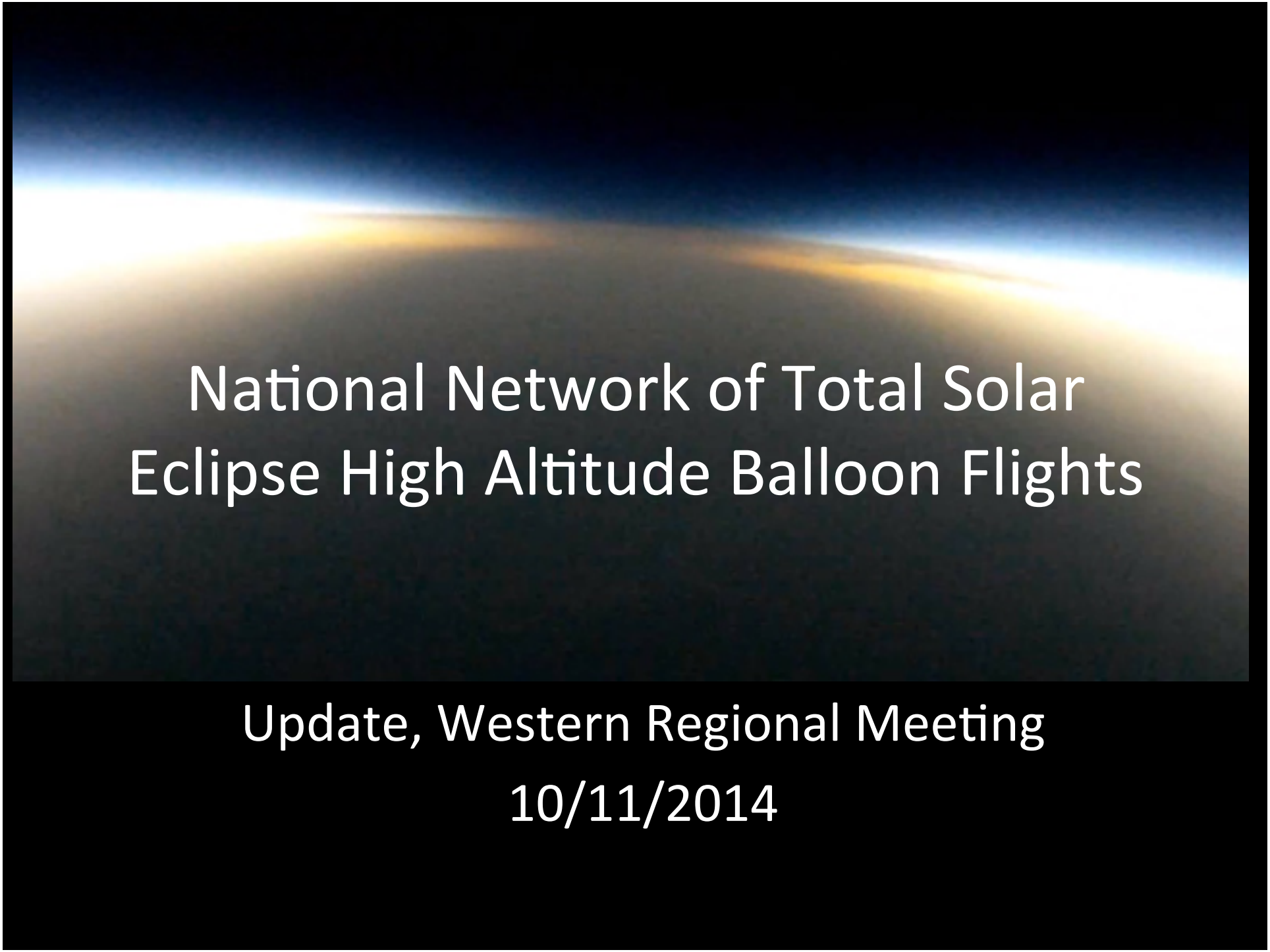


National Network of Total Solar Eclipse High Altitude Balloon Flights

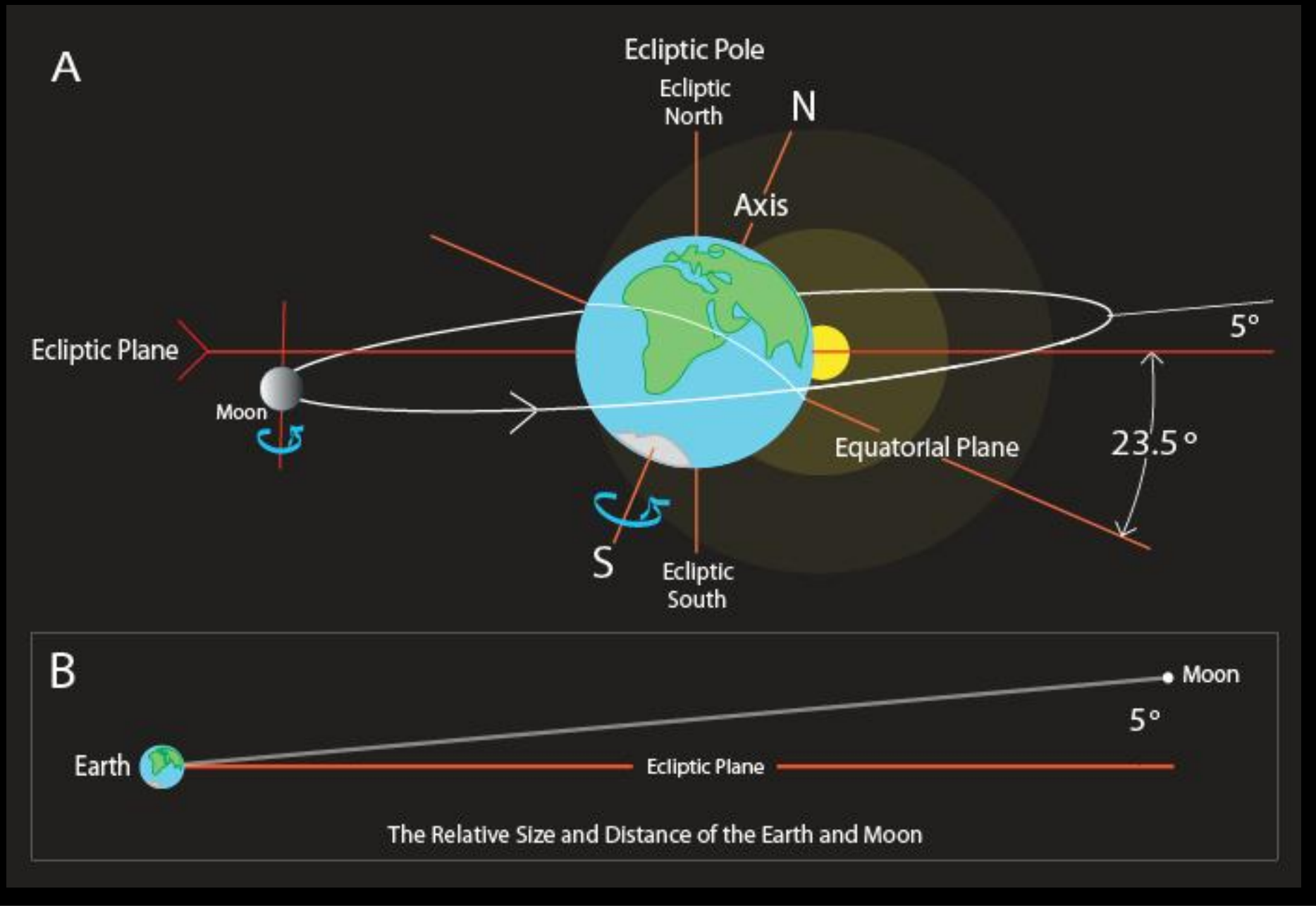
Update, Western Regional Meeting

10/11/2014

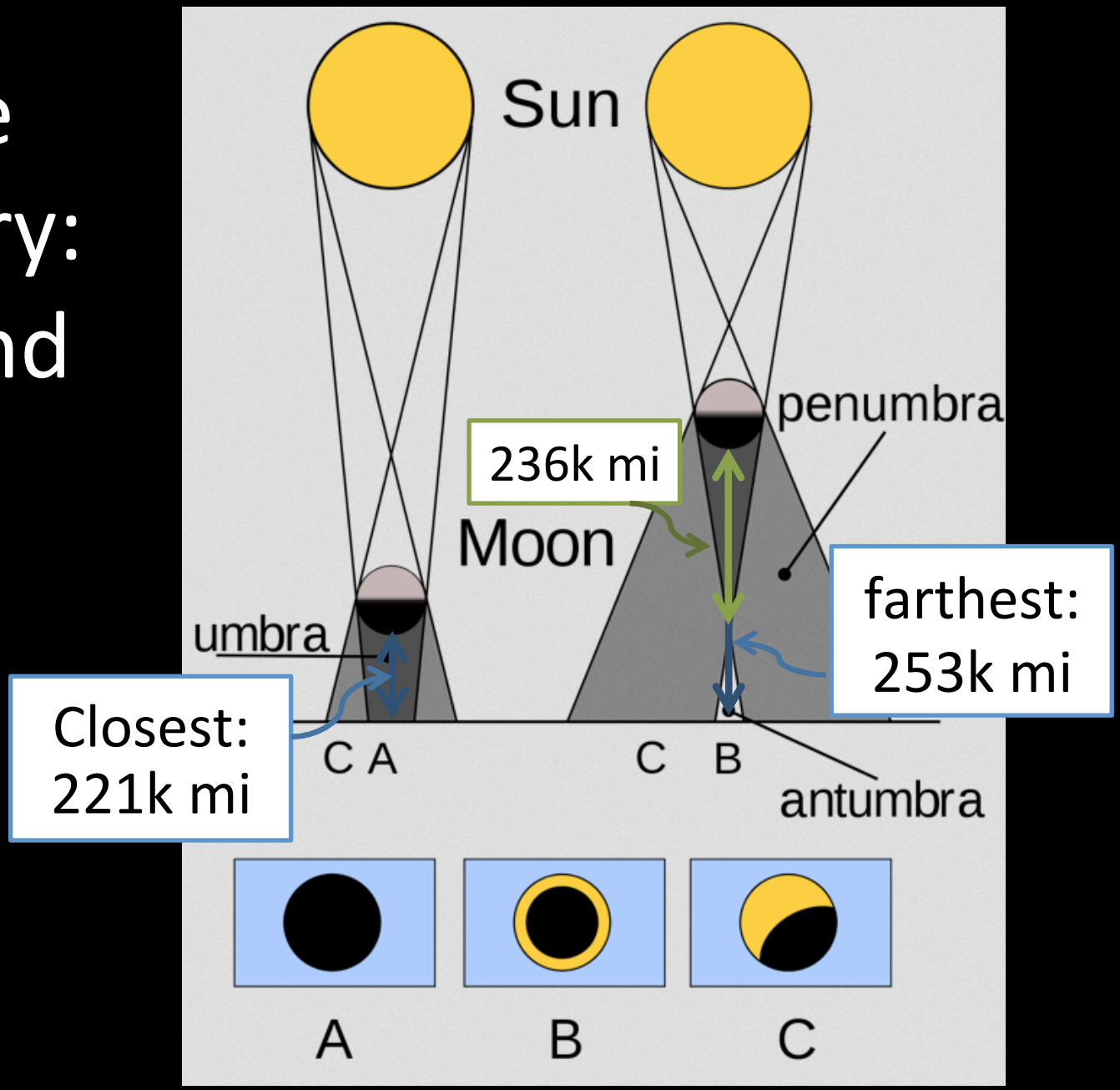
Eclipse Science History

- Chinese 2800 BC
- Kepler 1605
- Helium 1868
- Einstein's theory of general relativity 1919

Eclipse geometry: rarity and types



Eclipse geometry: rarity and types



Duration and timing (local)

WHY… using NASA's unique capabilities

- Public engagement
  - Incredible learning moment opportunity
  - Millions can view live from anywhere in world
- Workforce development
  - Highly collaborative, mission-like
  - Multidisciplinary
- Science and Technology
  - Atmospheric and solar science
  - Space communications
- Collaborations and partnerships
  - Inter-agency
  - industry

TIMELINE

- 2014 – 2015: fundraise, organize, develop common camera payload, advertise and select teams
- December 2015: distribute primary common camera payload kits and assembly instructions
- Summer 2016: virtual/regional workshops to verify each primary payload functionality; testing
- AY 2016 – 2017: build and test secondary payloads
- Summer 2017: June: dry run, at least one flight for each launch location. August: Eclipse totality starts in Oregon at ~1:20 PM Eastern on August 21st, 2017 and ends at ~2:50 PM Eastern in South Carolina.
- Fall 2017: Students present at national meeting

COSTS – very rough estimates

- Primary payload with camera, satellite modem/ communication device: $1,500 - $2,500
- Secondary payload: $50 - $1,000
- Balloons, helium/hydrogen, basic flight supplies (some times two including dry run): $1,500 - $3,000
- 2016 regional/virtual workshop: $0 – $3,000
- Travel to launch and recovery sites (some x2): $2,000 – $10,000
- Data download fees: $20 – $5,000

Total estimate for supplies, travel, and fees: $6,000 - $25,000 over two years. WORKING ON SUPPORT!

Planning teams

- Primary payload and kit design (in place)
- Launch sites (in place)
- Participating teams (forming)
- Atmospheric Science (forming)
- Solar Science (seeking membership)
- External Engagement (forming)
- Art (seeking membership)
- Media (seeking membership)

Preliminary Primary Payload Design team	
Randy Larimer (lead)	Montana
Berk Knighton	Montana
Chris Koehler	Colorado
James Flaten	Minnesota
Greg Guzik	Louisiana
Chris Goyne	Virginia
Alex Peters	Iowa state senior engineering student
Charlie Lambert	Colorado Springs, skysentry
Parker Swanson	Oregoon

Launch sites team	*= fringe or neighbor
Berk Knighton (lead)	Montana*
Claude Kansaku	Oregon
Robert Winglee	Washington*
Susie Johnson	Idaho
Paul Johnson	Wyoming
Michael Sibbernsen	Nebraska
no SG balloon program?	Kansas
Dave Riggins/Warfield	
Teague	Missouri
Tillman Kennon	Arkansas*
	Illinois*
Glen Kissel	Indiana*
Jacob Owen	Kentucky
no SG balloon program?	Tennesse
Cass Runyon	South Carolina
Don Day	ATA Aerospace/Day Weather

Coordination Team	
Catherine Lanier (temp lead)	Oregon
Shirley Campbell	Oregon/NSGF
Melissa Wragge	Nebraska
Chris Harmon	Montana
Caitlin Nolby	North Dakota
Rick Fink	TEDx

Atmospheric science team	
Jennifer Fowler (lead)	Montana
Erik Agrimson	St. Catharine in
Don Takehara	Indiana
June Wang	NCAR/New York

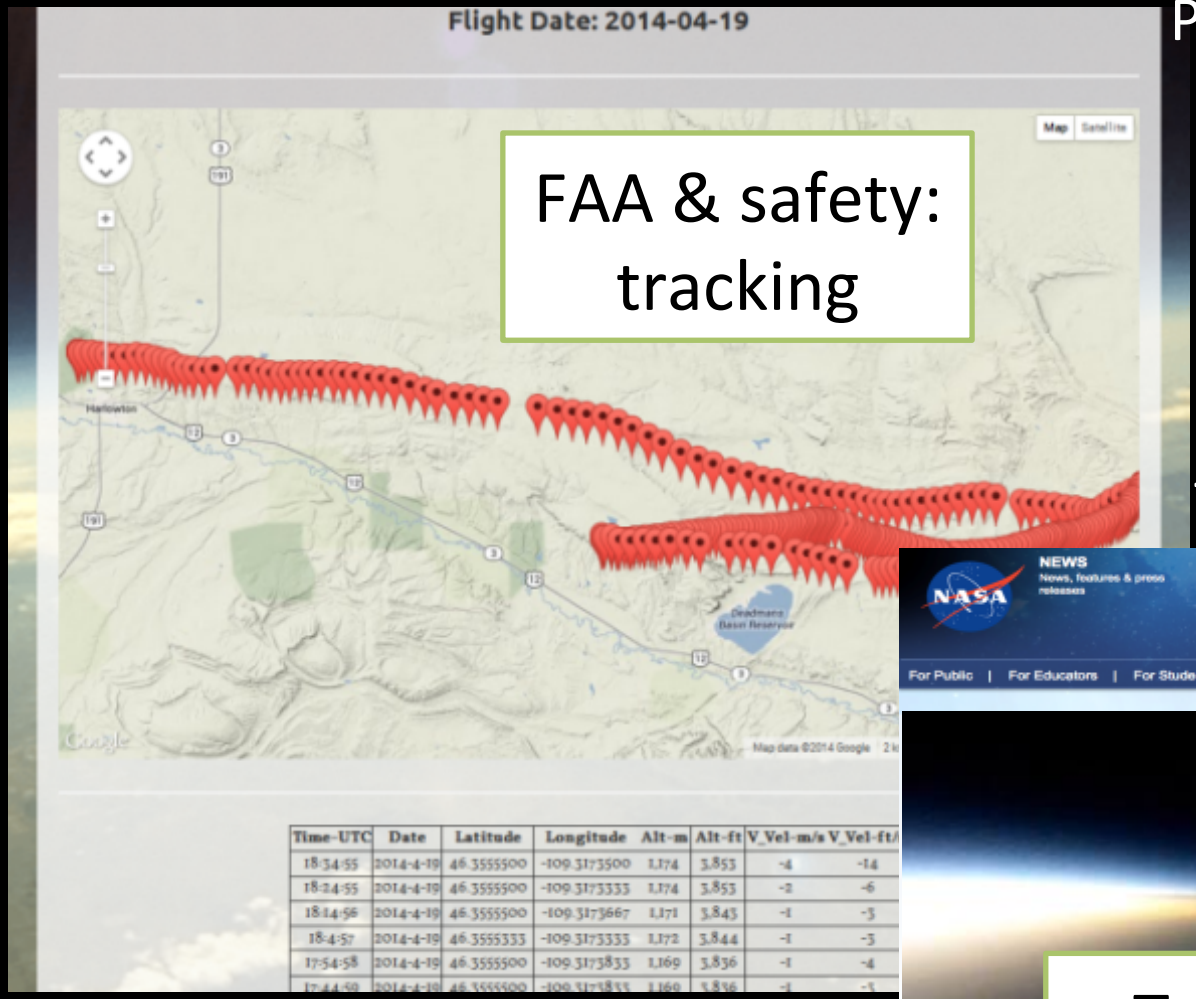
Solar science team	
Paul Hardersen	North Dakota

Art team	
Kathy Borgen	North Dakota

External Engagement team	
Ulli Kamp (lead)	U of Montana
Suzi Taylor	Montana
Bernhard Beck-Winchatz	Illinois
Trae Winter	Harvard CfA
Gary Bohannan	Minnesota

Media/Online video production

Common primary payload team update



FAA & safety: tracking

Primary payload includes

-Camera

- Camera Pointing
- Satellite Modem
- Video/Image Comm.
- Temperature sensor?

Talking to NASA website

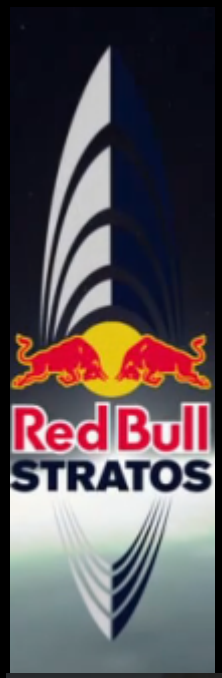
Primary Payload Team Update cont.

- Tracking options:
  - Iridium Modem
  - Ham Radio APRS
- Camera options:
  - GoPro
  - Raspberry Pi Camera – super cheap and very hands on for students in terms of programming
- Camera Pointing options:
  - Equation for Sun location at any time
  - Gimbal to steer camera to point at “Sun”
- Ground Station: Tracking Antennas

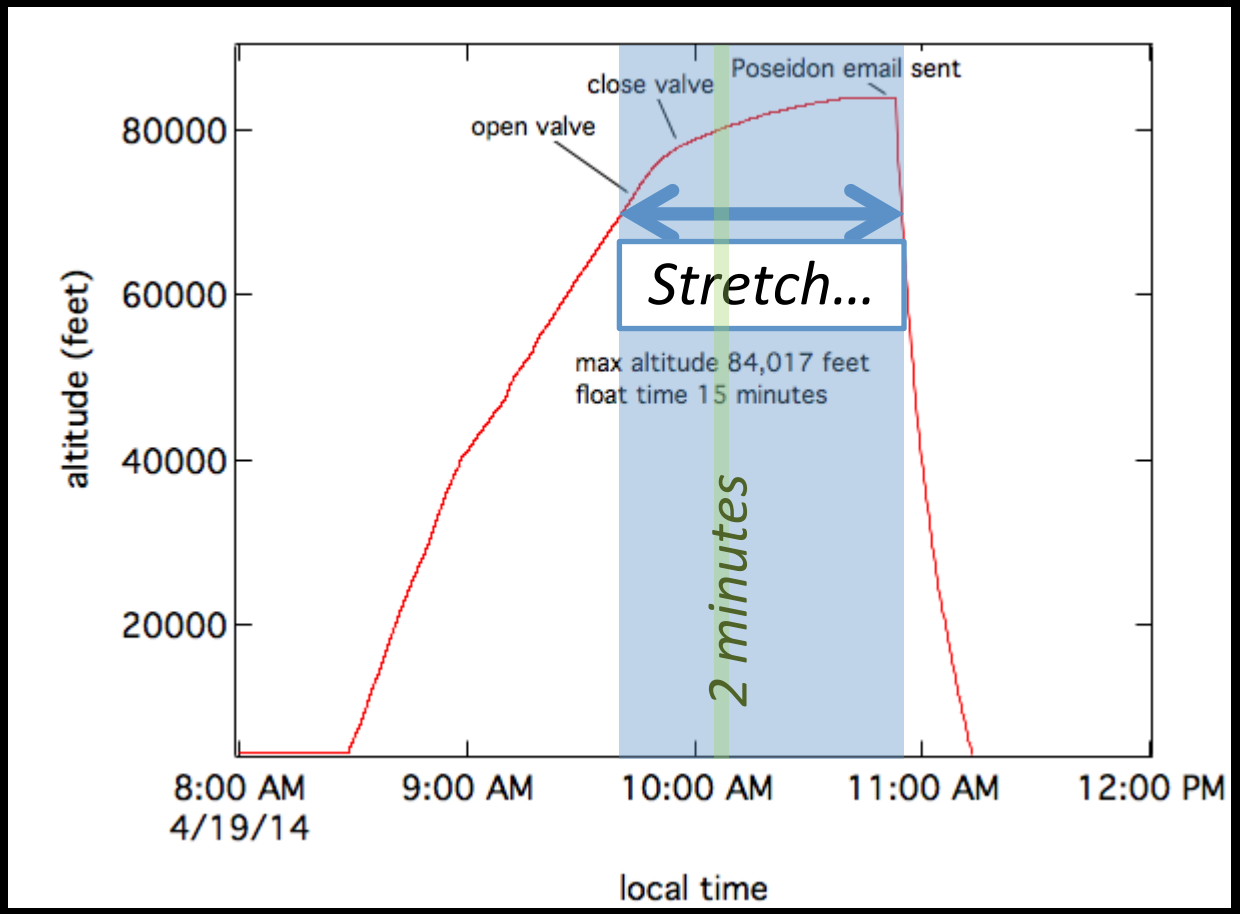
Primary Payload Team Update cont.

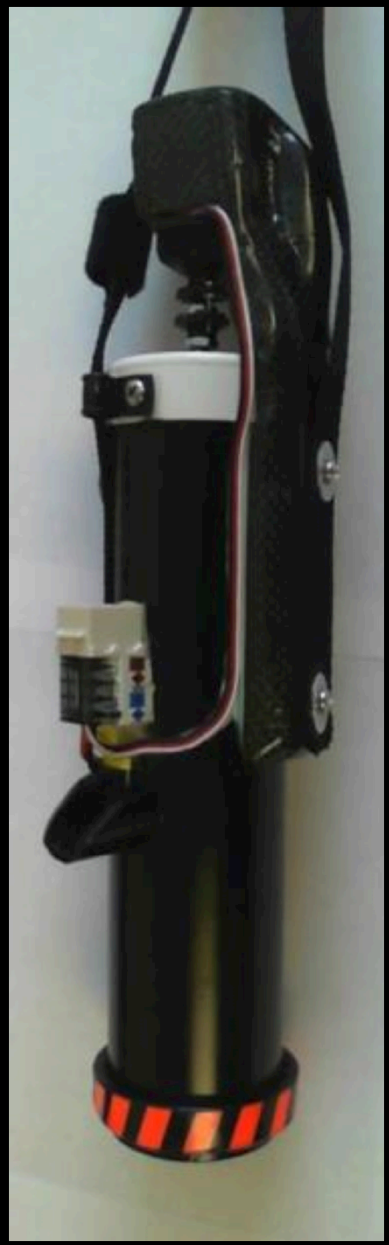
- Current Group focused on camera and transmission of video/images from balloon test flights
- Three test balloon flights to occur in October
  - James Flatten (MN) to test 900 MHZ video telemetry link with GoPro camera
  - Alex Peters (IA) to test Raspberry Pi camera with 5.8 GHZ radio link with custom antennas
  - Randy Larimer (MT) to test 900 MHZ still image link with Raspberry Pi camera

ATA Aerospace partnership



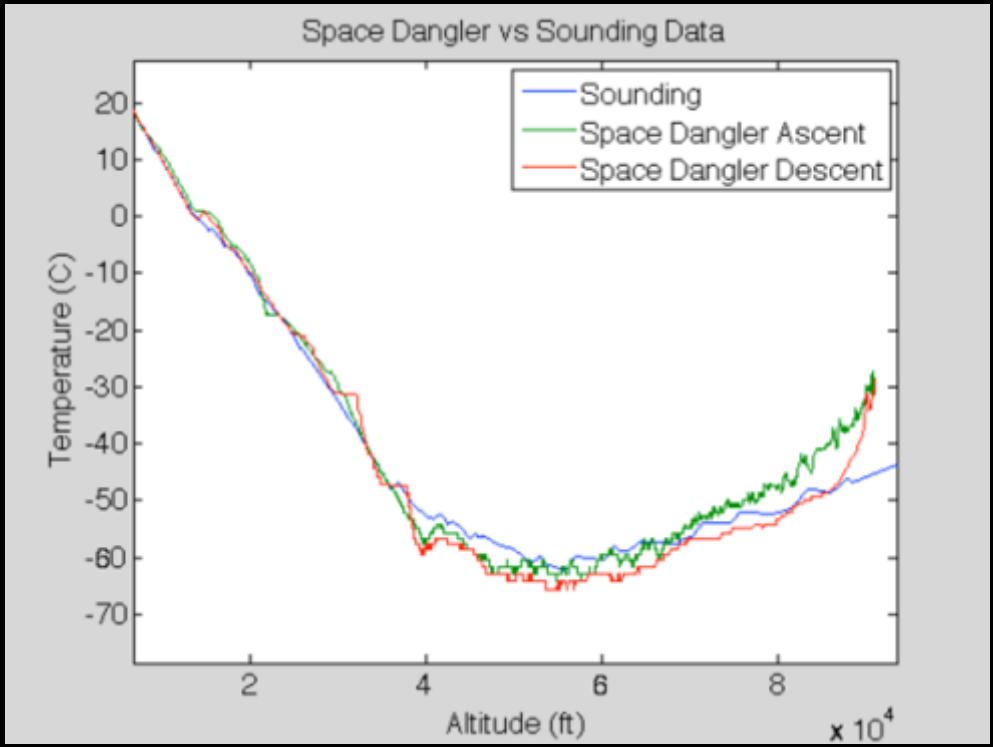
Individual payloads and options





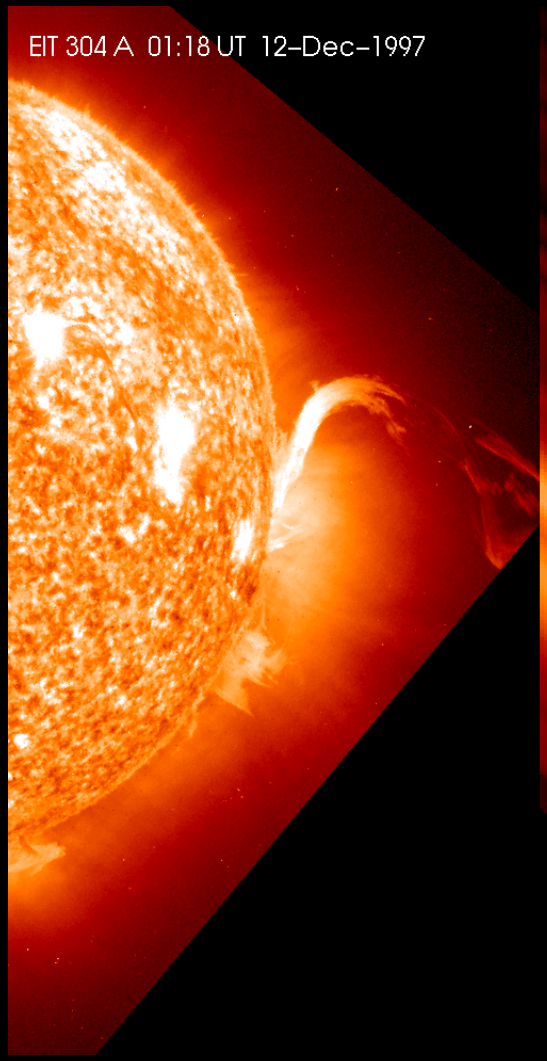
Atmospheric Science

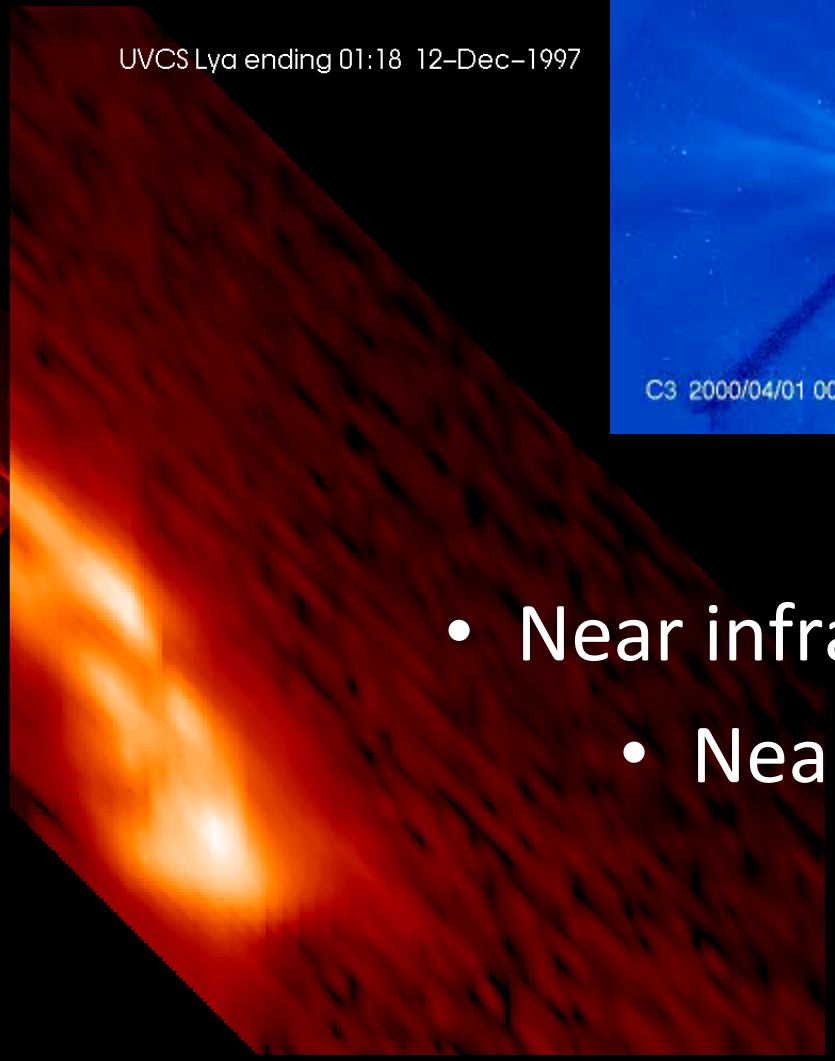
- Temperature changes
- Ozone changes
- …



"Due to the difficulty in making reliable and timely four-dimensional observations of atmospheric temperature in the vicinity of the path of the total solar eclipse, direct measurements of temperature changes from the troposphere to the stratosphere during a total solar eclipse still haven't been reported before."

Solar Science





- Near infrared corona
- Near UV corona
- …

STEAM: Art

Next steps

- Find funding for primary payload kits Organization for high level of collaboration with other teams (payloads, launch sites, etc.)
- Seeking partnerships with other federal agencies and industry (NOAA, Blue Origin, Google, Boeing, Garmin, Lockheed Martin…)
- Let me know if you want to be part of an organizational or science team or if you have a potential sponsorship contact – THANKS!