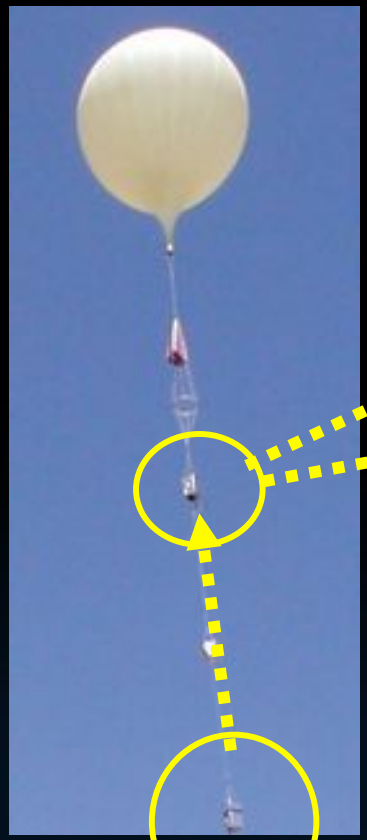
Near Space Impacting STEM Students

StratoStar Systems & Taylor University
Jason Krueger
2010 Western SG Regional Meeting
9/18/2010

Overview of Ballooning



Data and GPS coordinates are sent to antennas on the ground

Data is sent wirelessly to command pod

Student projects collect data

Computers plot GPS coordinates and record data

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Overview of Ballooning

Typical Balloon Flight

- Flight Time: 1 hour up 30 minutes down (1.5 hours total)
- Altitude: 65,000 ft – 110,000 ft
- Temperature: Ground temp to -60 to -90 F
- Distance Covered: 10 Miles – 100 Miles (Long flights in winter)
- Payload: 12 lbs or less (In order to meet FAA Regulations)
- Lifting Gas: Helium or Hydrogen (1.5 tanks for 12 lb payload)
- Latex Balloon: 1200g – 1500 g
- Parachute: 72 in
- Cost per launch: $300 (Includes gas for chase vehicle)
- Launch Conditions: Any season, Any condition, Any Location

FAA Regulations

Summary of Rules in FAR 101:

1. Payload is less dense than 3 ounces per square inch.
2. Total payload weight can't exceed 12 lbs and must be split into at least two 6 lb payloads.
3. Payload lines must separate with an impact force of less than 50 lbs.
4. Don't launch any hazardous payloads


StratoStar Platform: UCSD Student Project 90,000 ft over Salton Sea
(California Space Grant)
WWW.STRATOSTAR.NET
STRATOSTAR

Science + Adventure = Fun

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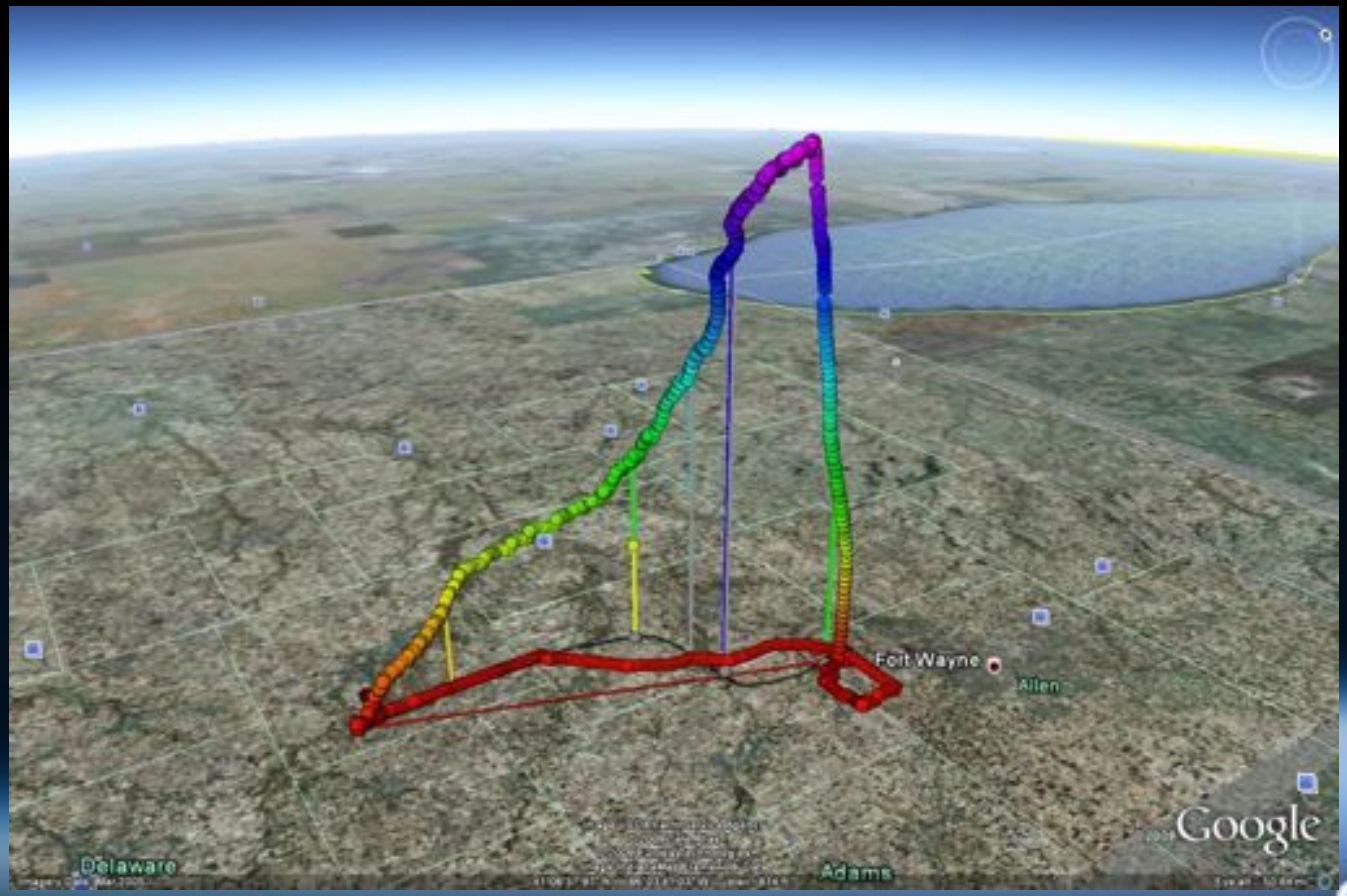
Overview of Ballooning

Typical Balloon Flight

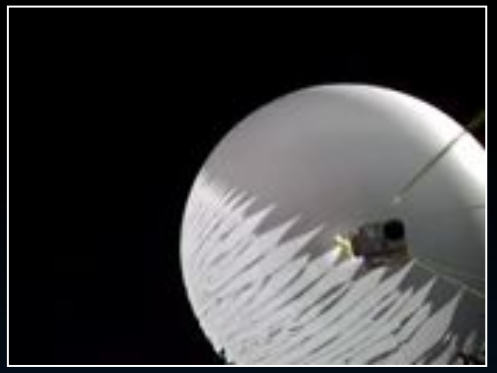


Balloon Bursting

DePauw University: Greencastle, IN

– All images taken from the same camera





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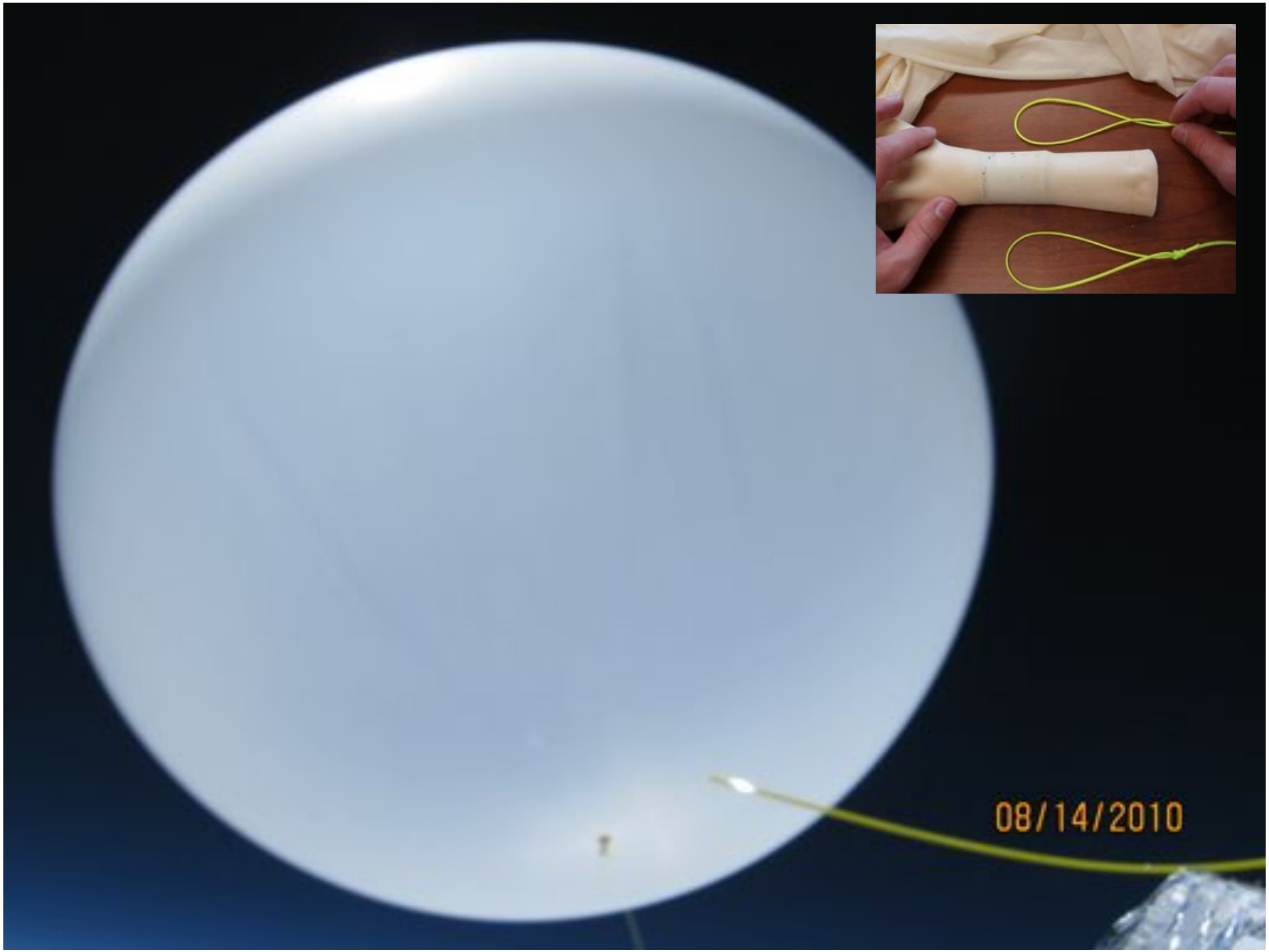
08/14/2010

Taylor University H-A Balloon Program

Students are the focus

- Build Scientific & Engineering payloads
- Track & Recovery payloads
- Coordinating logistics
- Working in teams
- Managing budgets and schedules
- Creative problem solving

Taylor University H-A Balloon Program

Classes implemented:

- Electronics
- Physics
- Computer Science
- Senior Design
- Science for Teachers
- GenEd – Astronomy
- GenEd – Chemistry

Outreach to K-12 & Admissions Marketing

StratoStar Systems

Who are we?

- Company has been in business for 4 years
- Slogan *"Gateway to Near-Space"*
- StratoStar has over 70 years R&D experience
- 99% payload retrieval to date (200 + Flights)
- Spun out of Taylor University balloon program

StratoStar Systems

StratoSat Complete Flight Package

- StratoStar's main product

StratoStar Systems

What do we do?

- Help institutions & Space Grants start high-altitude balloon programs
  - Hardware & Software
  - Training
  - Support
- We have created easy to use products to get you and your students to Near-Space

STRATOSTAR SYSTEMS

Who have we worked with?

Space Grant or Affiliates:
19 States

- California
- Washington
- Indiana
- Ohio
- Illinois
- Wisconsin
- Minnesota
- Kentucky
- Pennsylvania
- New York
- Virginia
- South Carolina
- Georgia
- Missouri
- Nebraska
- Kansas
- West Virginia
- Massachusetts

NSF CCLI Grant

- Goals of Project
  - Introduce & Train faculty in any STEM discipline to implement in to curriculum
  - Assess impact of launches on STEM Students
- 3 year project
- 55 Universities attended workshops
- 800 Students assessed in longitudinal study

NSF CCLI Grant

Workshops (2 days)

- Learn about Near Space Environment
- Build Scientific Payload
- Launch and Recover Payloads
- Analyze Data
- Learn from STEM professors who have implemented launches in to curriculum
- Video: www.StratoStar.net/workshop

NSF CCLI Grant

Launches at the Universities

- Pre & Post Test given to Students
- Observational assessments
- Classes assessed each semester
- Feedback given to professors on how to improve
  - Develop best practices for future implementers

NSF CCLI Grant

Areas of Assessment:

- Intrinsic Motivation
- Valuing Science
- Application Knowledge
- Metacognitive Processes
- Cognitive Skills
- Content Knowledge

NSF CCLI Grant – Summary of Findings

Impact of workshop on professors:

- Practical Significant growth in:
  - Intrinsic Motivation
  - Metacogntive Processes
  - Procedural Knowledge

Indicates workshops can equip professors to effectively implement HARP program in to their classes. (See paper in ASEE 2010 Proceedings)

NSF CCLI Grant – Summary of Findings

Significant educational Findings:

- With our training process we can bring a novice up to the highest level of student impact in 2 launches (implemented over 2 semesters)
- One-time Event – "Flash in a pan" – No long-term impact

NSF CCLI Grant – Summary of Findings

Biggest impacts for Education:

- Non-Science majors gained more from launches than Science majors
  - Some students switched major to STEM related field
- Comparing growth between males and females
  - Females experienced more impact (Statistically significant)
    - Metacognitive Process
    - Cognitive Skills
    - Content Knowledge

NSF CCLI Grant – Summary of Findings

- Using high-altitude balloon launches in STEM curriculum produces growth in key educational areas
- Multiple implementations of launches into curriculum provide the best results

Your State & Affiliates

- BalloonSat 2.0
- Student led flight project
- Reducing failures
- Innovative Program
- Low cost Instant flights
- Attract & Retain Students
- Easy to implement

Getting involved

High-Altitude Workshops:

- Nebraska July 25th & 26th
- Host a workshop for your affiliates
  - 1 to 12 Professors
  - Go through all steps of balloon launch and recovery
  - Designed for all types of Professors not just EE and Physics professors

Getting involved

Academic High-Altitude Conference (AHC)

- Second annual conference
- Des Moines, IA June 20th
- Place for established programs to share ideas
- Advanced user workshops

Getting involved

High-Altitude Ballooning Competition:

- Design a payload to accomplish a task
- Competition launch event April 15th 2011
  - Launched from Evansville, IN
- Contest Website
  - http://haballoons.evansville.edu/index.html

Continuing Funding

- $500,000 for 3 years
- Develop Curriculum for Pre-service teachers
- Textbook
- Annual Conference
- Continued longitudinal tracking
- Legal and regulation research
- Resource sharing website

Contact Info

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