Introduction to the 2020-2021 LaACES Program

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Introductions – LaACES Management

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Introductions – LaACES Teams

Delgado Community College (DCC):

Faculty Advisors:	Joanna Rivers, Ray Duplessis
Student Commitment:	15 students – 5 teams

Grambling State University (GSU):

Faculty Advisors:	Lane Elien, Khaliq Abdul, Colton Brown
Student Commitment:	8 students – 2 teams

Loyola University (Loyola):

Faculty Advisors:	Jamileh Mohammadi, Martin McHugh
Student Commitment:	10 students – 3 teams

McNeese State University (MSU):

Faculty Advisor:	Zhuang Li, Bei Xie, Qiu Liu

Northwestern State University of Louisiana (NSULA):

Faculty Advisors:	Anna Dugas, Carlee Lake
Student Commitment:	6 students – 2 teams

Southeastern Louisiana University (SELU):

Faculty Advisors:	Gerard Blanchard, Ryan Rumsey
Student Commitment:	4 students – 2 teams

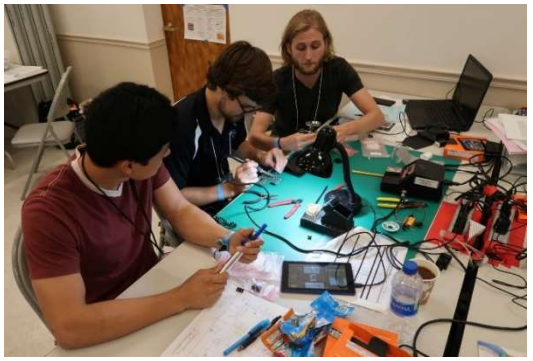
What is LaACES?

- Louisiana Aerospace Catalyst Experiences for Students
- A two-semester program that includes the Student Ballooning Course and building a payload
- Students develop science experiments and fly them to 100,000 feet
- Students gain practical skills in:
  - Electronics
  - Microcontroller programming
  - Project management
  - Writing and communication
- Target entry level students enrolled in Science, Technology, Engineering, or Mathematics fields (STEM)

LaACES Goal & Objectives

Goal:

"To inspire students to continue towards STEM related careers"



Objectives:

Provide students with an authentic flight project experience not normally available through the classroom

Develop student skills in electronics, real-time programming, communication, and project management

Guide students to work in teams and to use acquired knowledge to create a science payload for balloon flight

Students communicate their progress through required documents and presentations on a milestone schedule

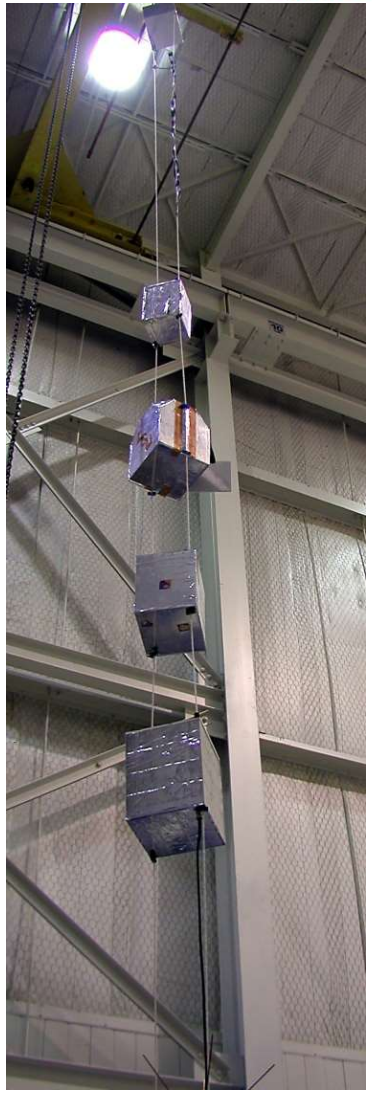
Conduct annual flight operations where approved student team payloads are flown on a latex sounding balloon to an altitude of ~100,000 feet or the very "edge of space"

A Historical Look at LaACES

- Evolved from the pilot program ACES implemented with NASA funding during 2002-2003 academic year
- ACES involved only students at LSU
- NASA approved LaACES funding in February 2004
- Student Ballooning Course (SBC) developed in early 2004
- Over 65 flights since 2004
- Major revision of the LaACES electronics, lectures, and activities in 2018, field tested in 2019, and implementing in 2020-2021

LaACES Structure

- Involves students from Louisiana institutions
- Students are organized into teams of 3-4
- Fall semester consists of bi-weekly 2 hour “classes”
  - Usually meet Tuesday / Thursday from 6 pm to 8 pm
  - Each week (i.e. two classes) usually consists of 1 hour of lecture and 3 or more hours of activities
  - Lectures and activities cover electronics, programming, payload design, project management, balloon payload design, and science
- Spring semester devoted to designing, developing, testing, and documenting a balloon payload
- Flight operations trip to CSBF in May
- Students expected to devote 10-15 hours per week and will have specific deliverables due on milestone dates

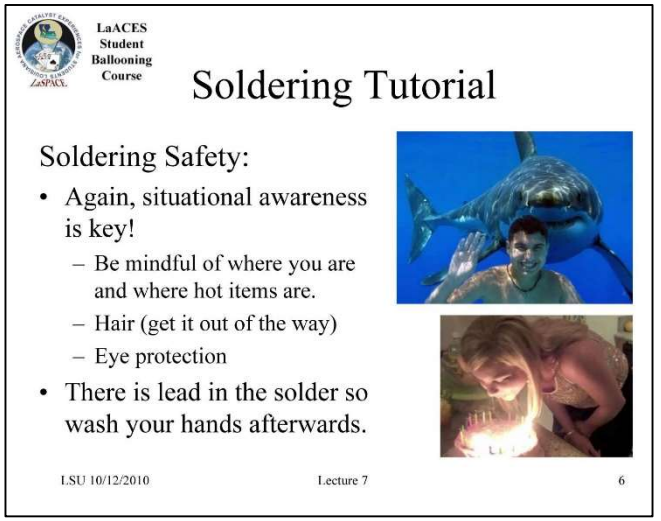


Major Differences between then and now

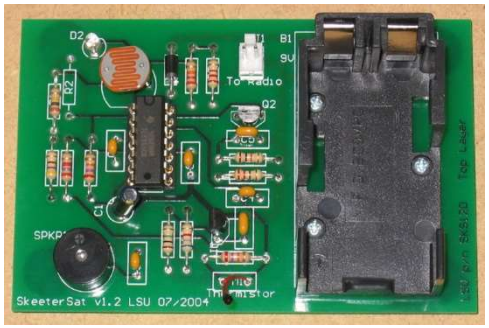
- Replaced the old BalloonSat with an Arduino Mega based system
  - Now include a GPS receiver, SD card read/write, custom sensor board, plus ability for easy expansion
- Revised a majority of the lectures and activities, plus added new units on surface mount component soldering, Arduino programming, GPS usage, and SD card storage
- New LaACES website at https://laspace.lsu.edu/laaces/
- LaACES Management will provide remote presentation of lectures and mentoring of activities
  - Institution advisors will be responsible for assuring all students understand the program content and that all deliverables are vetted prior to submission to LaACES Management
- All institutions and teams will have hard deliverables that will affect the decision on whether a particular team will be allowed to fly
  - SkeeterSat report and Capstone sensor interface report for fall semester
  - PDR, CDR, FRR documents, T/V system test, FRR presentation for spring semester (NOTE: These are the flight critical pass / fail items!)

Student Balloon Course (SBC) Content

- All lectures, activities, and auxiliary material is available for download from the LaACES website
- ~35 PowerPoint presentations covering the primary topics relevant to the program
- ~30 hands-on activities that complement the lectures
- These lectures and activities are organized on the website in the order they should be presented to the students
- Two major projects during fall are the SkeeterSat calibration report and the "Putting it all together" semester capstone project

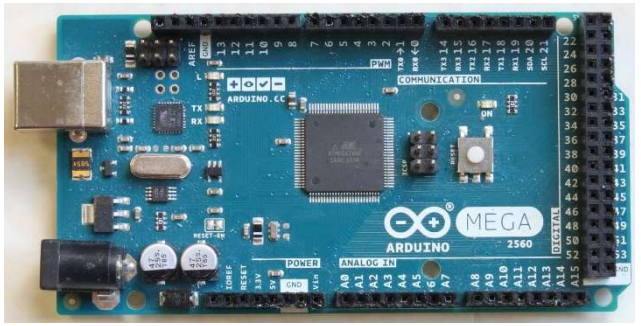


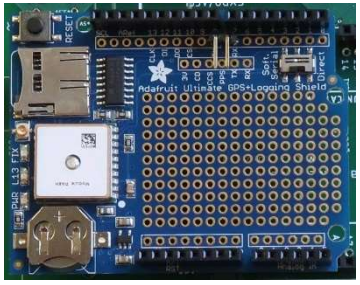
SBC Hardware Components (1 of 2)



SkeeterSat is an introductory circuit assembly activity where the output beep frequency is temperature dependent and the interval between beeps is light intensity dependent. Used to learn basic electronics, assembly, troubleshooting, calibration, and documentation.

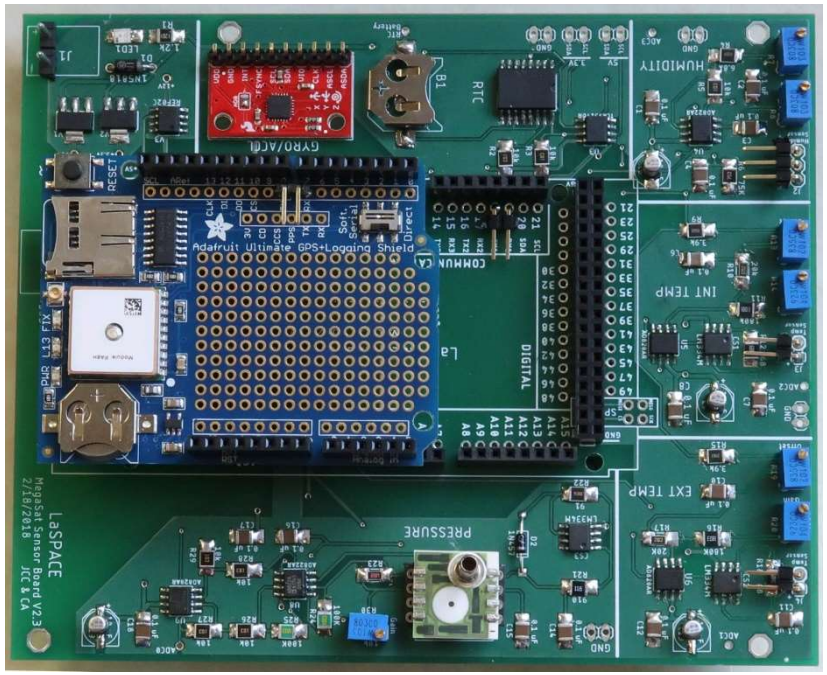
Arduino Mega2560 is a powerful microcontroller with 54 digital I/O lines, 16 channels of 10-bit ADC, and plenty of memory for complex programs. Used for learning programming and as a payload controller.





Adafruit Ultimate GPS Logger includes a GPS receiver (validated to at least 100,000 feet), internal GPS antenna, external antenna socket, a battery backup coin cell holder, and a prototyping area. It interfaces with the Arduino Mega and is used for time stamping data and data logging.

SBC Hardware Components (2 of 2)



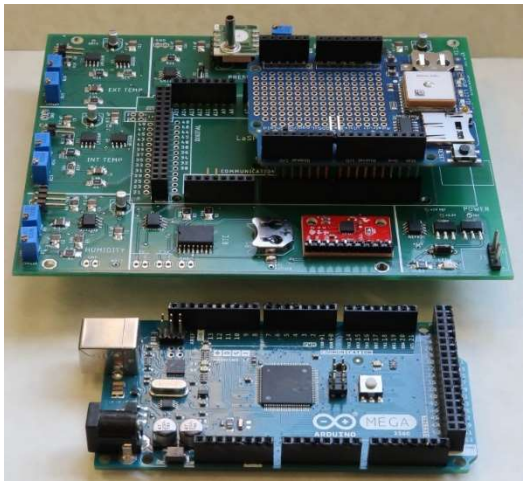
MegaSat Shield is a custom Arduino Mega board that includes two temperature sensors, a pressure sensor, a humidity sensor, a 3-axis accelerometer, a 3-axis gyroscope, and a real time clock. The board interfaces with the Arduino Mega and Adafruit GPS Logger Shield to provide a complete payload solution. Other prototype or custom PCB shields can be easily interfaced to expand the payload capability.

Miscellaneous Parts includes specialized components & sensors used by some activities including solder practice.

SBC distribution also includes numerous reference documents and specialized software

Spring Semester

- Build the MegaSat, learn how to use it, and plan a payload using the Mega, MegaSAT, and GPS / SD card shield as the payload core
- Complete SBC project management component and develop a team contract
- Develop the payload document using the Pre-PDR, PDR, Pre-CDR, CDR, and FRR document templates in sequence



LaACES MegaSat payload stack

- Student Teams will need to complete the following in order to be allowed to fly
  - PDR, CDR, and FRR documents must be delivered by the milestone date and approved by LaACES Management
  - Payload must successfully complete a thermal / vacuum system test in April
  - FRR presentation, usually conducted at CSBF, must be approved by LaACES Management
- **Institutions will be responsible for delivering the number of student teams they claim they will support for 2020-2021 (i.e. slide 3)**

LaACES Conducted by LaSPACE

- As part of our response to the COVID-19 pandemic, LaACES Management will conduct the LaACES sessions remotely
- Sessions will be conducted every Tuesday and Thursday evening from 6 pm to 8 pm via Zoom session
- We are planning to provide each institution with a document camera to accommodate real-time mentoring during activities
- These evening sessions will be recorded but these will be the only times that real-time mentoring will be available
- All LaACES institutions and students will be responsible for all of the material in the LaACES Student Ballooning Course
- The required content in the PDR, CDR, and FRR payload documents makes heavy use of the LaACES SBC material

Laboratory and Student Tool Kit

- The table below provides our recommendation for the tool kit that each "remote" student should have for the fall semester
- Total cost per student is about $220 per set

Description	Ordering catalog number	Unit Cost
needle nose pliers	Harborfreight 63815	$1.99
flush cutting wire cutters	harborfreight 90708	$3.49
Screwdriver set, harbor freight 47823	HarborFreight Item # 47823	$4.99
Hand-operated vaccuum pump	HarborFreight Item # 92474	$24.99
lock ring plier	Amazon (Lisle 44900)	$17.43
Wire strippers	Harborfreight 98410	$4.99
Lead forming tool for 1/4W resistors	Jameco 801 (Pricey on Amazon)	$4.49
Solder sucker and wick	Amazon (B07TC1MGJP)	$7.89
hand magnifiers magnifiers	Sargent-Welch WL8068 from http://sargentwelch.com/	$2.00
digital multimeter	Harborfreight 63759	$6.39
safety glasses or goggles	McMaster-Carr 54185T601	$2.21
temperature controlled solder station	Amazon (X-Tronic Model #3020-XTS)	$54.80
wire, solid 22AWG uninsulated 100' roll	Jameco 2098486	$7.95
Hookup wire, Red, 22 AWG stranded, 100' roll	Jameco 734303	$9.95
Hookup wire, Black, 22 AWG stranded 100' roll	Jameco 734311	$9.95
63-37 tin-lead solder, 0.020	Mouser 533-24-6337-0010	$49.00
Liquid Electrical Tape	WalMart item	$5.00

Details in other workshop sessions

- Session 1: Changes to the LaACES Hardware

  Aaron Ryan will provide details about the changes we have made over the last two years with the LaACES electronics hardware kit. The capabilities of the new vs old hardware will be discussed

- Session 1: First Semester Course Overview

  Dana Browne will detail the sequence of lectures and activities that will be conducted over the fall 2020 semester. The student team deliverables and expected performance level will be discussed

- Session 2: Second Semester Course Overview

  Greg Guzik and Colleen Fava will detail sequence of events expected from each student team as they design and develop their balloon payloads. The milestone deliverable dates will be specified

- Session 2: Anticipated Flight Operations 2021

  Aaron Ryan will detail the expected plan for system testing and flight. The criteria for allowing teams to fly will be specified

- Questions & Answers

  Time will be allowed to address all questions

LaACES is always fun plus students end up learning something