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Minority Outreach – UAS as a STEM Minority Outreach Learning Platform for K-12 Students Final Report

November 30, 2017

FAA Final Report

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16. Abstract Under the FAA’s ASSURE UAS Center of Excellence, a team of two Universities were tasked with providing two STEM Outreach approaches to the FAA that use UAS’s as the central learning platform. The target of this outreach are minority or underserved students. The two Universities tasked with this UAS outreach were Tuskegee University which can reach out to a predominantly African American student population, and the New Mexico State University (NMSU) that can reach out to predominantly Hispanic and Native American student populations. The approach for all of the activities focused on STEM education using UAS or drones as the central learning platform. The STEM topics included fundamental related aviation and programming concepts and included unique UAS related content. The ASSURE team conducted the outreach in two phases that included; 1) UAS Roadshows for broad community outreach, and 2) UAS summer camps. Educators designed the UAS Roadshows for broad community engagement. There were three UAS Roadshow events held at both locations for a total of six roadshow events. With these events, the ASSURE team reached over 1,000 students providing hands-on activities, aviation education, flight demonstrations, UAS displays, lectures, flight simulator time, student UAS flights with a trained pilot, and more. The UAS summer camps took advantage of the materials developed for the UAS Roadshows. The ASSURE team’s approach with all of the activities was to provide background knowledge, teach skills, and build upon those skills. The camps approaches and content varied by location based on resources and demographics. Students were started with aviation education and flight safety. The physics of flight lessons were transferrable into time flying fixed wind and rotary wing aircraft on the flight simulator. There was a focus on hands activities on at both locations. The Tuskegee “Camp Drop Zone” hosted 20 students for one week in an all day camp. NMSU’s “UAS Summer Camp” hosted 116 students in four camps that ran for two weeks each in half-day sessions. The UAS Roadshow materials and summer camp curricula materials were provided to the FAA.					
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Contributing Authors

The Principal Investigator for this effort is Henry Cathey. However, other investigators have performed the work required to produce this report. The contributing authors are:

New Mexico State University:

Henry Cathey, Deputy Director, NMSU Physical Science Laboratory

Tuskegee University:

Dr. M. Javed Khan, Head of the Aerospace Science Engineering Department

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Table of Acronyms

Acronym	Meaning
ASSURE	Alliance for System Safety of UAS through Research Excellence
COE	Center of Excellence
DOT	Department of Transportation
FAA	Federal Aviation Administration
NTIS	National Technical Information Service
NMSU	New Mexico State University
PSL	Physical Science Laboratory
PDF	portable document format
R/C	Remote Control
STEM	Science Technology, Engineering, and Math
TBA	To Be Assigned
UAS	Unmanned Aircraft System

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Executive Summary

Within the framework of the Federal Aviation Administration (FAA) Unmanned Aircraft Systems (UAS) Center of Excellence (COE), there is strong desire to incorporate Science Technology, Engineering, and Math (STEM) Outreach to students from groups who are under-represented in STEM fields. There is no one single approach that addresses STEM outreach for students of different ages, backgrounds, or who have different cultural and regional influences. There are common technical ideas and instructional approaches that can be used as building blocks, which can then be tailored to the various under-represented target groups.

An initial approach, “UAS as a STEM Minority Outreach Learning Platform for K-12 Students” was proposed and funded by the FAA. The objective of the overall project was to provide two STEM Outreach approaches to the FAA that use UAS’s as the central learning platform. The target of this outreach are minority or underserved students. The two Universities tasked with this UAS outreach were Tuskegee University which can reach out to a predominantly African American student population, and the New Mexico State University (NMSU) that can reach out to predominantly Hispanic and Native American student populations.

The approach for all of the activities focused on STEM education using UAS or drones as the central learning platform. The STEM topics included fundamental related aviation and programming concepts and included unique UAS related content. The ASSURE team conducted the outreach in two phases that included; 1) UAS Roadshows for broad community outreach, and 2) UAS summer camps. Educators designed the UAS Roadshows for broad community engagement. There were three UAS Roadshow events held at both locations for a total of six roadshow events. With these events, the ASSURE team reached over 1,000 students providing hands-on activities, aviation education, flight demonstrations, UAS displays, lectures, flight simulator time, student UAS flights with a trained pilot, and more. Presenters highlighted aviation and FAA careers all within the context of flight safety as a central theme. These were very successful outreach activities.

The UAS summer camps took advantage of the materials developed for the UAS Roadshows. The ASSURE team’s approach with all of the activities was to provide background knowledge, teach skills, and build upon those skills. A blend of the various elements that were part of the summer camps at the two locations included the following:

Physics of Flight – education, paper airplanes, etc.	UAS speakers on work and career
Smoke Tunnel demonstrations	Team Research Project – UAS Mission Design
UAS uses, education, and careers	Collecting, Analyzing, and Interpreting data
Flight simulator time using fixed wing & multi-copters	3D Printing of mission specific tool, testing, and execution
Ground Drone Jumping Bots – free driving and programming	sUAS flight – professional pilot on buddy box with student
Flight Drone – free flying, programming, and obstacle course challenge	Tour of Flight Test Site – facilities, aircraft, support equipment, etc.



The camps approaches and content varied by location based on resources and demographics. Students were started with aviation education and flight safety. The physics of flight lessons were transferrable into time flying fixed wing and rotary wing aircraft on the flight simulator. There was a focus on hands-on activities on at both locations. The Tuskegee “Camp Drop Zone” hosted 20 students for one week in an all day camp. NMSU’s “UAS Summer Camp” hosted 116 students in four camps that ran for two weeks each in half-day sessions. The UAS Roadshow materials and summer camp curricula materials were provided to the FAA.

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1 Introduction

Inspiring the next generation toward technical careers, specifically in aviation related fields is a challenge. Within the framework of the Federal Aviation Administration (FAA) Unmanned Aircraft Systems (UAS) Center of Excellence (COE), there is a strong desire to incorporate Science Technology, Engineering, and Math (STEM) Outreach to students from groups who are under-represented in STEM fields. There is no one single approach that addresses this for students of different ages, backgrounds, or who have different cultural and regional influences. There are common technical ideas and instructional approaches that can be used as building blocks which can then be tailored to the various under-represented target groups. These building blocks, using the development approaches and support materials, can then be replicated by other ASSURE members or external groups as well.

1.1 Purpose

The purpose of this project was to provide two potential STEM Outreach approaches to the FAA that use UAS's as the central learning platform. The STEM topics included fundamental related concepts and included unique UAV related content. A number of various approaches for STEM Outreach were provided and discussed with the FAA. Two specific approaches were down selected by the FAA. Foundational research was completed on what relevant material was available. New materials were developed. As the efforts proceeded, the focus was to build on previous materials generated as part of this effort and other available efforts.

1.2 Scope

The effort proposed was to develop a number of approaches that can bridge some of these gaps and/or provide opportunities to these under-represented groups. Some of the overarching goals were to develop demonstrations, activities, events, and project-based hands-on learning opportunities for students from under-represented groups using UAS as the central learning platform. The initial thrust was to create UAS Roadshow events that can be tested in two or more locations. The event elements would be refined and prepared for future opportunities. The requirement was to conduct two UAS Roadshows at each location for a total of four events. As a follow up to the UAS Roadshows, the longer term potential STEM Outreach opportunity was to prepare and conduct UAS summer camps. The original plan was to conduct a summer camp at each location with up to 25 students per camp. These programs were designed around leveraging current networks with school districts, teachers and parents.

The sections below provide a summary of the work completed and the outreach activities performed as part of this work. The UAS Roadshow events are highlighted at a top level and what was accomplished by each university. The results of the UAS Summer Camps are presented and focus on the curricula and outcomes. A listing of the various deliverables is also provided for reference. A short summary of the demographics and feedback is also provided for reference.

2 UAS Roadshows

Each university had access to different resources that could be used to provide hands-on experiences with UAS as the central learning platform. To cross over different fiscal years, the FAA required that events be held before the end of September 2016 and before the end of December 2016. The desire was that two events be held at each supporting location. Each university held a UAS Roadshow before the end of September and at least one more before the end of December. A total of six UAS Roadshow events were held in 2016 and early 2017. An additional UAS Roadshow was held by Tuskegee University in the Fall of 2017. In general, the UAS Roadshows included hands on activities, demonstrations, education, and lots of fun! A summary of Tuskegee's and NMSU's UAS Roadshows is presented in the sections below and included are the dates and locations where the events were held.

2.1 Tuskegee University UAS Roadshows

Tuskegee University held three UAS Roadshows in the Fall of 2016 and one in the Fall of 2017. The dates and locations are shown below.

Date	Location	Number of Students
9/22/2016	Tuskegee Institute Middle School	65
10/18/2016	St. Joseph School, Tuskegee (abbreviated event)	15
11/3/2016	Notasulga School	60
10/5/2017	Tuskegee Middle School	65

2.1.1 Tuskegee University UAS Roadshow – Tuskegee Institute Middle School

Tuskegee held its first road show event was held on Sept 22 at Tuskegee Institute Middle School. Approximately 65 middle school students attended the event. Four faculty from Tuskegee University, six undergraduate students, three teachers and one counsellor and the Principal of the school supported the event. Mr. Claude Jones represented the FAA. A short outline of the activities included the following:

- Introduction to the event
 - Mr. Claude Jones, FAA
 - Principal, Tuskegee Institute Middle School
 - Dr. M. Javed Khan
- Physics of Flight Presentation
- Presentation on UAS
- Smoke Tunnel Flow Viz Station
- UAS Applications Station
 - Posters (Agriculture, Land surveying, surveillance)
- Flight Simulation Station – great hit!
 - Large screen
- Drone Programming Stations (10) – great hit!
 - Teams of 10 students/team

Some images from the event are presented below.



Presentations



Smoke Flow Viz Tunnel



Flight Simulator



Posters

Agriculture Application using Unmanned Aerial Vehicles (UAVs)

Helena Williams (Tuskegee University), Dr. M. Javed Khan(Tuskegee University), Davon Pittman(Tuskegee University)

This poster details the use of UAVs in agriculture. It includes sections on:

- 1. Unmanned Aerial Vehicle (UAV):** Definition and types.
- 2. Field Level Information that Soaring Can't Match:** Comparison of ground-based vs. aerial data collection.
- 3. Field Health Monitoring and Reporting:** How UAVs capture high-resolution imagery for crop health analysis.
- 4. Variable Rate Fertilization:** Using UAV data to optimize fertilizer application.
- 5. Variable Rate Irrigation:** Using UAV data to optimize water usage.
- 6. Variable Rate Harvesting:** Using UAV data to optimize harvest efficiency.
- 7. Variable Rate Planting:** Using UAV data to optimize planting density.

Unmanned Aerial Systems For Surveillance

By: Prince Johnson, Daniel Wynn, Akil Hodge

This poster discusses UAV surveillance applications. Key sections include:

- What is a UAS? (Unmanned Aerial System):** Definition and components.
- Unmanned Aerial System Specifications:** Flight time, range, speed, and payload.
- Objective (Surveillance):** Monitoring, tracking, and intelligence gathering.
- Unmanned Aerial System Sensors:** High Definition Camera, Thermal Imaging, and Laser Range Finder.
- Unmanned Aerial System Control systems:** Ground Control Station (GCS) and Remote Pilot (RP).

Addressing the Global Warming Crisis Using UAVs

Tuskegee University Aerospace Engineering Department
 Dr. M. Javed Khan, Clay Thompson, Clarkyris Evans

This poster explores UAVs as a tool for climate change research. It covers:

- Introduction:** UAVs for environmental monitoring and data collection.
- Equipment Needed for The UAV:** Drone, camera, and ground control station.
- Effects of Global Warming:** Rising sea levels, extreme weather, and melting ice sheets.
- Observation Locations:** Coastal areas, urban centers, and agricultural fields.
- Compatible Software for the Drones:** Pix4r, DroneDeploy, and others.



Students flying their programmed quadcopters

2.1.2 Tuskegee University UAS Roadshow – St. Joseph School, Tuskegee (abbreviated event)

Tuskegee University held a successful abbreviated UAS Road Show outreach at the St. Joseph School. There were about 15 middle school students. Some of the same elements were used as before and there were presentation on UAS. The students had an opportunity to fly the mini-drones and the AR-2 drone.

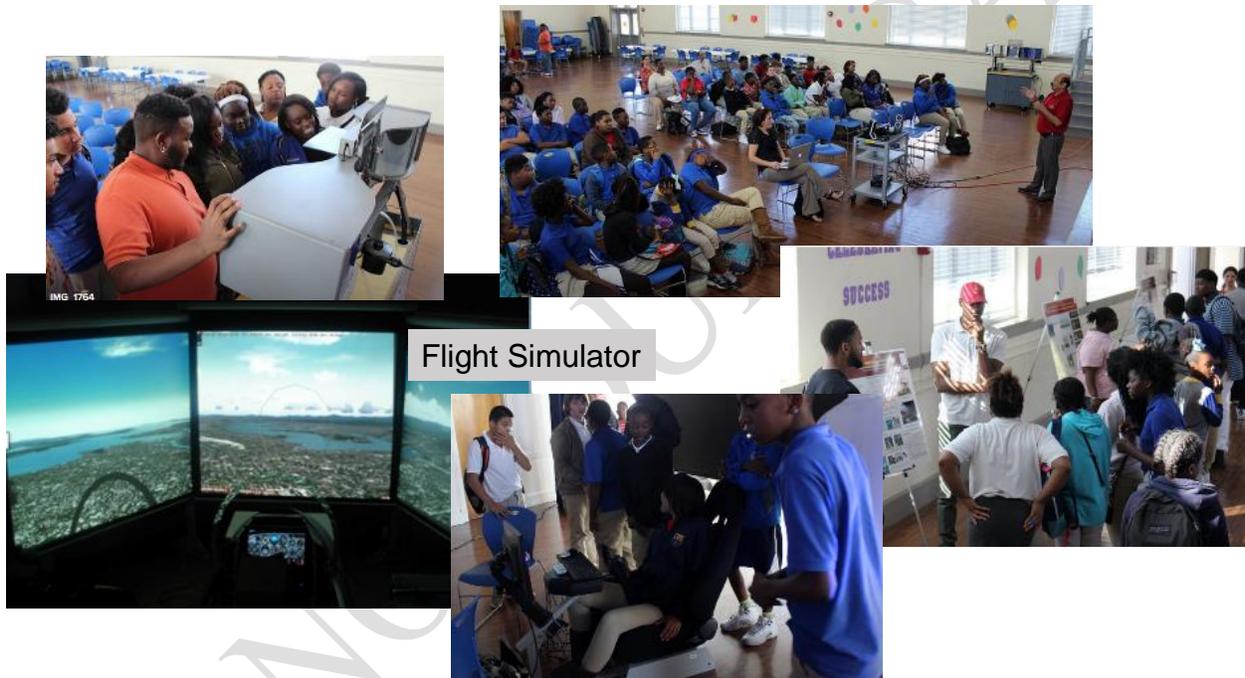


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2.1.3 Tuskegee University UAS Roadshow – Notasulga School

Tuskegee University held its third UAS Roadshow at the Notasulga School, Macon County, Alabama. In attendance were the Principal, Vice Principal, and three Math & Science teachers. Dr. M. Javed Khan, Dr. Aji, Dr. Ali, Mr. Heath, and 10 undergraduate students from Tuskegee supported the event. The activity consisted of the following:

- Physics of Flight Presentation
- Presentation on UAS
- Smoke Tunnel Flow Viz Station
- UAS Applications Station including posters (Agriculture, Land surveying, surveillance)
- Flight Simulation Station on the large screen – always a great hit!
- Drone Programming Stations (10)



2.1.4 Tuskegee University UAS Roadshow – Tuskegee Middle School

Tuskegee University held a successful UAS Road Show (Drone Day) on October 5, 2017 at the Tuskegee Middle School. There were 65 students from 7-8 grades who participated. The activity consisted of the following:

- Presentations
 - UAS and their uses
 - Basics of Programming
- Hands-on activity of programming ozobots
- Hands-on activity of programming quadcopters

The images below capture some of the activities.



2.2 *New Mexico State University UAS Roadshows*

The New Mexico State University held three UAS Roadshows, with two in the Fall of 2016 and one in early 2017. The dates and locations are shown below.

Date	Location	Number of Students
9/26/2016	NMSU Basketball Arena, 8 th grade Middle school students from Las Cruces, NM	~500
10/27/2016	Laguna Elementary School, Laguna Pueblo, NM – 3 rd , 4 th , 5 th , and 6 th grade students	94
3/3/2017	“The 2017 STEM Discovery Showcase” at the Dña Ana Community College – The day was focused on STEM outreach to local high school students (there were 7 or more of the local schools in attendance) and to some of the Community College students	~300

2.2.1 *New Mexico State University UAS Roadshow – NMSU, Las Cruces, NM*

New Mexico State University held its first road show event on September 26, 2016 at the NMSU Pan Am Center (basketball arena). This was a clear example of “It is always good to have a backup plan.” The original plan was to have the event outdoors at the NMSU football stadium. There were going to be stations set up all over the stadium with flights taking place on the football field including a live video flight feed on to the stadium screen. The winds were a bit too high on Monday and there were some spotty sprinkles so the event was moved indoors into the basketball area. The team had to change the logistics for the day to adjust.

There were stations set up all over the building. Approximately 500 8th Grade Middle School students from the Las Cruces area started in staggered groups at 9 AM. Coordination for school and student engagement arranged by Susan Brown and Nicole Delgado in the NMSU College of Education. They brought a support crew with them! Ms. Amela Zanacic represented the FAA. An outline of the activities and some images from the event are presented below.

- Station 1 – Basic UAS education including:
 - How a UAS flies (Physics of Flight) – Subsystems of a UAS – How UAS are used



New Mexico State University

**UAS UAV
RPV Drone**

sUAS = 0.25 kg to 25 kg
 or
 0.55 lbs to 55 lbs



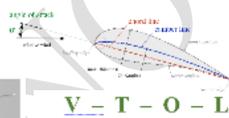
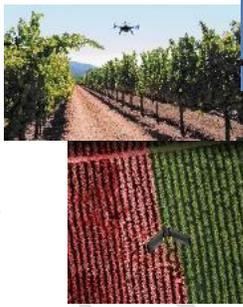
Fixed Wing



Rotary Wing sUAS



Multi-rotor sUAS



V - T - O - L
 Vertical
 Take
 Off and
 Landing

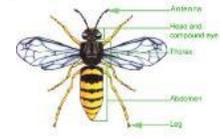
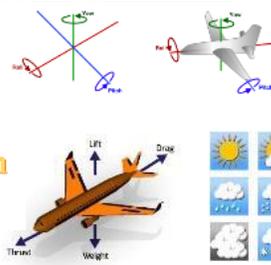
**Transmitter
Receiver**



**Airframe
Avionics
Autopilot
Propulsion
Payload**



**Air Component
Ground Component
Communications
Component**



Visible Light Sensors (RGB)

Near Infrared Sensors (NIR)

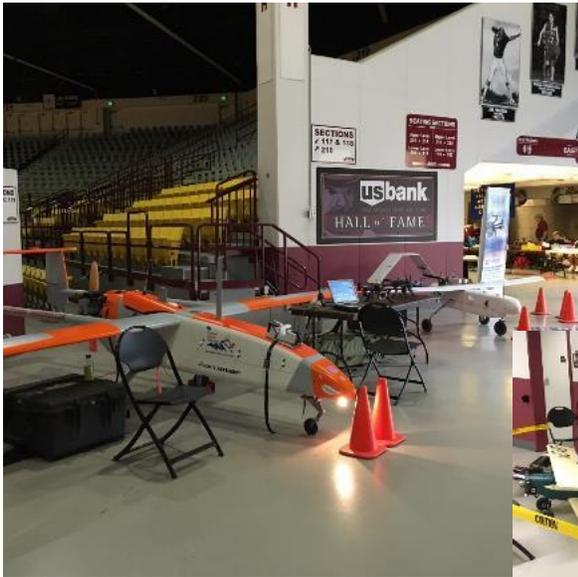
Infrared Sensors (IR)

Multispectral Sensors

Hyperspectral Sensors

Safety First!

- Station 2a – NMSU aircraft on display
 - Included small, medium, and large vehicles and demonstrate fixed wing, helicopter, and quad-copter types of UAV's.
- Station 2b – Mesilla Valley Model Airplane Club display



- Station 3a – Three hands on STEM activities
 - Set up by the College of Education to engage students who are not flying the flight simulator
 - Activities – Build a small hoop flyer, build a cup anemometer, and build a slingshot plane
- Station 3b – Flight simulators – 12 stations set up



- Station 4 – Flight Demonstrations (with commentary)
 - On the gym floor with students in the stands at one end
 - Model Airplane Club flights of small airplanes and a micro quad-copter
 - NMSU professional pilot demonstration of a small helicopter and a DJI Phantom
 - Camera video on the Phantom was piped to a large TV in front of the students so they could see the video real time (video recorded and screenshots taken)



2.2.2 *New Mexico State University UAS Roadshow – Laguna Elementary School, Laguna Pueblo, NM*

New Mexico State University held its second road show event on October 27, 2016 at the Laguna Elementary School, Laguna Pueblo, NM. This event required a road trip and overnight stay to support. The outreach was supported by 6 NMSU PSL staff, 5 NMSU College of Education staff, and 2 additional volunteers. The support team traveled up on Wednesday and were able to start set up at 4 PM on Wednesday afternoon. After spending the night in a local hotel, the final setup was completed Thursday morning between 7 and 9 AM. The group portions of the event, talks, and flight demonstrations were from 9 to ~11 AM. This was followed by rotation to different stations and hands on activities. This event was for 3rd, 4th, 5th, and 6th grade students. An outline of the activities and some images from the event are presented below.

The event started with the following:

- Aviation education PowerPoint presentation kicked off the event
- A number of the NMSU UAS were on display and operation and performance information presented by one of PSL's female pilots
- Presentation on aviation and FAA careers, and flight safety was given



The entire student body went outside for a flight demonstration with a number of different aircraft including;

- Powered glider
- Small plane
- Small helicopter
- Multi-rotor UAS with a camera onboard that sent images back so the students could see the flight from the vehicle on a large TV screen

Eight students (two from each grade) were selected and flew with a small multi-rotor UAV in front of their classmates. Their hands on flight experience was cheered on by their class mates.



Classes then broke down into three groups for rotations with multiple stations to provide students with education and hands-on experience. Three separate hands on STEM activities prepared and supported by the College of Educations STEM Outreach Center staff focused on flight projects.

- Hoop Flyer
- Straw Rocket
- Slingshot Plane



Groups were divided by age and given a carry bag that was color coded to easily divide into sub-groups for stations. Each bag had instruction sets pre-bagged ready for activity.





Each student also tried their hands at flying both a fixed wing aircraft and a quadcopter on one of a dozen flight simulator computer stations.





Also included in the color coded “goodie bag” was some NMSU information, UAS puzzles, stress ball, and follow up information. Strong interest from students and faculty in continuing this aviation education. Information provided to principal on items and approach to starting an after school aviation club. Some of the lessons learned included the following:

- Speakers system inside and out and PowerPoint made things easier
- This time provided better gender mix among various station/activities

- Female pilot presented the aircraft descriptions and flew part of the demonstration flights (some of the young female students pointed at the NMSU female pilot and were heard saying at the flight simulator stations that “if she can do it I can too”)
- Male and female instructors at flight simulation center
- Pre-bagging of STEM hands on activity into a kit worked well
- More time and fewer students during STEM activities and flight sims time worked well
- Flight sim sessions allowed for both fixed wing and multi-rotor flight time

On a personal note, the NMSU PI has spoken to thousands of students over the years. All ages. Elementary, middle school, high school, university, civic groups, church groups, scouting groups, and more in a number of different countries. The Laguna outreach was the most personally rewarding talk and educational events he has done in over two decades.

It is difficult to relay in words the student excitement, the level of engagement, the respect, and more from these young men and women. They were a delight. They took notes during the talks (every student had paper and pencil – every one). They asked questions. They laughed, were amazed, and had fun. The faces of the students when they flew the flight simulators was a personal highlight. The faces of the teachers and school staff flying the simulators...they looked like they were kids again. Very fun to watch.

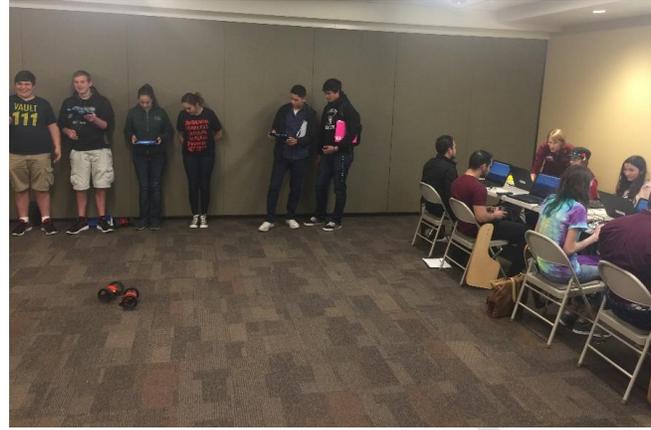
As follow up to this “igniting a flame”, the Principal, and staff were motivated for follow on. Students were asking if they could have an afterschool aviation club. One of the tribal community members volunteered to help organize. During the event, the Principal asked for some specific information on the flight simulators, some UAS that can be flown indoors, the vehicles flown outside with the buddy-box system, and some small R/C flight trainers. NMSU provided her the names, models, and costing for these. She putting a proposal together and presented this to the Tribal Council in the following days to ask for specific funds. She said that there were funds available the she can ask for. The program was approved and the Aeronautics club started meeting weekly for the rest of the school year with over 50 students participating.

2.2.3 *New Mexico State University UAS Roadshow – Dōna Ana Community College, Las Cruces*

New Mexico State University held its third road show event was held on March 3, 2017. This was part of “The 2017 STEM Discovery Showcase” at the Dōna Ana Community College in Las Cruces. The day was focused on STEM outreach to local high school students (there were 7 or more of the local schools in attendance) and to some of the Community College students. ~300 high school and community college students attended. The NMSU PI was one of the kickoff speakers to talk about STEM careers. The talk featured the FAA and ASSURE. STEM Workshops followed the opening speakers. The UAS STEM Workshop was one of these sessions.

A total of 4 sessions were held with 24 students per session (~100 students). There were two activities with 15 minutes at each activity. One activity included the 12 flight simulator stations that were used at the UAS Roadshows. A new outreach element used six Parrot Drone Jumping Bots. The jumping bots were planned to be used for the summer camp. This was a way to test drive the equipment and get a jumpstart on planning for camps. Using the bots taught the students to drive and then to program a set course. The same programming skills were used later during the summer camp to fly Parrot Cargo Drones. Below are some images from this day.





2.3 Support Materials for UAS Roadshows

Each location presented unique challenges and opportunities for the Roadshows. There were some common elements, but many/most were tailored to the specific groups, age levels, events, locations, and the resources available at each University. All of the Roadshow materials were gathered in one location and provided to ASSURE and uploaded to the FAA KSN site. Along with the documentation, a summary document was supplied that provided a breakdown of the materials submitted. That document was intended to provide a general overview of the materials generated that supported the UAS Roadshows and serve as a guide to the materials provided to the FAA and ASSURE. The materials came from a number of different sources. The outline below provides a listing of the various topic area folders provided to the FAA and the materials they contain. This listing is intended to aid in searching through the materials.

Folder – Hands On STEM Activities

Directions for a number of different hands on activities related to flight

- Build a cup anemometer
- Directions for making hoop gliders
- Directions for making a Foamie Flyer
- Directions for making paper rockets

Folder – UAS Puzzles and Vocabulary

Crossword puzzle and word search files

- UAS Crossword Puzzle – printable crossword puzzle file
- Unmanned Aerial Systems Word Search – printable word search file
- UAS Crossword Puzzle and Word Lists – word lists for puzzles in an Excel file
- UAS Vocabulary Word List – various word lists pulled from a number of online sources (sources not cited). This is a just a gathering of various aeronautical related words for reference.

Folder – NMSU Roadshow Materials

Various files

- Copy of FAA UAS OUTREACH Individual Reg Form – Event sign in form
- FAA UAS Roadshow STEM Event School Registration Information – Event school sign in form

- Flight Demonstration Scripts – Reference scripts that can be used for Professional Pilot flight demonstration and during the student flight demonstrations (students flying with professional pilot on a “buddy box”)
- Laguna Elementary STEM Event Planning – planning materials for what was taken for this event and some questions for the school during planning
- Laguna STEM Planning2 – initial planning materials for the logistics for the Laguna trip
- STEM Stadium Plan Images – planning for a big outdoor event
- UAS Roadshow Binder Cover – binder cover for event
- UAS Roadshow Schedule Laguna – daily schedule for event
- UAS Roadshow Schedule – schedule for rotating school groups
- Support Items by Education Station – list of items purchased by education station and sources for equipment

Folder – STEM Reference Materials

Various STEM reference files

- Aerospace Micro-Lesson 16 – How do Airplanes Fly – An AIAA lesson plan
- Flyer_Web – AUVSI reference file on flying sUAS
- K-12 UAS Education Applications – results of a web search of UAS related education materials that may be of use. This is a reference file with links
- KBYF_Brochure_WEB – FAA “Know Before You Fly” brochure
- Safetyinsert-bestbuy – brochure of AMA and FAA KBYF information
- STEM Slides for Reference – PowerPoint report on STEM Outreach events at NMSU
- UAS Roadshow Laguna Picture Show – PowerPoint report on STEM Outreach event at the Laguna Pueblo
- UAS Websites from the FAA – list provided by the FAA at the onset of this outreach

Folder – Press – Cost Share – In Kind

Various files

- Email for Political Folks UAS STEM Event at NMSU on October 27 – part press release and part instruction for the Laguna event
- Email for Political Folks UAS STEM Event at NMSU on September 26 – part press release and part instruction for the NMSU stadium/arena event
- FAA UAS OUTREACH PRESS Guidance – event day information for attending press
- In-Kind for Roadshow Events – Blank form for in-kind support

Folder – STEM Materials from Tuskegee

Various files used by Tuskegee University for their Roadshows

- Agriculture (UAV) – poster of agriculture uses
- Drone Day Banner
- Drone Day – Outreach objectives and activities
- Geese Take off in Slow Motion – video
- Ornithopter – video
- Physics of Flight – Drone Day – PowerPoint presentation for student education
- Posters – various UAS use case posters
- Programming AR2 Parrot

- UAS – Drone Day – education presentation
- UAS poster 3 for Surveillance
- UAV Terrain Poster

Folder – STEM Presentation Materials from NMSU

Various files used by New Mexico State University for their Roadshows

- UAS STEM Outreach Briefing Oct 2016 – PowerPoint presentation
- Final UAS Script for UAS Roadshow Education Station– script used for “blue board” presentation at Education Station
- Final UAS Script for UAS Roadshow Education Station with Images – script with images used for “blue board” presentation at Education Station
- Final UAS Script for UAS Roadshow Education Station – print file for 11”x17” images to be used for “blue board” presentation
- Final UAS Script for UAS Roadshow Safety and Careers Station with Images – script used for “blue board” presentation at Safety and Careers Station
- Education Images Final – Print File – print file for 11”x17” images to be used for “blue board” presentation
- Career Images Final – Print File – print file for 11”x17” images to be used for “blue board” presentation
- Blue Board – PowerPoint instruction to make a Blue Board

3 UAS Summer Camps

The UAS Summer Camps at each university were different. Like the UAS Roadshows, there were many common elements, but each school took advantage of the in hand and established resources. The initial goal offered to the FAA was to support ~25 student's full day for one week of camp. The goal was to reach 50 total students. As noted below, the response in some cases was so overwhelmingly positive that additional opportunities were provided.

The plan was to develop project-based hands-on learning opportunities for students from under-represented groups using UAS as a learning platform. Students from 5-12 grades were targeted for the structured summer programs. Tuskegee focused on High School students and NMSU focused on the Middle School aged students. Both the Universities leveraged current networks with school districts, teachers and parents. Both Universities used their existing facilities and resources to the greatest extent possible.

The summer camp effort required specific value centered curricula development. The hands-on activities from the Roadshow events were used in part for these camps, with new more detailed curricula developed. One of the outcomes of this was to develop a detailed "how to" that included all of the curricula, planning, materials lists, support, etc. so the UAS learning experiences can be easily adapted to other locations. This could easily provide ASSURE schools and affiliates a solid foundation to set up summer programs in their areas. The sections below provide information on each camp.

3.1 Tuskegee University UAS Summer Camp

Tuskegee University's "Camp Drone Zone" was held from June 19 to June 23, 2017. The initial plan was for 25 participants, 30 accepted, and in the end 20 students participated. A probable cause for this reduction in numbers was transportation issues (rural county, dependence on school buses). The highlights of the camp were;

- Physics of Flight
- Using Excel (Data entry, formulas, graphing)
- Ozobot programming and Maze Running Competition
- Drone programming and Obstacle Course Competition

3.1.1 Tuskegee University UAS Summer Camp Schedule

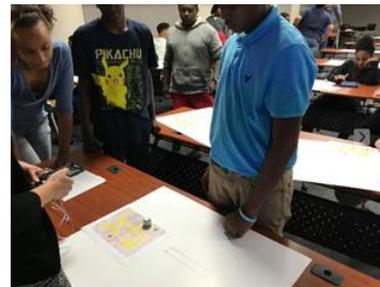
The Tuskegee University Camp Drone Zone Schedule was as follows:

- Monday, June 19 (Day -1)
 - 0830 - 0930 Registration
 - 0930 - 1030 Introduction
 - 1030 - 1100 Ice breaker
 - 1100 - 1145 Physics of Flight
 - 1145 - 1315 Lunch
 - 1315 - 1515 Demonstrations (a) Water Tunnel (b) Smoke Tunnel (c) Wind Tunnel
- Tuesday, June 20 (Day -2)
 - 0830 - 0930 Flight Instruments and Aircraft Controls

- 0930 - 1030 Flight Simulator Hands-on
- 1030 - 1130 Introduction to Excel
- 1130 - 1300 Lunch
- 1300 - 1330 Unmanned Aerial Systems
- 1330 - 1515 Teaming and Team Research
- Wednesday, June 21 (Day-3)
 - 0830 - 0930 What is programming
 - 0930 - 1030 Hands-on programming activity
 - 1030 - 1130 Maze runner competition
 - 1130 - 1300 Lunch
 - 1300 - 1415 Team research activity completion
 - 1415 - 1515 Paper airplane competition
- Thursday, June 22 (Day - 4)
 - 0830 - 1000 Team research presentations
 - 1000 - 1130 Hands-on programming activity
 - 1130-1300 Lunch
 - 1300 - 1515 3D printing demonstration and Hands-on drone programming activity
- Friday, June 23 (Day -5)
 - 0830 - 1000 Hands-on drone programming activity
 - 1000 - 1130 Drone derby
 - 1130 - 1300 Lunch
 - 1300 - 1400 Certificate ceremony

3.1.2 Tuskegee University Camp Drop Zone Images

Below are some images from the Tuskegee University's "Camp Drone Zone".







3.1.3 Tuskegee University Participant STEM Perceptions

Below is some feedback from the Tuskegee summer camp. The post Camp Survey had typical comments like the following:

- First off, I liked when we flew the flight simulator. Secondly, I enjoyed when we programmed the ozobots. Lastly, I enjoyed when we programmed and coded our drones in the gym.
- I like how we got to use our iPads to program the ozobots. I also liked the tour we got of the different labs. The last thing I liked was going to eat in the cafe.
- I liked programming ozobots, programming drones, and doing the flight simulator
- Learned how to program a Drone and Ozbot and the competitions
- The Flight Simulator , Flying the Drones , and Lunch

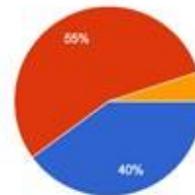
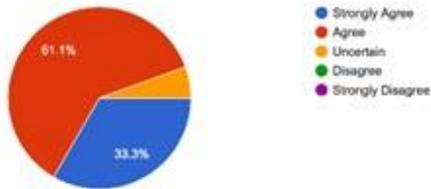
Pretest

Post test

1. Science is useful for the problems of everyday life.

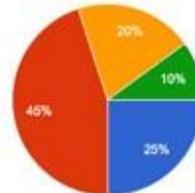
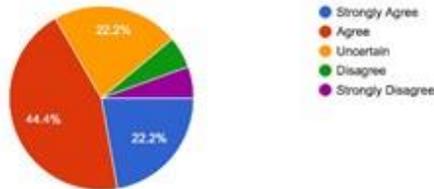
18 responses

Color Palette



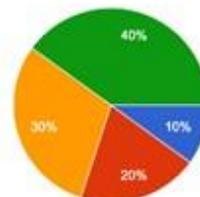
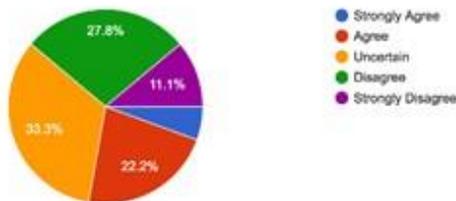
2. Mathematics is something which I enjoy very much.

18 responses



3. I don't do very well in science.

18 responses

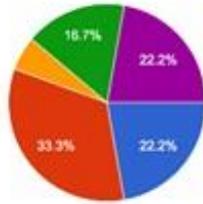


Pretest

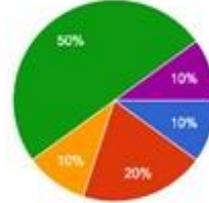
Post test

6. There is little need for mathematics in most jobs.

18 responses

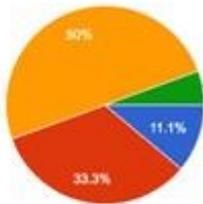


● Strongly Agree
● Agree
● Uncertain
● Disagree
● Strongly Disagree

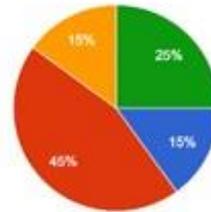


7. Science is easy for me.

18 responses

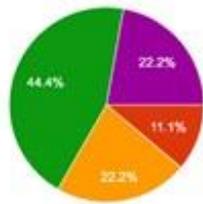


● Strongly Agree
● Agree
● Uncertain
● Disagree
● Strongly Disagree

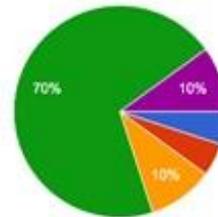


39. No matter how hard I try, I cannot understand science.

18 responses



● Strongly Agree
● Agree
● Uncertain
● Disagree
● Strongly Disagree



Post Camp Survey

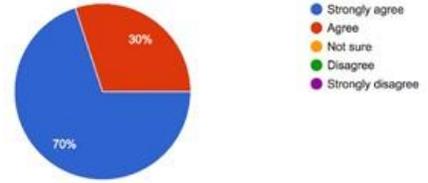
I have learned about how airplanes fly

20 responses



I have learned how to program the Ozobot

20 responses



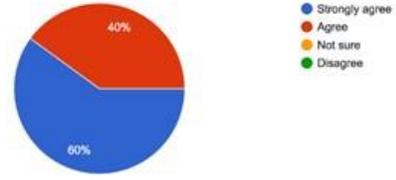
I have learned what are Unmanned Aerial Systems

20 responses



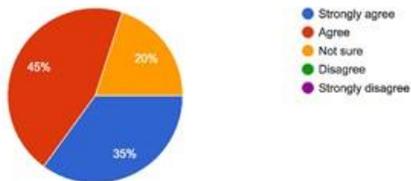
I have learned how to program a drone

20 responses



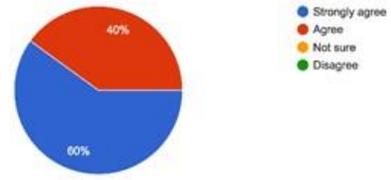
I have learned about the different uses of Unmanned Aerial Systems

20 responses



I have learned how to program a drone

20 responses



DO NOT

Post Camp Survey

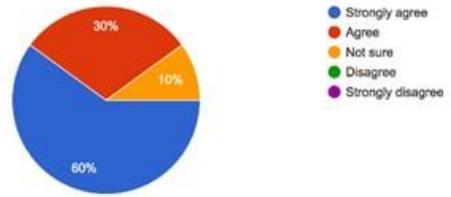
I plan to go to College

20 responses



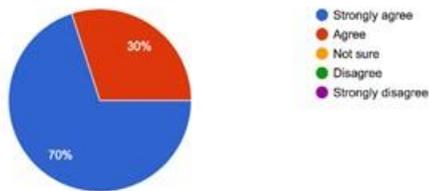
I will get a good job if I study math, science and engineering

20 responses



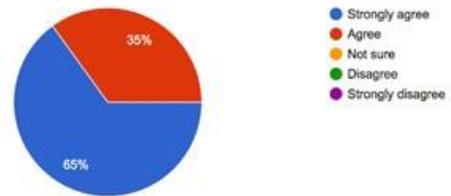
I enjoyed Camp Drone Zone

20 responses



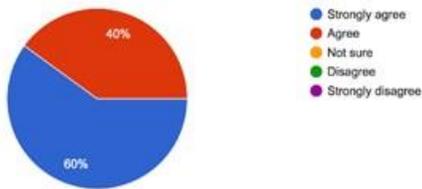
I enjoyed talking to the Professors

20 responses



I enjoyed the demonstrations in the lab

20 responses



I would like more about programming Unmanned Aerial Systems

20 responses



DO NOT

3.2 *New Mexico State University UAS Summer Camps*

The New Mexico State University's UAS Summer Camps had to evolve based on demand. The initial promise to the FAA was for 25 students for 1 week. It appeared demand would be high so camp was split into morning and afternoon classes to double the numbers. This allowed two different sets of students to be taught during each 2 week session. The camp was broken down into ten 2.5 hour sessions. This revised approach now targeted 30 students per class or 60 students total per session, essentially doubling what was initially promised.

The online camp registration was opened and the camp filled in 1.5 days and ended up with 150 on the wait list. This was the best response ever for a NMSU STEM summer camp which NMSU has been doing for many years. After crunching the numbers and assessing budgets, it was decided to offer a second camp. This again doubled the numbers to 120 student slots.

The New Mexico State University's UAS Summer Camps were held two times from June 19 to 30 and July 10 to 21, 2017. The camp program was repeated AM and PM each day of camp. There was some evolution of the materials and teaching for the camps as shown below.

- June 19 to June 30
 - AM session were taught using the originally planned course materials
 - PM session had lesson plans slightly altered based on AM class results.
 - This was an excellent example of real time adaptation of lessons learned.
- July 10 to July 21
 - Course materials and lesson plans were updated based on the first two weeks of classes.
 - Improvements seen in camp flow and instruction.

3.2.1 *New Mexico State University UAS Summer Camp Schedule*

The New Mexico State University Summer Camp Schedule was as follows:

- AM Session 9 to 11:30 AM and PM Session 1 to 3:30 PM (AM session shown below)
- Monday (DAY -1)
 - 9:00-9:30 – Registration/Attendance Name tags
 - 9:30 -10:00 – Flight, what is it, how does it work, Forces etc.
 - 10-11:15 – Teams - Paper airplanes, building different planes and testing distance based on shape and paper used.
 - 11:15-11:30 – Wrap up – discuss what we learned from the paper airplanes and how the different shapes affected distance.
- Tuesday (DAY – 2)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 9:20 – Guest Speaker (TBA)
 - 9:20 – 10:20 – RC Flight Simulator – Fixed Wing Aircraft
 - 10:20 – 11:15 – Use different craft as well as editing their parameters to see how they are affected.
 - 11:15 – 11:30 – Wrap up – discuss how the fixed wing craft controlled compared to the quad copters etc.
- Wednesday (DAY – 3)

- 9:00 – 9:05 – Attendance
- 9:05 – 9:30 – Introduction to the Parrot Sumo and general Drone Safety
- 9:30- 10:00 – Free Drive (Get used to the driving controls)
- 10:00 – 11:15 – Driving Track 1 – Race the track and time it to see which team can get the fastest time
- 11:15 – 11:30 – Wrap up
- Thursday (DAY – 4)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 9:35 – Introduction to programming activity
 - 9:35 – 10:00 – Tynker Software how too
 - 10:00 – 11:15 – Program the Parrot Sumo to run the same track from Day 3 to see if its faster
 - 11:15 – 11:30 – Wrap up
- Friday (DAY -5)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 9:20 – Guest Speaker (TBA)
 - 9:20 – 9:30 – Parrot Mambo Safety and general usage
 - 9:30 – 10:15 – Free Flight - non grabber claw
 - 10:15 – 11:15 – Flight track 1 – Fly the track and track times to see which team is the fastest
 - 11:15 – 11:30 – Wrap up
- Monday (DAY – 6)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 10:00 – Programming the Parrot Mambo
 - 10:00 – 11:15 – Program the Mambo to run a track completely hands free
 - 11:15 -11:30 – Wrap up
- Tuesday (DAY – 7)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 9:15 – Grabber claw
 - 9:15 – 9:55 – Creating a payload with the 3d doodle pins
 - 9:55 – 11:15 – Fly the payload track and drop off your payloads in the designated baskets highest score wins
 - 11:15-11:30 – Wrap up
- Wednesday (DAY – 8)
 - 9:00 – 9:05 – Attendance
 - 9:05 – 9:20 – Camera Overview
 - 9:20 – 10:15 – Camera Challenge Track
 - 10:15 – 11:15 – Program Camera Track Challenge
 - 11:15 – 11:30 – Wrap up
- Thursday (DAY – 9)
 - Meet at the LAS CRUCES Airport
 - 9:00 – 9:05 – Attendance
 - 9:05 – 10:00 – Drone Demos
 - 10:00 – 11:15 – Free Flight/Programming
 - 11:15 – 11:30
- Friday (DAY – 10)

- 9:00 – 9:05 – Attendance
- 9:05 – 11:15 – Final Drone Challenge – Advanced track
- 11:15 – 11:30 – Final Wrap up

A single summary graphic that covers the instruction over the 10 days of camp is show below. This presents the focus and tools of each day of the camp.

NMSU – UAS Summer Camp

1. Aviation Education and Flight Safety



2. Flight Simulator Time



Close to 120 students participated in the NMSU UAV Summer Camp!



3. Driving, 4. Programming, and 5. Payload Challenge with Ground Bots

6. Flying, 7. Programming, and 8. Payload Challenge with Mini Drones

9. UAS Flight Test Site Visit

10. Combined Challenge with Ground and Flight Vehicles

3.2.2 New Mexico State University UAS Summer Camp Images

Below are some images from the New Mexico State University's UAS Summer Camp.



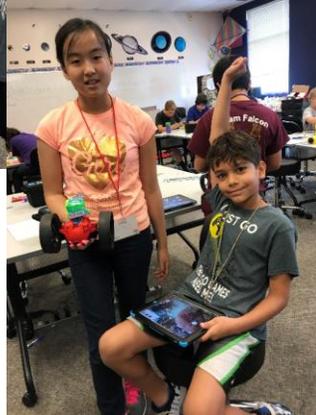
Free Driving



Programming Course Challenge



Ground Payload Challenge



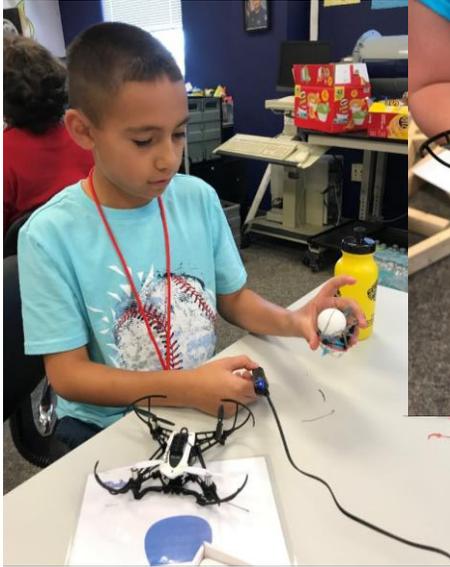
Ground Payload Challenge

Outdoor Flight Challenge Course



Free Flight
and
Programming





Airborne
Payload Challenge



Payload Challenge



Visit to the NMSU Flight Test Site



Talks by professionals in the industry
Tour of site and vehicles
Flight demonstration



Drive and Flight Challenges in the hangar





116 Students in 4 camp sessions

3.3 *New Mexico State University UAS Summer Camp Evaluations*

This section provides an overview and a brief review of the student's engagement and assessment of the flight summer camp that was facilitated by STEM outreach center in 2017. The summer camp lasted ten days, Monday through Friday with one group from 9:00 – 11:30 and a second group from 1:00 – 3:30 June 19 – June 30 and another session July 10 – July 21. At the end of the ten days for each camp period, the students took a survey. Below is an overall response to the survey

3.3.1 *New Mexico State University UAS Summer Camp Summary for June Survey*

We had 42 students participants take the survey. All students (100%) agreed to have enjoyed the unmanned aerial camp. Students also agreed that they learned a lot about drones. Two types of drones were used in the camp; the land unmanned vehicle and the air unmanned vehicles. Almost all students (95%) preferred the land unmanned vehicles more so than the air unmanned vehicles (36%) although all of them agreed to have enjoyed the unmanned vehicles with the exception of 5% of students who did not enjoy the air unmanned vehicle.

The students' understanding and execution of programming with respect to the unmanned vehicles was strong. 95% of the students said so. The camp achieved its aim of fostering peer to peer relationship amongst the students. Almost all students (98%) were satisfied working with other students. More than half of our student participants (69%) were excited to continue learning about programming and unmanned vehicles in the future while 9% of them were not interested.

UAS Drone Camp – Student Survey Question Results (June 19th - June 30th)

- | | | |
|---|--------------------|----------------------|
| 1. Overall, I enjoyed the Drone/Unmanned Aerial and Land Vehicles Camp | Strongly Agree- 33 | Strongly Disagree- |
| | Agree- 9 | Disagree- |
| 2. I learned a lot about drones! | Strongly Agree- 17 | Strongly Disagree- |
| | Agree- 24 | Disagree- 1 |
| 3. I enjoyed the land unmanned vehicle that we used (red one with big wheels.) | Strongly Agree- 40 | Strongly Disagree- |
| | Agree- 2 | Disagree- |
| 4. I enjoyed and learned useful information using the flying unmanned vehicle | Strongly Agree- 15 | Strongly Disagree |
| | Agree- 16 | Disagree- 2 |
| 5. The programming of the vehicles was useful and I understood how to do it. | Strongly Agree- 15 | Strongly Disagree- |
| | Agree- 16 | Disagree- 2 |
| 6. Working with other students was a good experience. | Strongly Agree- 18 | Strongly Disagree- |
| | Agree- 14 | Disagree- 1 |
| 7. I want to learn more about programming as well as the use of unmanned vehicles today and for the future. | Strongly Agree- 15 | Strongly Disagree- 2 |
| | Agree- 14 | Disagree- 2 |

UAS Drone Camp – Student Survey Question Results (Comments Section)

1. Overall, I enjoyed the Drone/Unmanned Aerial and Land Vehicles Camp
 - I think it was cool and fun.
 - It was fun!!
 - I enjoyed how we can free drive
 - The whole experience was well planned and enjoyable. The whole camp was laugh and smiles!
 - It was fun
 - I like controlling the drones
 - It was fun and funny
 - I learned a lot from Drew and Michael
 - This was a great camp and would like to do it again
 - I learned from Michael while Drew babysat us
 - The camp is very fun and teaches a lot about drones. We did lots of cool stuff, and the instructors are very nice and have a sense of humor. Overall a great camp.
 - Flying drones are fun
 - It was great
 - Its fun flying/driving drones
 - Driving the sumos was fun
 - Maybe if kids are messing around punish them because they were mostly wild.
 - I enjoyed learning about drones.
 - They are hard to control
 - It was really fun and I loved the 3doodlers
 - It was so fun. I loved it
 - It was a good camp
 - It is good
 - I had a lot of fun. I am glad I decided to come!
 - It was fun. I'm really glad I came.
2. I learned a lot about drones!
 - I already knew a lot about drones
 - I had fun. I learned how to program
 - I learned how to program and fly drones
 - M and D are good
 - I learned how to drive and program drones
 - I learned that if you fly the mambos close to the ground, it will be harder to control.
 - I can fly now!
 - When we went to the airport we learned a lot for sure. We also learned to fly them
 - I learned some things about drones but not a lot
 - Drew and Michael are crazy and fun
 - The camp was good and the instructors have a good humor they are very nice
 - Yes, I did
 - I know how to fly
 - It was ok

- The flying and driving was a true learning experience with coding and controlling!
 - Before I did not know a lot about drones
 - I guess I did
 - I learned a lot about aircraft and I had a fun experience
 - The drones they were shown off were cool. I also learned of a good model of RC plane
3. I enjoyed the land unmanned vehicle that we used (red one with big wheels.)
- I never used one and was thrilled to drive it
 - I loved controlling the jumping sumo and I learned how to control drones better
 - I crashed it
 - I did enjoy them
 - I really enjoyed the jumping and driving
 - This one was my favorite thing
 - They are fun
 - Yes I tried so many times and it went in the trash
 - Drew and Michael helped us out a lot when we were confused and it was super fun
 - The jumping sumo was fun to play with
 - I played trick on Drew with them
 - I loved doing the land drones. The courses were super fun and fast
 - Long battery and a camera. What's not to love?
 - This was my favorite part.
 - They are better than flying drones
 - I like how you can see where you're going with the camera
 - I enjoyed the drone because I like driving on the ground
 - Easy to control
 - I had so much fun
 - I loved driving them. I had fun!
 - They were fun to drive
4. I enjoyed and learned useful information using the flying unmanned vehicle
- This summer camp was fun
 - I enjoyed but didn't learn a lot
 - Drew was standing in the way so I crashed
 - I know how to properly handle one now
 - I still don't know that much about the Mambos
 - This space kills trees
 - The mambo we used are really hard to control and they crash. It would have been better if there were less wind. Not that you can control the weather.
 - I learned how to fly and take care of drones
 - I had fun!
 - I knew a little already
5. The programming of the vehicles was useful and I understood how to do it.
- Yes!
 - I didn't get it at first but I got it
 - Cant program
 - I have used scratch before and Tynker was basically the same

- It was easy to understand
 - I've had experience
 - I love coding so that was fun
 - It was hilarious
 - The programming was easy not hard
 - When we had free time with the jumping sumos we played tricks on Drew
6. Working with other students was a good experience.
- Drew and Michael are funny
 - The people I worked with were great
 - I made new friends
 - I thought that when we were coding. I had fun working with partners
 - Minor distractions
 - Fun
 - Oooooweeee!
 - I liked working with my Brother, and our friends Owen and Eli.
 - Most of them were to wild and sometimes even almost broke the drones
 - I made friends.
 - I made two friends.
 - I had fun mingling with other students
 - Yes, I made a new friend!
7. I want to learn more about programming as well as the use of unmanned vehicles today and for the future.
- I would want to deliver pizza!
 - I had more fun than I ever thought.
 - 3doodler
 - This camp was kind of fun, but I don't really want this to be my career.
 - It was fun, but I'm not interested in drones as a career.
 - Yes!
 - Yes, because I think programing is a good skill to have and a great hobby
 - Do this next year
 - I want to see drones in my future job
 - Drew is my favorite teacher and Michael is my 2nd favorite.

3.3.2 *New Mexico State University UAS Summer Camp Summary for July Survey*

We had 43 students participants take the survey. All students (100%) agreed to have enjoyed the unmanned aerial camp. Students also agreed that they learned a lot about drones. Almost all students (95%) agreed to have learned a lot about drones. Two types of drones were used in the camp; the land unmanned vehicle and the air unmanned vehicles. Almost all students liked the unmanned vehicles. 95% of them liked the land unmanned vehicles and 93% of them liked the air unmanned vehicles.

The students' understanding and execution of programming with respect to the unmanned vehicles for the July camp was also strong since 84% of the students easily understood the programming section. The camp achieved its aim of fostering peer to peer relationship amongst the students.

Almost all students (84%) were satisfied working with other students. More than half of our student participants (86%) were excited to continue learning about programming and unmanned vehicles in the future while 9% of them were not interested. Finally, we asked them about their visitation to the hangar; 86% of them found the visitation to be informative and interesting.

UAS Drone Camp – Student Survey Question Results (July 10th – July 21st)

- | | | |
|---|--------------------|----------------------|
| 1. Overall, I enjoyed the Drone/Unmanned Aerial and Land Vehicles camp. | Strongly agree-27 | Strongly disagree- 0 |
| | Agree- 16 | Disagree- 0 |
| 2. I learned a lot about drones! | Strongly agree- 19 | Strongly disagree- 2 |
| | Agree- 22 | Disagree- 0 |
| 3. I enjoyed the land unmanned vehicle that we used (red one with big wheels). | Strongly agree- 27 | Strongly disagree- 1 |
| | Agree- 14 | Disagree- 1 |
| 4. I enjoyed and learned useful information using the flying unmanned vehicle. | Strongly agree- 28 | Strongly disagree- 0 |
| | Agree- 12 | Disagree- 3 |
| 5. The programming of the vehicles was useful and I understood how to do it. | Strongly agree- 14 | Strongly disagree- 0 |
| | Agree- 22 | Disagree- 4 |
| 6. Working with other students was a good experience. | Strongly agree- 15 | Strongly disagree- 1 |
| | Agree- 21 | Disagree- 4 |
| 7. I want to learn more about programming as well as the use of unmanned vehicles today and for the future. | Strongly agree- 19 | Strongly disagree- 1 |
| | Agree- 18 | Disagree- 3 |
| 8. The day visiting the hangar with the large drones was informative and interesting. | Strongly agree- 31 | Strongly disagree- 1 |
| | Agree- 6 | Disagree- 1 |

NMSU UAS Drone Camp – Student Survey Question Results (Comments Section)

- Overall, I enjoyed the Drone/Unmanned Aerial and Land Vehicles camp.
 - It was really fun
 - Alex and Michael are cool
 - I actually would say that it was ok.
 - It's fun
 - I really enjoyed coming!
 - Only flying drones
 - Michael is fun
 - I extremely enjoyed everything we did
 - The programming was flawed
 - Because it was fun and because I crashed into the wall!

- I loved camp. It was fun and awesome and cool.
2. I learned a lot about drones!
 - I would say that, because I now know how to control one
 - A ton of facts
 - Learned nothing
 - I think the camp was targeting younger students than me
 - I learned how they move and how to control a drone and other things too.
3. I enjoyed the land unmanned vehicle that we used (red one with big wheels).
 - Lots of fun to drive
 - Boring
 - They were really cool
 - Because I jumped into the bowls
 - It was fun and the first day of playing with the first drone it was a spy bot
4. I enjoyed and learned useful information using the flying unmanned vehicle.
 - Fun
5. The programming of the vehicles was useful and I understood how to do it.
 - I understood how to do it but it was difficult
 - It was hard
 - Some data was confusing
 - Tinker is a terrible thing
 - I understand it completely and I had fun doing it
 - Little confusing at first until you get the hang of them
 - Not very useful, lots of problems, lots of variables we can't control
6. Working with other students was a good experience.
 - Just no
 - I don't think that everyone here was really being calm or at least respectful
 - Okay
7. I want to learn more about programming as well as the use of unmanned vehicles today and for the future.
 - It was okay
 - I want to learn on how to program the software, but not with the drones.
8. The day visiting the hangar with the large drones was informative and interesting.
 - I enjoyed being here a lot, thank you for teaching the class
 - So much fun to see a lot of drones and meet pilots.
 - I loved it



4 Summary

This UAS Minority STEM Outreach effort using UAS as the central learning platform was a success for both Universities and the FAA. As shown below, over 1,200 students were reached through all of the events and summer camps.

School	Date	Description	Location	Number of Students
Tuskegee	9/22/2016	UAS Roadshow	Tuskegee Institute Middle School	65
NMSU	9/26/2016	UAS Roadshow	NMSU Basketball Arena, 8 th grade Middle school students from Las Cruces, NM	500
Tuskegee	10/18/2016	UAS Roadshow	St. Joseph School, Tuskegee (abbreviated event)	15
NMSU	10/27/2016	UAS Roadshow	Laguna Elementary School, Laguna Pueblo, NM – 3 rd , 4 th , 5 th , and 6 th grade students	94
Tuskegee	11/3/2016	UAS Roadshow	Notasulga School	60
NMSU	3/3/2017	UAS Roadshow	“The 2017 STEM Discovery Showcase” at the Dõna Ana Community College – The day was focused on STEM outreach to local high school students (there were 7 or more of the local schools in attendance) and to some of the Community College students	300
Tuskegee	June 19 to 23, 2017	Summer Camp	Tuskegee University	20
NMSU	June 19 to 30, 2017	Summer Camp	New Mexico State University	57
NMSU	July 10 to 21, 2017	Summer Camp	New Mexico State University	59
Tuskegee	10/5/2017	UAS Roadshow	Tuskegee Middle School	65

Total 1235

All of the UAS Roadshow materials were provided to the FAA. Copies of the UAS summer camp curricula were also provided to the FAA. It is hoped that these materials can be disseminated widely to offer these unique experiences to this next generation of aviation enthusiasts.