Summer Residential Experience Final Report

PI Name: Dr. Joseph O. Arumala
Institution Name: University of Maryland Eastern Shore

Camp Name	Camp Start Date	Camp End Date
HAWKS MUREP PSI (80NSSC22M0139)	July 10, 2022	July 22, 2022

2022 HAWKS MUREP PRECOLLEGE SUMMER INSTITUTE

SUMMER RESIDENTIAL EXPERIENCE

FINAL SCHEDULE OF ACTIVITIES

Sunday, July 10. 2022 Participants Arrive on UMES Campus and checked into **HARFORD HALL** from 5:00 p.m.			
Week 1			
	Monday, July 11, 2022		
	Activity	Location	Assigned to
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Residence Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 11:00 AM	UMES Campus Tour, Facilities & Laboratories	UMES	Dr. Zhang
11:00 AM – 1:00 PM	Lunch	SSC	Student Assistant
1:30 PM – 4:00 PM	Wind Tunnel Design & Testing	EASC	Dr. Brown
4:30 PM – 6:00 PM	Dinner	SSC	Student Assistant
6:30 PM – 9:00 PM	Reflection on day's activities and briefing for next day's activities.	ATC 1162	Dr. Dabipi
9:30 PM – 6:00 AM	Retire to Rooms for the Night.	Harford Hall	Residence Assistant

Week 1			
	Tuesday, July 12, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Residence Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Residence Assistant
9:30 AM – 10:30 AM	SAT Preparation - English Session	ATC 1162	Ms. Carrol
10:30 AM - 11:30 AM	SAT Preparation - Mathematics Session	ATC 1162	Mr. Salih
11:30 AM – 1:00 PM	Lunch	SSC	Student Assistant
1:30 PM – 4:00 PM	Wind Tunnel Design & Testing	EASC	Drs. Brown
4:30 PM - 6:00 PM	Dinner	SSC	Student Assistant
6:30 PM – 9:00 PM	STEM Mentoring	EASC	Dr. Dabipi
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 1			
	Wednesday, July 13, 2022		
	Activity	Location	Assigned To
6:00 AM - 8:00 AM	Wake-Up & Personal Grooming	Harford Hall	Residence Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Residence Assistant
9:00 AM – 10:00 AM	NASA Wallops Flight Facility Virtual Tour	EASC Auditorium	Ms. Benner
10:15 AM – 11:00 AM	NASA WFF Internship/Student Opportunity Session	EASC Auditorium	Ms. Benner
11:00 AM – 11:30 AM	UMES Precollege Support	EASC Auditorium	Ms. Benner
11:30 AM – 1:00 PM	Lunch	SSC	Student Assistant
1:30 PM – 4:00 PM	Flight Simulator & Safety Training	EASC	Dr. Brown
4:00 PM – 6:00 PM	Dinner	SSC	Student Assistant
6:30 PM – 9:00 PM	Reflection on day's activities and briefing for next day's activities.	EASC	Dr. Dabipi
9:30 PM – 6:00 AM	Retire to Rooms for the Night	Harford Hall	Residence Assistant

Week 1			
	Thursday, July 14, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:00 AM – 4:00 PM	Field Trip to Virginia Space Center	Hampton, Virginia	Dr. Arumala
4:30 PM - 6:00 PM	Dinner	SSC	Student Assistant
6:30 PM – 9:00 PM	STEM Mentoring	EASC	Dr. Dabipi
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 1			
	Friday, July 15, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 10:30 AM	SAT Preparation - English Session	ATC 1162	Ms.. Carroll
10:30 AM - 11:30 AM	SAT Preparation - Mathematics Session	ATC 1162	Mr. Salih
11:30 AM – 1:00 PM	Lunch	SSC	Student Resident
1:30 PM – 4:00 PM	iOS APP Development with Swift.	EASC	Dr. Zhu-Stone
4:30 PM - 6:00 PM	Dinner	SSC	Resident Assistant
6:30 PM – 9:00 PM	Reflection on day's activities and briefing for next day's activities.	EASC	Dr. Dabipi
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 2			
	Monday, July 18, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 10:30 AM	SAT Preparation - English Session	ATC 1162	Ms. Carroll
10:30 AM - 11:30 AM	SAT Preparation - Mathematics Session	ATC 1162	Mr. Salih
11:30 AM – 1:00 PM	Lunch	SSC	Student Assistant
1:30 PM – 4:00 PM	iOS APP Development with Swift.	EASC	Dr. Zhu-Stone
4:30 PM - 6:00 PM	Dinner	SSC	Resident Assistant
6:30 PM – 9:00 PM	Virtual Reality Lab Activities.	EASC	Dr. Zhang
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 2			
	Tuesday, July 19, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 10:30 AM	SAT Preparation – English Session	EASC Auditorium	Ms. Carroll
10:30 AM – 11:30 AM	STEM College Programs & STEM Careers	EASC Auditorium	Dr. Dabipi
11:30 AM – 1:00 PM	Lunch	SSC	Student Assistant
1:30 PM – 4:00 PM	Flight Simulator & Safety Training	EASC	Dr. Brown
4:30 PM - 6:00 PM	Dinner	SSC	Student Assistant
6:30 PM – 9:00 PM	Virtual Reality Lab Activities.	EASC	Dr. Zhang
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 2			
	Wednesday, July 20, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 4:00 PM	Visit to Goddard Space Flight Center	Greenbelt, MD	Brian Ash
4:30 PM - 6:00 PM	Dinner	SSC	Resident Assistant
6:30 PM – 9:00 PM	Reflection on day's activities and briefing for next day's activities/STEM Mentoring.	EASC	Dr. Dabipi,
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 2			
	Thursday, July 21, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Harford Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 A.M. - 10:30 A.M.	SAT Preparation – English Session	ATC 1162	Ms. Carroll
10:30 AM - 11:30 AM	STEM College Programs & STEM Careers	ATC 1162	Dr. Dabipi
11:30 AM – 1:00 PM	Lunch	SSC	Student Resident
1:30 PM – 4:00 PM	Job & Career Counselling	EASC	Dr. Dabipi
4:30 PM - 6:00 PM	Dinner	SSC	Resident Assistant
6:30 PM – 7:30 PM	Aerospace Virtual Lecture	ATC 1162	Dr. Reed
8:00 PM – 9:00 PM	Reflection on day's activities and briefing for next day's activities.	EASC	Dr. Dabipi
9:30 PM- 6:00 AM	Retire to Rooms for the Night	Harford Hall	Resident Assistant

Week 2			
	Friday, July 22, 2022		
	Activity	Location	Assigned To
6:00 AM – 7:30 AM	Wake-Up & Personal Grooming	Wicomico Hall	Resident Assistant
8:00 AM – 9:00 AM	Breakfast	SSC	Resident Assistant
9:30 AM – 10:30 AM	Student Presentations	ATC 1162	Ms. Carroll
10:30 AM - 11:30 AM	Closing Ceremony	ATC 1162	Institute Staff
11:30 AM – 1:00 PM	Lunch	SSC	Student Resident
1:30 PM – 4:00 PM	**PARTIPANTS DEPART FOR HOME**		
4:30 PM - 6:00 PM			
6:30 PM – 9:00 PM			
9:30 PM- 6:00 AM			

Actual Final Camp Hours with Three Key Program Elements:

Total Camp Hours	Authentic STEM Activities Total Hours	Engagement Opportunities with STEM Professionals Total Hours	College and Career Readiness Development Activities Total Hours
286	**24**	**13**	**10**

The details of the Three Key Program Elements are shown below:

AUTHETIC STEM ACTIVITIES		
	ACTIVITY	**HOURS**
1	Wind Tunnel Design and Testing	5
2	NASA WALLOPS	3
3	Flight Simulator and Safety Training	5
4	iOS App Development with Swift	5
5	Virtual Reality Lab	5
6	Aerospace Virtual Lecture	1

	TOTAL	**24**

ENGAGEMENT OPPORTUNITIES WITH STEM PROFESSIONALS		
	ACTIVITY	**HOURS**
1	Field Trip to NASA Goddard Space Center	5
2	STEM Mentoring	5
3	Field Trip to Virginia Air and Space Museum	3
	TOTAL	**13**

COLLEGE AND CAREER READINESS DEVELOPMENT		
	ACTIVITY	**HOURS**
1	SAT Preparation – Mathematics Sessions	3
2	SAT Preparation – English Sessions	3
3	Internship/Student Opportunity Session	1
4	UMES Precollege Support	1
5	Job & Career Counselling	2
	TOTAL	**10**

Full Description of Project Activities over the Performance of the Award with discussion of Three Key Program Elements:

General Summary:

Authentic STEM Activities:

1. **Wind Tunnel Design & Testing**

The project introduced STEM concepts of NASA practices that involve an integrated approach of curriculum according to the AEROKATS and ROVER Education Network - https://www.globe.gov/web/aren-project/overview (AREN) community model. These concepts are directly related to engineering objectives and project designs that focus on testing, validation, and verification. The explored concepts to develop a wind tunnel design in the constructing process continue to address pre-college areas of STEM education by applying an existing approach for active learning activities. For instances, the concept explored STEM disciplinary options with regard to building the wind tunnel and identifying specific material selections. The concept addressed the understanding of math calculations and graphing of wind speed vs. fan speed measures. The students were introduced to AutoCAD using a commercial computer-aided design and drafting software application to model the requirements of the proposed wind tunnel design with flow. This wind tunnel design using the specific concepts was tested and evaluated according to the system behavior from NASA's *Aeropod* technology (e.g., kite-borne instrumentation technology). The specification in testing and instructional learning served as objectives to promote the requirements of system designs, airspeed measurements at multiples within the test sections, fan speed comparison, the understanding of Benoulli's Principle based on the flow of air through a Venturi tube, application characters, and addressed minimum requirement standards. **Figures 1 – 5 show some of the hands-on Activities in this section.**

Fig 1 Wind Tunnel Construction1

Fig 2 Wind Tunnel Construction2

Fig 3 Wind Tunnel Construction3

Fig 4 Wind Tunnel Construction4

Fig 5 Wind Tunnel Construction

2. NASA Wallops Activities

The University of Maryland Eastern Shore and NASA Wallops Flight Facility has a 40+ years partnership in providing educational opportunities for students. On September 7, 2021, UMES and NASA Wallops signed ***The Space Act Agreement*** to reaffirm the relationship with a formal agreement pledging to develop opportunities for student internships, faculty research and diversifying the aeronautics industry. ***The Space Act Agreement*** calls for "collaborative education, workforce development, research and development, commercialization and testing opportunities on topics of mutual interest to enable a sustained pipeline of diverse talent for science, technology, engineering and mathematics."[1*]

The HAWKS MUREP PSI leveraged the long-standing relationship and the Space Act Agreement with NASA Wallops Flight Facility to provide authentic STEM and NASA Mission based activities to the students admitted to the PSI. The NASA Specialists that facilitated this leverage include **Patricia Benner**, Wallops Flight Facility Education Specialist. These Specialists assisted HAWKS MUREP PSI gain access to NASA Wallops Flight Facility's Professionals, Engineers and Scientists. NASA Wallops is about 30 miles from the UMES campus**. Figures 6 & 7 show Participants during NASA Wallops Flight Facility activity.**

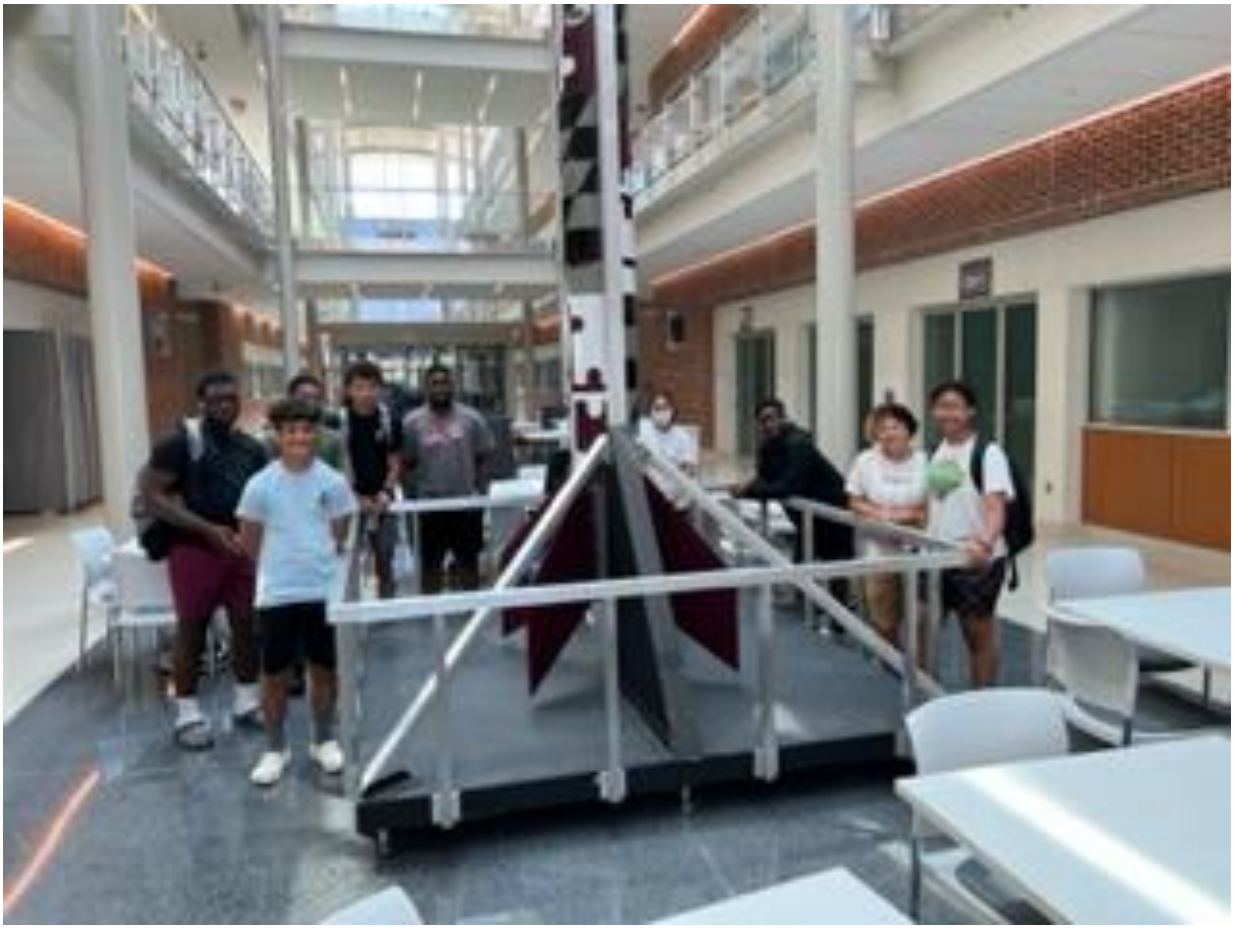

Fig 6 Participants with NASA Donated Rocket to the UMES Engineering Program

Fig 7 Participants with Ms. Benner of NASA Wallops Flight Facility

3. Flight Simulator Experience and Safety Awareness Training

This experience and training was on a Redbird MCX Flight Simulator. The Redbird MCX provides dual pilot controls making it ideal for any flight school providing enhanced training from student pilot to professional crew**. Figures 8 – 11 show Participants on the Flight Simulator.**

Fig 8 A Participant on the Flight Simulator with the Instructor1

Fig 9 A Participant on the Flight Simulator with the Instructor2

Fig 10 A Participant on the Flight Simulator with the Instructor3

Fig 11 A Participant on the Flight Simulator with the Instructor4

4. iOS App Development with Swift

Students learnt to develop iOS App applications using the Swift programming language and the Apple toolset in Xcode. Students also learnt basic concepts about designing intuitive and user interfaces, as well as basic programming knowledge in Swift 5. Five Apps are planned to develop.

Active Learning

1. ***Cornell note-system*** was introduced to students. Students learnt how to actively make notes in lectures.
2. The lectures included the applet design. A lot of professional online tools were introduced to the students, such as harmony color matching and graphic design'
3. Initiated students' imagination and creation in design. Students presented their works in the class which offers an open ***student-evaluating system*** to encourage students to find and learn "good designs" from each other's projects and to make free-lance applets without limiting any imagination.

Figures 12 – 14 below show Participants in this Activity

Fig 12 Participants in the App Programming Activity1

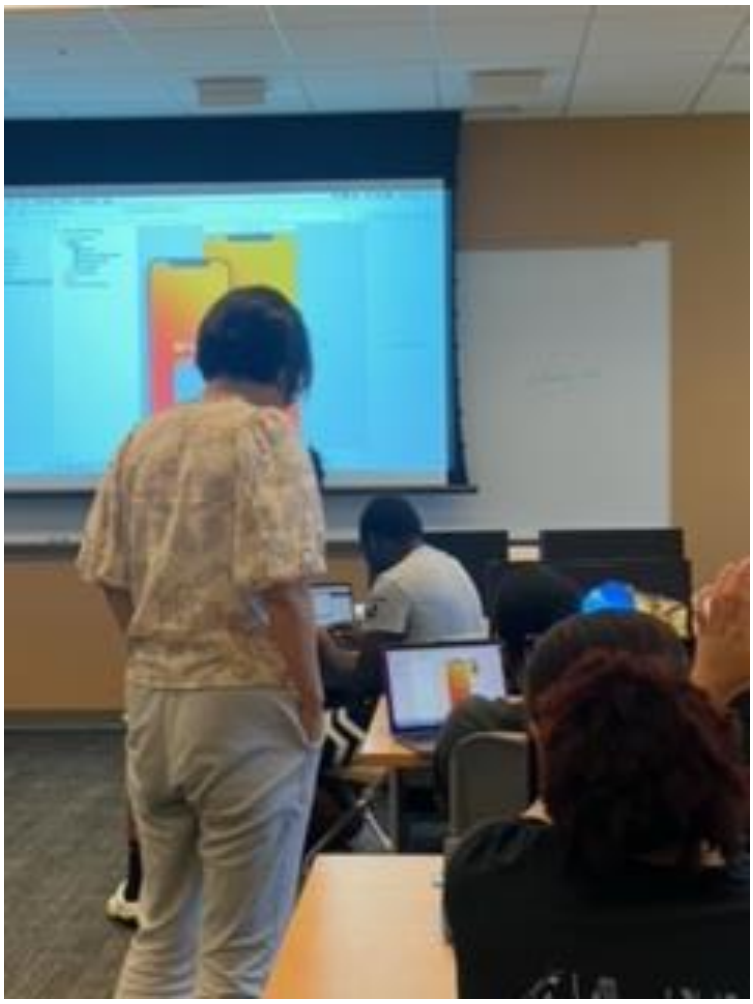

Fig 13 Participants in the App Programming Activity2

Fig 14 Participants in the App Programming Activity3

5. **Virtual Reality Lab**

The areas covered included: Introduction to Virtual Reality, Augmented Reality, and Game-Based-Learning. Demonstration of VR educational modules and VR design and development process in Unity. Discussion on future VR game design and free motion in 3D space. Students also practiced VR playing with the Quest2 VR kits**. Figures 15 & 16 show Participants in the Virtual Reality Lab.**

Fig 15 Participants in the Virtual Reality Lab Activity1

Fig 16 Participants in the Virtual Reality Lab Activity2

Engagement Opportunities with STEM Professionals:

1. Field Trip to NASA Goddard Space Flight Center. There was guided tour of the Center by a NASA Professional**. Figures 17 – 19 show different NASA Goddard Flight Center venues.**

Fig 17 Participants on tour of the NASA Goddard Space Center1

Fig 18 Participants on tour of the NASA Goddard Space Center2

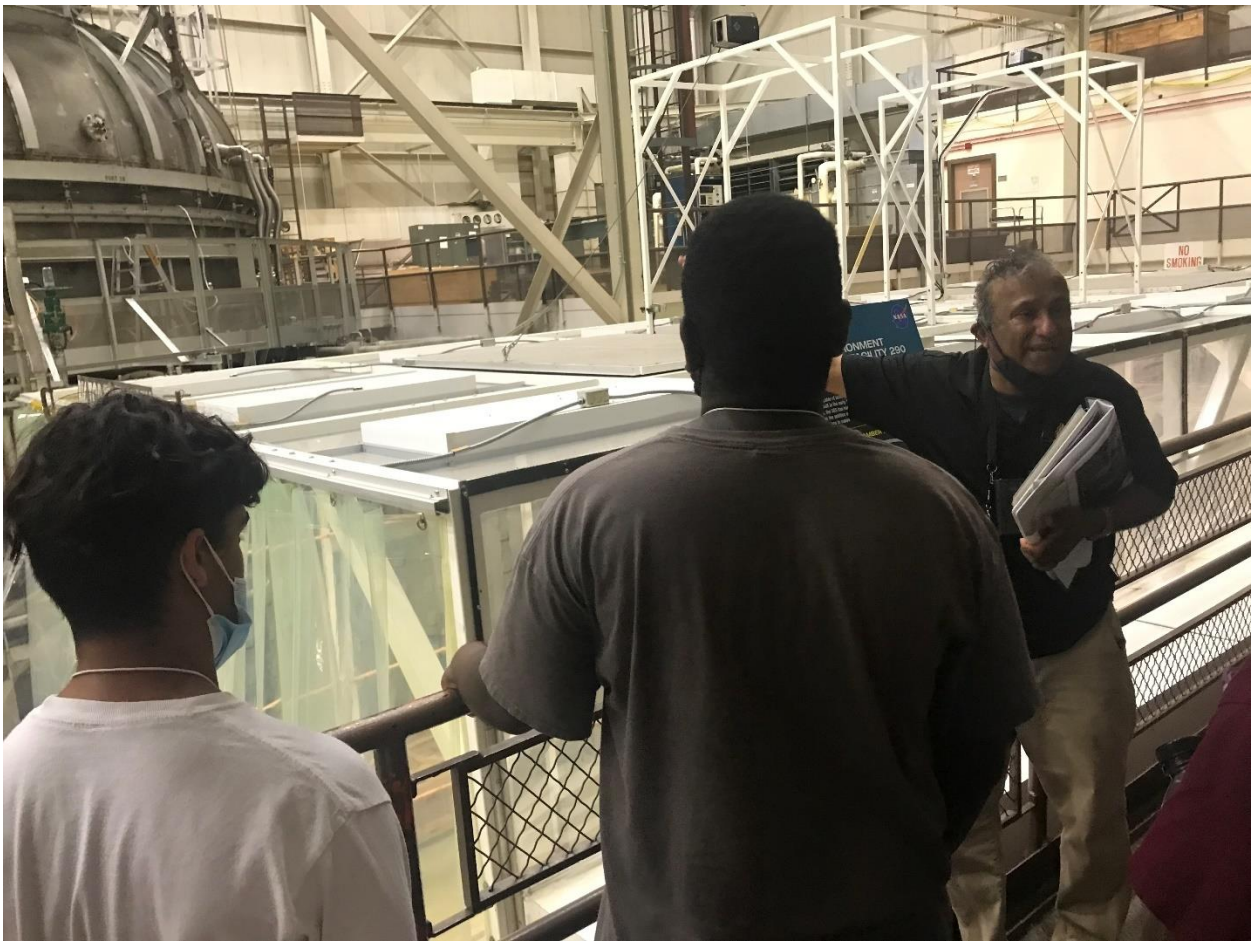

Fig 19 Participants on tour of the NASA Goddard Space Center1

2. STEM Mentoring
3. Field Trip to Virginia Air and Space Center, Hampton, Virginia. **See Figures 20 & 21 below.**

Fig. 20 A view of the Virginia Air & Space Center during the visit1

Fig. 21 A view of the Virginia Air & Space Center during the visit2

4. Erin Reed has previously worked on the Artemis Mission and in different testing roles at the Armstrong Test Facility and now works at Wallops in the Balloon Program Office. She made virtual presentation on Balloons. (SME Connection). **See Fig. 22 below.**

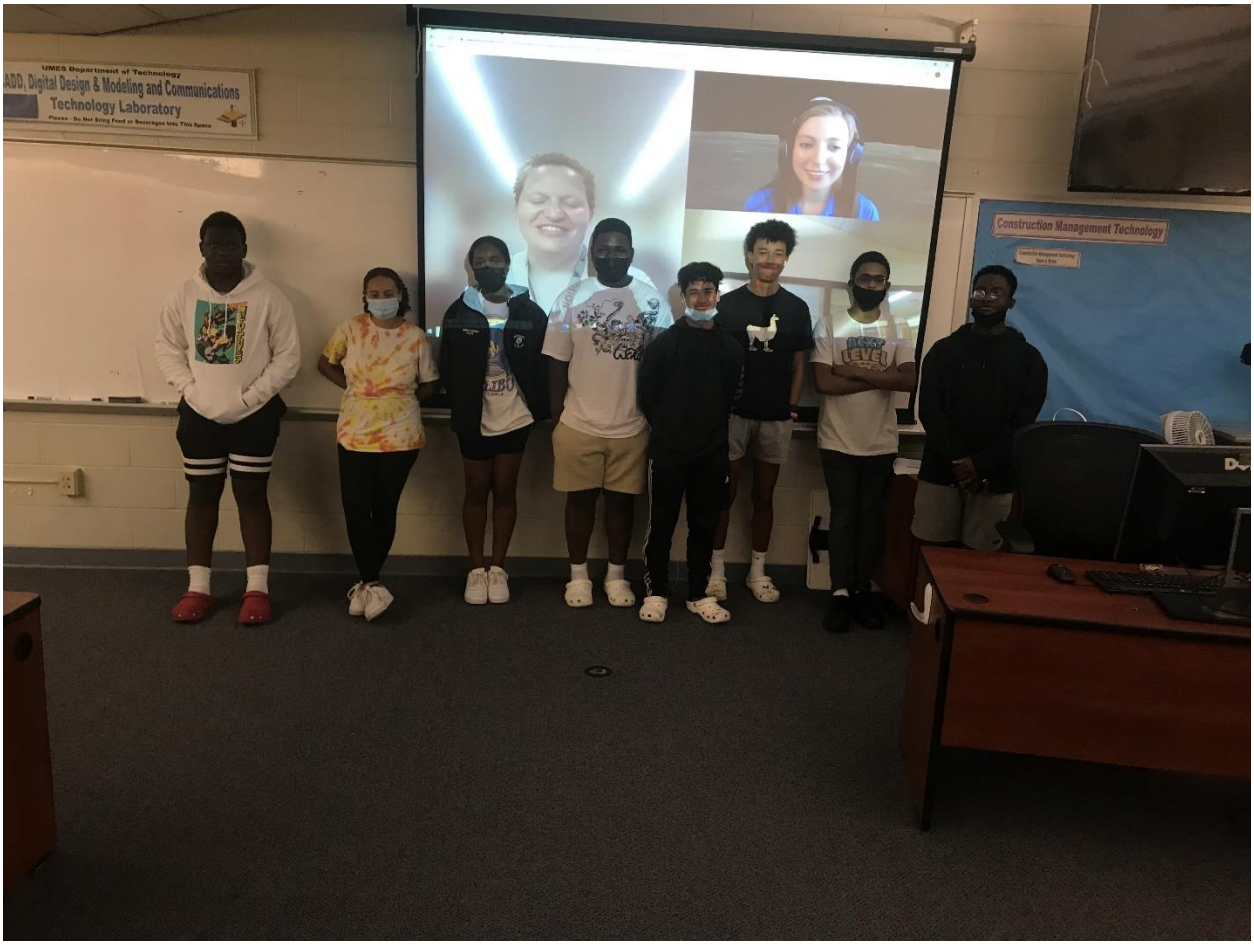

Fig. 22 Participants with Dr. Reed during the Virtual Lecture (Dr. Reed & Adeline on the Screen)

College and Career Readiness Development Activities:

1. SAT English: Used standard SAT preparation materials, worked through sample questions and the participants were each given a copy of KAPLAN's SAT PREP PLUS 2O22 which includes 5 Practice Tests.
2. SAT Mathematics: Used standard SAT preparation materials, worked through sample questions emphasizing the non-calculator section and the calculator section.

See Fig. 23 below

Fig. 23 Participants in an SAT Preparation Class

Closing Ceremony

The Closing Ceremony was held on July 22, 2022. The Participants made presentations on their Institute Experiences and were presented with Certificates of Attendance, Calculators and SAT Study Materials. **See Figures 24 – 27 below**

PARTICIPANT PRESENTATION1.MC

Fig. 24 A Student making a Presentation during the Closing Ceremony1

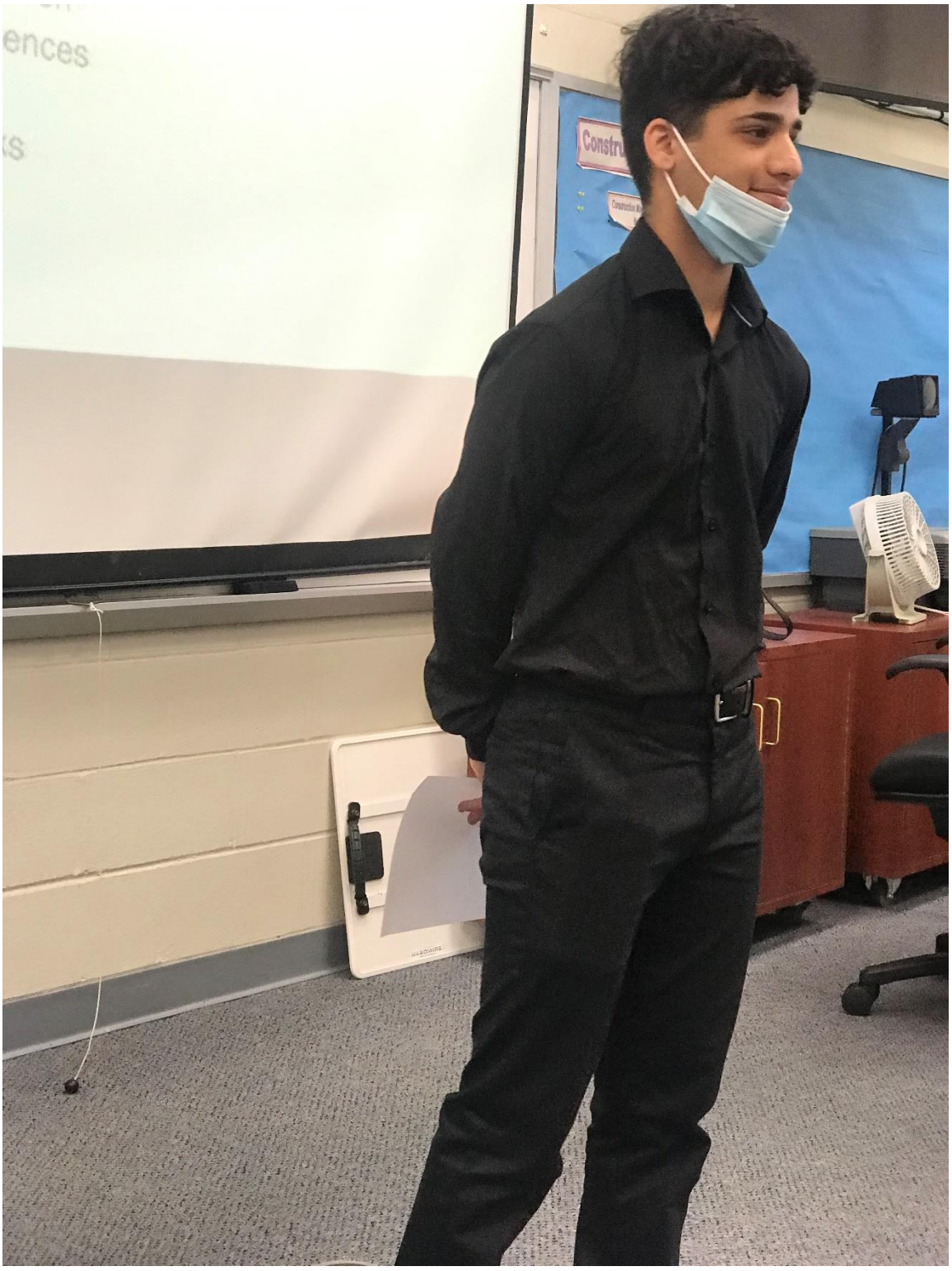

Fig. 25 A Student making a Presentation during the Closing Ceremony2

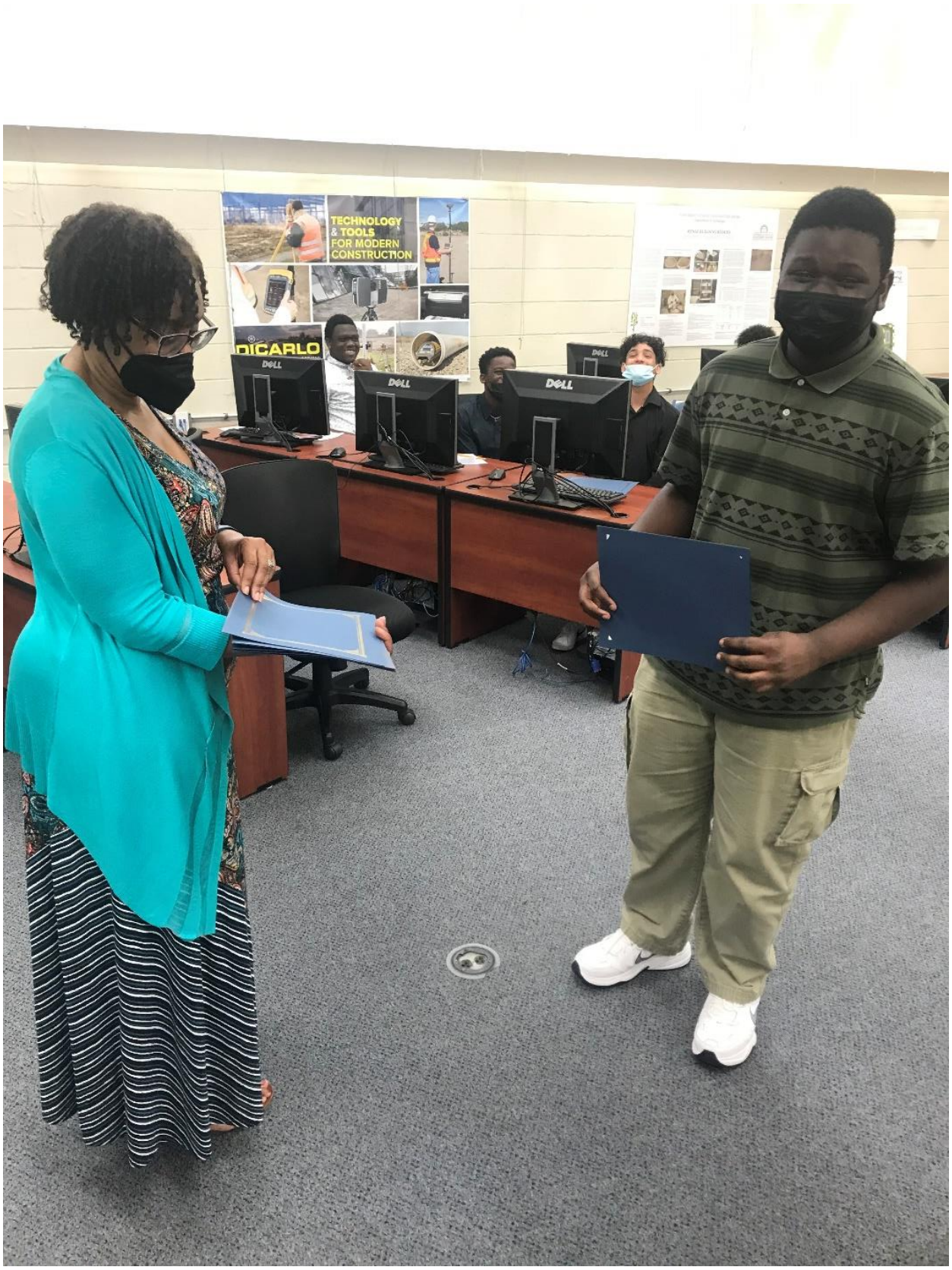

Fig. 26 A Participant receiving his Certificate of Attendance

Fig. 27 Participants with their Certificates and a Parent

Project Accomplishments Versus the Proposed Goal(s) and Objective(s):

PROPOSED GOALS & OBJECTIVES	PROJECT ACCOMPLISHMENTS
Goal 1: Enhance female, historically underserved and underrepresented high school students' STEM identity, skills, and knowledge by engaging them in NASA-based STEM learning activities in aerospace and aeronautics. To achieve this goal, selected NASA Missions Activities will be used including the ***History of NASA***, ***Beginner's Guide to Aerodynamics*** and ***Aircraft Accidents.*** These activities are taken from NASA Mission webpage. In addition, the participants will have the opportunities of working with scientists and engineers working in NASA Wallops Flight Facility	Female, historically underserved and underrepresented high school students' STEM identity, skills, and knowledge were enhanced by engaging them in NASA-based STEM learning activities in aerospace and aeronautics. These activities included Wind Turbine Design and Construction, Flight Simulator and Flight Safety Training, Virtual and in-person Field Trips toNASA Wallops Flight Facility and NASA Goddard Space Center and Virginia Air and Space Museum.

and interacting with those stationed in NASA Goddard Space Flight Center in Greenbelt, Maryland. A field trip will be scheduled to take the participants to Greenbelt for this purpose.	
Goal 2: Increase female, historically underserved and underrepresented high school students' preparedness for college degree programs by building a powerful connection to a HBCU-University of Maryland Eastern Shore's faculty mentors/advisors, and peers who share interests in STEM. The University of Maryland Eastern Shore (UMES) has four-year STEM related undergraduate degree programs in Computer Science, Mathematics, Engineering Technology, Aviation Science and Engineering. Most of the activities in this summer program will be held in the Engineering and Aviation Science Complex (EASC). The EASC houses the Department of Engineering and Aviation Sciences. The mission of the Department is to provide quality professional degree programs, to prepare students for employment in their chosen field, to establish close partnerships with and facilitate technology transfers to industry and government, to prepare students for advanced studies, to contribute to economic development of the State, and to provide related service to the campus community and the community at large. The department offers a Bachelor of Science degree in Engineering with specialization in Aerospace, Computer, Electrical, or Mechanical. The department also offers a Bachelor of Science program in Aviation Sciences with concentration in Aviation Electronics, Aviation Management, Aviation Software, or Professional Pilot. The laboratories in the department are equipped with state-of-the-art instrumentations, developmental	The Strong connection between the student participants and UMES Scientists and Engineers was developed through a STEM Mentoring Session in which participants shared their challenges and take-away gems collectively. The feedback from these daily sessions were share with the Scientist and Engineers hence greatly enhancing their interest on the subject matter and bonding more with the Professionals

hardware, and software tools for teaching and research. The curricula and undergraduate research activities in the department combine strength of engineering fundamentals with hands on and laboratory experiences to reinforce the principles and concepts used in the classroom and to apply the knowledge learned to solve real-world problems in an environment that emphasizes leadership and teamwork. UMES and NASA Scientists and Engineers in the STEM related programs will act as mentors and advisors to the participants in the summer program.	
Goal 3: Increase female, historically underserved and underrepresented high school students' awareness of STEM careers by enabling connections to STEM professionals and NASA's missions. HAWKS MUREP PSI will partner with NASA Wallops Flight Facility (see attached Partnership Letter) to provide opportunities for the student participants to tour NASA Wallops facilities and interact with its Scientists and Engineers. NASA Scientists and Engineers will also act as mentors and advisors to the participants in the summer program.	A Virtual Tour of the NASA Wallops Flight Facility was undertaken. Presentations were made on Summer Internship and career opportunities and resources were made available.
The number of high school students to be accommodated in the HAWKS MUREP Precollege Summer Institute is Fifteen (15).	Student Participants were initially Ten (10) and ended with Eight (8)

Partner / Collaborator Support:

List of Partners* (with type of support provided)*:

HAWKS MUREP PSI partnered with NASA Wallops Flight Facility to provide opportunities for the student participants to have a virtual tour NASA Wallops facilities and interact with its Scientists and Engineers

Summary of Partner Support Provided:

- Virtual Tour of NASA Wallops Flighty Facility
- Internship and Career Opportunities for high school and college students
- Virtual Lecture on Aerospace (Balloon Program) Engineering.

Discussion of how Collaborations and/ or Partnerships Evolved:

We receive positive response the NASA Wallops Fight Facility Team and partnership grew from there. “Thank you for reaching out to WFF’s Education Team. We are interested in supporting your initiatives for high school students. Our team currently supports Job Shadow Day opportunities, internships and other existing programs that we can discuss. If you would be so kind as to send a time frame, the expected number of participants and any additional details to assist our discussion how Wallops can support your proposal, it would be appreciated.
You may be aware that UMES and Wallops Flight Facility recently signed a Space Act Agreement and your MUREP proposal is certainly consistent with the goals of that agreement. We will be happy to provide a letter for your proposal which will state Wallops willingness to support your plans based on availability of our facility and personnel to support it”.

Evidence of How Project Has Furthered Stakeholder Priorities:

“The University of Maryland Eastern Shore (UMES), the state’s historically black 1890 land-grant institution, has its purpose and uniqueness grounded in distinctive learning, discovery and engagement opportunities in the arts and sciences, education, technology, engineering, agriculture, business and health professions.

UMES is a student-centered, doctoral research degree-granting university known for its nationally accredited undergraduate and graduate programs, applied research, and highly valued graduates.

UMES provides individuals, including first generation college students, access to a holistic learning environment that fosters multicultural diversity, academic success, and intellectual and social growth.

UMES prepares graduates to address challenges in a global knowledge-based economy, while maintaining its commitment to meeting the workforce and economic development needs of the Eastern Shore, the state, the nation and the world.”

The HAWKS MUREP PSI certainly fulfilled the mission of UMES and that of NASA Wallops Flight Facility as evidenced by the PSI support and the Regional Interest in the Institute

Link to interview WMDT

External

Inbox

https://www.wmdt.com/2022/07/umes-nasa-partnership-looks-to-create-future-stem-professionals-with-new-summer-program/

Additional Notes:

Developed the HAWKS MUREP PSI Summer Residential Experience Manual.