It has been an exhilarating experience to be part of the MLP / ML RCP since its inception in 2005. Over the years I had the opportunity and privilege to impart knowledge and work with a number of faculty and students. Together we did great research, published papers, and produced future researchers and leaders. But the most satisfying aspect of this program is building an everlasting partnership and friendship.

Dr. Vasu Chakravarthy
Sensors Directorate, AFRL

Ms. DeAnna Brown, Universal Technology Corporation (UTC), who many of you have known through the years, departed UTC in August 2018. DeAnna left to join the Central State University (Wilberforce OH) team to serve as their Administrative Coordinator for the Undergraduate Student Success Center. One of DeAnna’s favorite parts of working the ML RCP, was the opportunity to work with the students. She felt her new position would be the perfect job to allow more time with students. We will greatly miss DeAnna and want to extend our sincere appreciation for her many contributions to the program during the 11 years she was with UTC.

Since 2005, the Air Force Research Laboratory’s (AFRL) Minority Leaders Program (MLP), now referred to as the AFRL Minority Leaders Research Collaboration Program (ML RCP), has been successful in bringing together talented students and faculty members from across the United States to work with Government scientists and engineers in a mentor/protégé’ structured environment. Through this partnership, research capabilities and educational opportunities at Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) were enhanced as well as a strong academic network formed. Basic and applied research efforts in support of AFRL have focused on advancing critical Air Force and national research areas such as nanotechnology, electro-optical materials, composites, and manufacturing technologies.

This program began in 2005 with eight schools involved and has grown to its current status of 37 university participants. Hundreds of university professors and students from undergraduate to doctoral candidates have been involved in the program throughout its existence. Contractual support has primarily been provided to the Materials and Manufacturing and Sensors Directorate of AFRL, but additionally the Information, Aerospace Systems, and Airman Systems Directorates have also participated. Universal Technology Corporation, a small business (Dayton OH), has served as the primary contractor for this effort since 2005 responsible for the execution of the program. Assisting UTC was Clarkson Aerospace, a small disadvantaged business from Houston TX, who coordinated the funding to the universities and provided additional technical and management support. The current contract comes to an end March 2019. This program has primarily been funded with Congressional intent funding. The Government has been working diligently to continue this program and are working through several options. For those of us involved in the program, it has been a privilege and honor to work with the Government and the schools, but most importantly the students. The intent of the program is to energize minority students who were US citizens to pursue studies in the areas of science and engineering. Through the years, we have seen that happen. Many students had the opportunity to visit Wright-Patterson AFB and Rome NY and work side by side with Government and the schools, but most importantly the students. The intent of the program is to energize minority students who were US citizens to pursue studies in the areas of science and engineering. Through the years, we have seen that happen. Many students had the opportunity to visit Wright-Patterson AFB and Rome NY and work side by side with Government scientists and engineers during the summer months. Consistently at the end of their internships, students expressed their excitement to continue on with the research at their schools and were contemplating futures in the Science and Engineering spectrum – whether it be as a civil servant, DOD contractor, or industry related field. The reinforcement of the significance of these career fields has more than been prevalent throughout the existence of this program. Students were given access to amazing research laboratories and researchers at these locations and were able to participate in activities that otherwise might not have been possible. Likewise, faculty members across the United States also benefited from working with AFRL and welcomed the opportunities provided their students. This program also resulted in increased grants and contracts being leveraged by the ML RCP for the schools. For AFRL, this program provided new sources of quality research and increased the pool of prospective candidates for employment while giving AFRL opportunities to increase diversity in their workforce. Working with students and faculty members from varied backgrounds, contributed to innovative thoughts from culturally and scientifically diverse sources.

In addition to the efforts and opportunities this program afforded so many, we also want to thank the many, many AFRL researchers who took their time and expertise to share with the many students. In addition to summer internships, AFRL researchers participated in monthly and often bi-monthly teleconferences reviewing the project work and offering (Continued on Page 2)
This program would not have been the success that it is without the total commitment of each one of these entities.

Clarkson Aerospace Corp
Integrating Subcontractor

It is a great honor for UTC to have been associated with the ML-RCP program since its inception. In that time, we’ve worked with hundreds of students who have had their lives changed through the opportunity to work with world-class researchers at the Air Force Research Laboratory; and they have gone on to change the world through their own work. The research done by ML-RCP students is beyond impressive. The students, the schools, and the country, are better for it.

Mr. Wendell Banks
Director, Sensor and Cyber Systems
Universal Technology Corporation

On behalf of the Materials and Manufacturing Directorate (AFRL/RX), I am honored to have served as the Program Manager for the Minority Leaders Research Collaboration Program. It was rewarding to work with the students, professors, and our AFRL mentors. I was able to witness first-hand the many opportunities presented to students who otherwise may not have been exposed to this type research. It certainly reinforced the necessity of programs such as this to help students realize the many possibilities STEM careers have to offer. I would like to thank all the AFRL/RX scientists and engineers that I have worked with through the years on this program and please note how appreciative I am of your guidance, knowledge, and willingness to help support the program!

Ms. Ashley Blackford
Program Manager, ML RCP
Materials and Manufacturing Directorate, AFRL

As I reflect on this journey one word is woven through the fabric of its existence, “OPPORTUNITIES.” Opportunities to inform, opportunities to inspire, and opportunities to come. I have been blessed to witness this at many stages and in various roles during this program. The efforts of many individuals should not be underestimated. You the students, professors, industry partners, and the government team have consistently ushered in a spirit of diversity and inclusion into STEM, not only at AFRL. The evidence of this is in the many testimonies shared over the years, but our work is not done.

One of the things that I have come to realize is (Continued on Page 3)

AFRL / ML RCP Final Newsletter
Issue 7 / APRIL 2019

(Reflections continued)

Daniel Drake is an aerospace engineering doctoral student at Mississippi State University and has worked with the AFRL ML-RCP for two years. Daniel, in cooperation with the Aerospace Systems Directorate, led by Dr. Steve Clay and the Materials and Manufacturing Directorate, led by the late Dr. Katie Thory and Dr. Jonathan Spowart, investigated cure parameters on the development of residual strain during cure using embedded optical fibers. With the guidance of Dr. Rani Sullivan and other research team members from AFRL, the Boeing Co. and NASA Langley, Daniel has developed a methodology to estimate the internal propagation of delaminations within composites using optical fibers. Daniel is continuing this research for stitched sandwich composites in continuation with AFRL.

Dr. Rani Warsi Sullivan
Professor
Richard H. Johnson Chair
Department of Aerospace Engineering
Mississippi State University

ML-RCP provided an excellent opportunity to bring a bright undergraduate student, Shannon Stephens from Tuskegee University to work in AFRL. In the beginning, as an aeronautical engineering major, she was enthusiastic about the mechanical characterization of the materials but had the least interest in chemistry and materials science. At AFRL, Shannon learned about biomimetic multifunctional nanomaterials. She fell in love with the topic and started exploring it with a great passion. As a result, Shannon was successful in making thin films of cellulose nanocrystals composite cholesteric liquid crystal and studied optical and mechanical properties. She made an outstanding impression among seniors in a short time, which was noted during her presentation in RX summer poster. She is highly interested in going to graduate school in Materials Science and Engineering.

Dr. Bhriti Nopal
Materials and Manufacturing Directorate, AFRL

It is always encouraging and gratifying to see the enthusiasm and energy that students bring to the projects and their desire to explore the unknown with “outside the box” creativity. I truly enjoy the involvement in the ML-RCP as mentor and technical lead primarily because I see students advance and sometimes get job offers from major companies with all the networking they can accomplish during the program or when students express interest in working for the Air Force in the future. Many of the students end up collaborating with AFRL at some stage later in their career. This program is very important to give everybody a chance to pursue a career in science and technology and to ensure strong future workforce for the ever advancing technology demands that the Air Force faces.

Dr. Hilmar Koerner
Materials and Manufacturing Directorate, AFRL

The Research Collaboration Program has been a great experience! I have enjoyed my time working with researchers from Central State University. Exposing students to research and hands-on experience in science and engineering fields is important for our society as a whole.

Dr. Joseph Meola
Sensors Directorate, AFRL

As an Air Force POC for Cyber Security & Networking projects, the Minority Leaders Research Collaboration Program (ML-RCP) has given me access to a number of innovative and valued-added technical projects. I’ve had the distinct pleasure of working with a number of talented principal investigators/professors and an even larger number of talented students from different colleges and universities. Some of those students that I’ve guided and mentored as interns have represented some of the highest caliber of undergraduate engineering and computer science students that I’ve ever encountered. I look forward to an opportunity to work with the ML-RCP again in the future!

Mr. Rob Riley
Information Directorate, AFRL

I have had the honor and pleasure of participating in the ML-RCP almost from its beginning as the Minority Leaders Program (MLP) in 2005. Over those 14 years, the program has been a shining example of what can be accomplished collaboratively by a team composed of dedicated faculty from a wide range of universities, a diverse array of focused student researchers from these universities, spanning undergraduate through PhD candidate rank, and motivated and caring expert AFRL scientists, engineers and program managers. Quality research and high value to the Air Force was accomplished, and professional relationships and friendships that will last a lifetime were established. Most importantly, students gained experience that will enhance their capability and confidence as they enter the STEM workforce and become the technology innovators of tomorrow. Accolades to all for a job well done!

Mr. Bob Denison
Program Manager
Universal Technology Corporation

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3

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(Continued on Page 12)
Student Researcher: Shavon Turner
School: Grambling State University
Major: Computer Science
Classification: Junior
Area of Research: Deep Learning, Machine Learning and Python
Mentor: Dr. Kenneth Hopkinson

I familiarized myself with python and was able to complete the Deep Learning course that was provided for the interns to use as reference. I worked with another intern, Ross Wise, on the assignment given to us to complete. We were assigned the task of using neural networks to train a computer to find the coordinates of images at different angles and rotation. This internship was a good experience as I’ve learned from graduate students, interns, and supervisors about the tasks at hand. This internship has given me direction to the career path I will venture on to after I receive my undergraduate degree.

Student Researcher: Kameron Wilcox
School: University of Dayton
Major: Chemical Engineering
Classification: Senior
Mentor: Dr. James Blackshire

For this summer, my research was focused on quantitative analysis of backscatter energy fields on a dual-crystalline material. Using non-destructive evaluation (NDE) techniques, I was able to generate images of the energy fields interacting with the grains in the nickel material. With these images, I was able to track the lobes in the energy field and plot the velocity of these lobes at different time intervals. Being able to track these lobes and analyze the energy field using NDE will ultimately help accurately determine the life span of the jet engine disks as well as other aerospace components with similar microstructure.
The ML RCP program has been a huge success for students at UTSA. Among the many students that participated in the program, one of our former students, David Wagner, completed his PhD and is now employed at NASA Langley in a Computational Materials position. Another, Wes Fields, completed his MS degree and is employed at StandarDero, and a third student, Eli Igleias, is completing his PhD at UTSA. Several undergrads are now in graduate school. In addition, a large percentage of students took the opportunity to work at AFRL in the summer to gain valuable experience working with world-class materials researchers.

Dr. Harry Milwater
Professor of Mechanical Engineering
Samuel G. Devson Endowed Professorship
University of Texas at San Antonio

The collaboration between the University of Texas at El Paso (UTEP) and AFRL, provided unique and excellent education, training and research opportunities to the UTEP students that are from historically underrepresented minority (URM) groups. Specifically, UTEP students received hands-on laboratory experience, broader exposure to the cutting edge research and technologies, research mentoring by the AFRL scientists and engineers, and finally the opportunities for networking and professional development. In addition to accelerating scientific excellence, the collaboration also helped the junior and mid-career faculty to become leaders in their respective research field, most importantly in the area of advanced materials science and engineering.

Dr. Ramanu ChintalaPalle
University of Texas at El Paso

Everyone involved over the history of the Minority Leaders Research Collaboration Program (ML RCP) should take pride in the impact this program has had on the students. Several of these young men and women have had their lives changed forever. How these “changed lives” impact other lives in the future is something we will never know. What we do know is that this program has provided the foundation to allow them to exploit their potential to its fullest.

Dr. Charles Browning
Torley Chair in Composite Materials Chair, Department of Chemical and Materials Engineering
University of Dayton

I have been privileged to participate in the program for a relatively short time, but the experience has been transforming for me...to be a small part of the process: quality students doing Air Force - pertinent research, guided by dedicated faculty and Air Force lab leaders, in a nurturing environment. Numerous times I observed collaboration across all, or many, of these process partners that made for even greater value. The ML RCP is truly a best practice that should be expanded across the Air Force and shared beyond.

Mr. Bob Rapson
Program Manager
Universal Technology Corporation

It has been a pleasure to work on the ML RCP, coordinating research and development collaborations at the universities, in the AFRL labs and at some unique test sites. The under-lengths of the ML RCP has always been helping a diverse group of undergraduate and graduate students develop their potential. This program has immensely influenced many of the universities in expanding and sustaining crucial capabilities. The success of the program stems from the people-connections among AFRL, the universities and contractors.

Mr. Roger Rucker
Program Manager
Universal Technology Corporation

The Minority Leaders Research Collaboration Program (MLRCP) provided an opportunity to advance equal opportunity in higher education, strengthen the capabilities of minority institutions, and transform the workforce of the DoD. The DoD requires access to the best trained scientists and engineers who can solve real-world problems, providing a technological advantage to our soldiers. By participating in the ML/RCP, students were provided with the opportunity to experience world-class scientific research environments in which they could build their skills as researchers. The program inspired the universities to investigate several new research areas. As a result, several new innovative research centers were created, research equipment was enhanced and purchased. Faculty research efforts were also increased, recognized, inspiring over 700 publications. More than 25% of the participating professors attributed receiving tenure to their participation in the ML/RCP and most importantly over 780 students and 130 professors are now solving those DoD real-world problems!

R. Douglas Hutchens, PhD
Former, ML RCP Program Manager
(UTC, Retired)

I am grateful to have the opportunity to work with world-class materials researchers, and engineers, and finally the opportunities for technologies, research mentoring by the AFRL scientists and UTEP students received hands-on laboratory experience, underrepresented minority (URM) groups. Specifically, the University of Texas at El Paso (UTEP) and AFRL provided unique and opportunities for students. This program has provided the foundation to allow them to exploit their potential to its fullest.

Lucas Raimondi
Student Researcher

University of Dayton

Major:
Chemical Engineering

Classification: Sophomore

Area of Research:
Thin Semiconductors

Created Through Pulsed Laser Deposition (PLD)

Mentor:
Dr. Shance Pacley

This summer I assisted Dr. Shance Pacley in her growth and study of β-Ga2O3 for wide band gap electronics. In particular, we analyzed the growth of β-Ga2O3 on various substrates. Pulsed laser deposition consists of the use of a laser, which ablates a target (e.g., a β-Ga2O3 target) in an argon atmosphere, creating a plasma plume of the ablated material that is deposited onto the substrate. The substrate is heated to a specified temperature enabling uniform absorption of the material. The samples each had varying growth conditions such as different substrate temperatures, different laser beam intensities, and varying number of laser pulses. This created a large number of samples that could be used in order to find the best growth method for β-Ga2O3 for the various substrates. We then analyzed the crystallinity of the substance using x-ray diffraction (XRD) to determine if the substance could properly form in thin layers.

Shannon Stevens
Student Researcher

Tuskegee University

Major:
Mechanical Engineering

Classification: 4th Year Undergrad Student

Area of Research:
Nanocomposite Research

Mentor:
Dr. Dhririi Nepal

My project focused on the influence of substrate effect and temperature effect on cellulose nanocrystals

(Continued on Page 11)
The Air Force Research Laboratory (AFRL) welcomed 32 students for the summer in support of the Minority Leaders Research Collaboration Program (ML RCP). These students worked in the Materials and Manufacturing and Sensors Directorates at Wright-Patterson AFB as well as the Information Directorate, Rome New York. It is rewarding for the students to be able to spend time with the dedicated mentors at AFRL. A special thanks goes out to all those individuals who helped with the students: Ms. Ashley Blackford, ML RCP Program Manager and Mentors: Dr. Ruth Pachter, Dr. Shantee Pacley, Dr. James Blackshire, Dr. Hilmar Koerner, Dr. John Jones, Dr. Josh Kennedy, Dr. Ajit Roy, Dr. Ben Leever, Dr. Dhruti Nepal, Dr. Neil Murphy, Dr. Jonathan Spowart, Dr. Craig Prybyla, Dr. Gail Brown, Dr. Rajiv Berry, Dr. Pat Golden, Dr. Tim Pruyne, Dr. Pat Dennis, Dr. Eric Payton, Dr. Reji John, Dr. Benji Maruyama, Dr. Dan Berrigan, Dr. Michael Groeber, Dr. Edwin Schwalbach, Dr. Matthew Dickerson, Dr. Philip Buskhol, Dr. Adam Pilchak, and Dr. Augustine Urbas–all from the Materials and Manufacturing Directorate. Mentors from the Sensors Directorate include Dr. Reginald Cooper, Dr. Kenneth Hopkinsin, Ms. Aji Mattamana, Mr. Trevor Bihl, Dr. Ben Seibert, Dr. Emily Heckman, Mr. Todd Jenkins, Dr. Charles Moore, Mr. Steve Hoberty and Mr. Andrew Rice, Mr. Rob Riley, Ms. Juanita Riley, and Dr. Marcus Pendleton from Rome NY Information Directorate served as mentors for three ML RCP students. We appreciate Ms. Blackford and all the mentors for the many hours of dedicated time they provide to these students.

More information on the students can be found below:
Students continued

Student Researcher: Stephen Bratz
School: University of Texas at San Antonio
Major: PhD Mechanical Engineering
Area of Research: Computational Crack Propagation
Mentor: Dr. Arturo Montoya

This summer served as an introduction for the research in my PhD program. The basis of my research is computationally dealing with crack propagation. For this, we started with learning as much as possible about fracture mechanics within a short period of time. Next, I learned about UEL’s or user element routines in ABAQUS. A UEL is a user subroutine that does all of the calculations you require for a specific series of elements in ABAQUS. To make this UEL, I had to learn how to use and utilize FORTRAN. Finally, the goal was to apply the fracture mechanics learned earlier in the summer via FORTRAN to the ABAQUS model in order to get the desired results. Although the research I will be doing in the future consists of this on a much larger scale, this was a great introductory experience and will provide a solid platform to build upon.

Student Researcher: Hugh DeJarnette
School: LA Tech
Classification: CAM PhD Candidate
Area of Research: Nanomaterial Simulation
Mentor: Dr. Josh Kennedy

During my time here, I contributed to multiple projects, from computer vision analysis of carbon fibers to particle modeling for optical scattering. For one project, I collected and analyzed visual microscopy data to gather length distributions of carbon fibers in a direct write 3D printer ink. For the other I developed a COMSOL Multiphysics model for the optical scattering responses of a dielectric clad gold nanorod for use as a temperature sensor.

Student Researcher: Leonardo I Gutierrez Sierra
School: The University of Texas at El Paso (UTEP)
Major: Mechanical Engineering
Classification: PhD Student
Area of Research: Additive Manufacturing, Composites, Robotic Systems
Mentors: Dr. Hilmar Koerner

This summer I worked in the Materials and Manufacturing Directorate at AFRL in the composites division team. Given my background, I was placed in a project regarding the additive manufacturing (AM or 3D Printing) of thermosetting polymer matrix composites (PMCs). These PMCs are epoxy reinforced with carbon fiber to enhance mechanical properties such as strength and elastic modulus. The goal of the project is to create deposition was learned and applied to the creation of multifiber thin film structures for the creation optical second harmonic generation with application in sensor technology and telecommunications. Pulsed laser
This summer I worked with Dr. Cooper exploring quantum networks. The program is an amazing platform to build upon. A great introductory experience and will provide a solid foundation in the use of magnetron sputtering to overcome physical limitations of the PLD system in regards to certain materials chosen for the layers. Finally in-situ ellipsometry and X-ray photoelectron spectroscopy techniques were elaborated on and used to analyze both the created films as well as other pre-existing samples.

Student Researcher: Samantha Knooth
School: University of Dayton
Major: Mechanical Engineering
Classification: Senior
Area of Research: Preceramic Polymers
Mentors: Dr. Tim Pruyn
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(Minority Leaders Research Collaboration Program 2018 Summer Interns continued)

are capable of accomplishing certain tasks independently from humans. After learning the fundamentals, as well as some of the more complicated aspects, I was given the task of creating my own neural network, capable of locating a single object in an image, finding that same object in an image where the object has moved. Then, getting it to relay how the object has translated, rotated and possibly how it scaled.

Student Researcher:
Kelah Forcaland
School:
Mississippi State University
Major:
Computer Engineering
Classification:
2nd Year Graduate Student
Mentor:
Dr. Reginald Cooper

I ran 10 replications on path planning algorithms (4 planning & 5 replanning) for a different number of UAVs in a swarm (4) for each map of edges (2) recording the running time and cpu time. So in total about 720 simulation runs. The data were then used to be presented in bar charts that reflected running time and cpu times and their respective variances for each setting. The bar charts were then used for my presentation on Accommodating Plan Revisions with Multiple Agents for Local Search in Road Networks in preparation for the National Aerospace and Electronics Conference (NAECON). Thankful for having the opportunity to work with this company again.

Student Researcher:
Christine Nguyen
School:
Rice University
Major:
Materials Science and Nano-Engineering
Classification:
1st Year Doctoral Student
Area of Research:
Laser Processing of 2D Materials for Flexible Electronics
Mentors:
Dr. Ajit Roy and Dr. Nick Glavin

This summer I worked on studying the laser irradiation effects of 2D transition metal dichalcogenide, Janus SMeSo. The purpose of this project is to induce local defects via laser processing to tailor structures of electronic components for Air Force electronic applications. By varying the laser and environment conditions, we can manipulate the atomic structure of the material and its properties to tailor it to a desired application, such as

(Continued on Page 9)

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More information on the students can be found below:

Student Researcher:
Darrell McClendon
School:
Jackson State University
Major:
Computer Engineering
Classification:
Freshman
Area of Research:
Reinforcement Learning, Quantum Computing
Mentors:
Dr. Reginald Cooper

My project for AFRL was geared towards mission assurance for UAVs. Dr. Pendleton believed this could be done by providing the UAVs with a decision-tree based Q-learning algorithm. With that being said, I was asked to implement the algorithm on a 2D simulation, Pac-man, in python2.7. In addition, I would have to research and learn on the topic of reinforcement learning. Although we still have some ways to go before testing on UAVs, I was able to complete the implementation of the algorithm. I really enjoyed the internship at AFRL. Receiving a guiding hand, I was able to gain valuable experience. I was doing challenging work. Also, I made long lasting relationships with fellow interns and mentors. With this internship making such a heavy impact on my future, I will forever appreciate it.

(Continued on Page 6)
The ML RCP program has been a huge success for students at UTSA. Among the many students that participated in the program, one of our former students, David Wagner, completed his PhD and is now employed at NASA Langley in a Computational Materials position. Another, Wes Fields, completed a MS degree and is employed at StandardAero, and a third student, Eli Iglesias, is completing his PhD at UTSA. Several undergrads are now in graduate school. In addition, a large percentage of students took the opportunity to work at AFRL in the summer to gain valuable experience working with world-class materials researchers.

Dr. Harry Milwater
Professor of Mechanical Engineering
Samuel G. Davison Endowed Professorship
University of Texas at San Antonio

The collaboration between the University of Texas at El Paso (UTEP) and AFRL, provided unique and excellent education, training and research opportunities to the UTEP students that are from historically underrepresented minority (URM) groups. Specifically, UTEP students received hands-on laboratory experience, broader exposure to the cutting edge research and technologies, research mentoring by the AFRL scientists and engineers, and finally the opportunities for networking and professional development. In addition to accelerating scientific excellence, the collaboration also helped the junior and mid-career faculty to become leaders in their respective research field, most importantly in the area of advanced materials science and engineering.

Dr. Ramanu Chintalapalli
University of Texas at El Paso

Everyone involved over the history of the Minority Leaders Research Collaboration Program (ML RCP) should take pride in the impact this program has had on the students. Several of these young men and women have had their lives changed forever. How these “changed lives” impact other lives in the future is a question that can only be answered by them. Here are just a few examples of the "changed lives" impact other lives in the future.

Student Researcher: Cristian Orozco
School: University of Texas at El Paso
Major: Mechanical Engineering
Classification: Sophomore
Area of Research: Thin Film Fabrication and Characterization
Mentors: Dr. John Jones

My summer research project was based on creating nonlinear optical metamaterials using multi-layer thin film coatings for second order optical response. These metamaterials with nanoscale dimension can alter the wavelength of photons as they pass through. Our goal was to create films that would produce second harmonic generation. These metamaterial coatings can change the wavelength of light and have benefits such as easier infrared detection (IR) detection and processing than with conventional materials. The films are able to be grown using pulsed laser deposition (PLD), a method I learned last summer, and magnetron sputtering. I implemented the different characterization methods I used last summer to grow samples, such as X-ray photoelectron spectroscopy, X-ray reflectivity, ellipsometry and learned new methods such as transmission electron microscopy.

Dr. Charles Browning
Torley Chair in Composite Materials Chair, Department of Chemical and Materials Engineering
University of Dayton

Student Researcher: Shannon Stevens
School: Tuskegee University
Major: Mechanical Engineering
Classification: 4th Year Undergrad Student
Area of Research: Nanocomposite Research
Mentor: Dr. Dhrrii Nepal

My project focused on the influence of substrate effect and temperature effect on cellulose nanocrystals

(Continued on Page 11)
Student Researcher: Shavan Tallerine
School: Grambling State University
Major: Computer Science
Classification: Junior
Area of Research: Deep Learning, Machine Learning and Python
Mentor: Dr. Kenneth Hopkinson

I familiarized myself with python and was able to complete the Deep Learning course that was provided for the intern to use as reference. I worked with another intern, Ross Wise, on the assignment given to us to complete. We were assigned the task of using neural networks to train a computer to find the coordinates of images at different angles and rotation. This internship was a good experience as I’ve learned from graduate students, interns, and supervisors about the tasks at hand. This internship has given me direction to the career path I will venture on to after I receive my undergraduate degree.

Student Researcher: Khameron Wilcox
School: University of Dayton
Major: Chemical Engineering
Classification: Senior
Mentor: Dr. James Blackshire

For this summer, my research was focused on quantitative analysis of backscatter energy fields on a dual-crystalline metal. Using non-destructive evaluation (NDE) techniques, I was able to generate images of the energy fields interacting with the grains in the nickel material. With these images, I was able to track the lobes in the energy field and plot the velocity of these lobes at different time intervals. Being able to track these lobes and analyze the energy field using NDE will ultimately help accurately determine the life span of the jet engine disks as well as other aerospace components with similar microstructure.
This program would not have been the success that it is without the total commitment of each one of these entities.

Clarkson Aerospace Corp
Integrating Subcontractor

It is a great honor for UTC to have been associated with the ML-RCP program since its inception. In that time, we’ve worked with hundreds of students who have had their lives changed through the opportunity to work with world-class researchers at the Air Force Research Laboratory; and they have gone on to change the world through their own work. The research done by ML-RCP students is beyond impressive. The students, the schools, and the country, are better for it.

Mr. Wendell Banks
Director, Sensors and Cyber Systems
Universal Technology Corporation

On behalf of the Materials and Manufacturing Directorate (AFRL/RX), I am pleased to have served as the Program Manager for the Minority Leaders Research Collaboration Program. It was rewarding to work with the students, professors, and our AFRL mentors. I was able to witness first-hand the many opportunities presented to students who otherwise may not have been exposed to this type research. It certainly reinforced the necessity of programs such as this to help students realize the many possibilities STEM careers have to offer. I would like to thank all the AFRL/RX scientists and engineers that I have worked with through the years on this program and please note how appreciative I am of your guidance, knowledge, and willingness to help support the program. Wishing all the schools and the students the very best.

Ms. Ashley Blackford
ML RCP Program Manager
Universal Technology Corporation

In 2005 the USAF initiated a pilot research and development program to increase Historically Black Colleges and Universities and Minority Small Business participation within AFRL. Thirteen years later the USAF MLP program is still the largest major university, HBCU, small business research collaboration within the USAF. What made this program successful when other programs had failed in the past were:
1. Guidance of dedicated program managers at the Air Force Research Laboratory
2. Universal Technology Corporation (UTC) - A prime contractor with the working knowledge of AFRL
3. Clarkson Aerospace Corporation - A minority small business with DOD experience and an acute working knowledge / credibility with many HBCUs.
4. HBCUs - Professors who could perform DOD quality research at AFRL and work with major mentoring universities like Texas A&M, University of Dayton, and Rice University to name a few.

As I reflect on this journey one word is woven through the fabric of its existence, “OPPORTUNITIES.” Opportunities for受损ing and gaining, and opportunities to come. I have been blessed to witness this at many stages and in various roles during this program. The efforts of many individuals should not be understated. You the students, professors, industry partners, and the government team have consistently ushered in a spirit of diversity and inclusion into STEM, not only at AFRL. The evidence of this is in the many testimonies shared over the years, but our work is not done.

One of the things that I have come to realize in (Continued on Page 3)

(Reflections continued)

Daniel Drake is an aerospace engineering doctoral student at Mississippi State University and has worked with the AFRL ML-RCP for two years. Daniel, in cooperation with the Aerospace Systems Directorate, led by Dr. Steve Clay and the Materials and Manufacturing Directorate, led by the late Dr. Katie Thory and Dr. Jonathan Spowart, investigated core parameters on the development of residual strain during cure using embedded optical fibers. With the guidance of Dr. Rani Sullivan and other research team members from AFRL, the Boeing Co. and NASA Langley, Daniel has developed a methodology to estimate the internal propagation of delaminations within composites using optical fibers. Daniel is continuing this research for stitched sandwich composites in combination with AFRL.

Dr. Rani Vardis Sullivan
Professor
Richard H. Johnson Chair
Department of Aerospace Engineering
Mississippi State University

ML-RCP provided an excellent opportunity to bring a bright undergraduate student, Shannon Stephens from Tuskegee University to work in AFRL. In the beginning, as a mechanical engineering major, she was enthusiastic about the mechanical characterization of the materials but had the least interest in chemistry and materials science. At AFRL, Shannon learned about biomimetic multifunctional materials. She fell in love with the topic and started exploring it with a great passion. As a result, Shannon was successful in making thin films of cellulose nanocrystals composite cholesteric liquid crystal and studied optical and mechanical properties. She made an outstanding impression among seniors in a short time, which was noted during her presentation in a national competition. She is highly interested in going to graduate school in Materials Science and Engineering.

Dr. Bhriti Nepal
Materials and Manufacturing Directorate, AFRL

It is always encouraging and gratifying to see the enthusiasm and energy that students bring to the projects and their desire to explore the unknown without “outside the box” creativity. I truly enjoy the involvement in the ML-RCP as mentor and technical lead primarily because I see students advance and sometimes get job offers from major companies with all the networking they can accomplish during the program or when students express interest in working for the Air Force in the future. Many of the students end up collaborating with AFRL at some stage in their career. This program is very important to give everybody a chance to pursue a career in science and technology and to ensure strong future workforce for the ever advancing technology demands that the Air Force faces.

Dr. Hilmar Koerner
Materials and Manufacturing Directorate, AFRL

The Research Collaboration Program has been a great success experience! I have enjoyed my time working with researchers from Central State University. Exposing students to research and hands-on experience in science and engineering fields is important for our society as a whole.

Dr. Joseph Meola
Sensors Directorate, AFRL

As an Air Force POC for Cyber Security & Networking projects, the Minority Leaders Research Collaboration Program (ML-RCP) has given me access to a number of innovative and valued-added technical projects. I’ve had the distinct pleasure of working with a number of talented principal investigators/professors and an even larger number of talented students from different colleges and universities. Some of those students that I’ve guided and mentored as interns have represented some of the highest caliber of undergraduate engineering and computer science students that I’ve ever encountered. I look forward to an opportunity to work with the ML-RCP again in the future!

Mr. Rob Riley
Information Directorate, AFRL

I have had the honor and pleasure of participating in the ML-RCP almost from its beginning as the Minority Leaders Program (MLP) in 2005. Over those 14 years, the program has been a shining example of what can be accomplished collaboratively by a team composed of dedicated faculty from a wide range of universities, a diverse array of focused student researchers from these universities, spanning undergraduates through PhD candidate rank, and motivated and caring expert AFRL scientists, engineers and program managers. Quality research I have enjoyed at the Air Force was accomplished, and professional relationships and friendships that will last a lifetime were established. Most importantly, students gained experience that will enhance their capability and confidence as they enter the STEM workforce and become the technology innovators of tomorrow. Accolades to all for a job well done!

Mr. Rob Denison
Program Manager
Universal Technology Corporation

(Continued on Page 12)
(Reflections continued)

It has been an exhilarating experience to be part of the MLP / ML RCP since its inception in 2005. Over the years I had the opportunity and privilege to impart knowledge and work with a number of faculty and students. Together we did great research, published papers, and produced future researchers and leaders. But the most satisfying aspect of this program is building everlasting partnership and friendship.

Dr. Vasa Chakravarthy
Sensors Directorate, AFRL

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Since 2005, the Air Force Research Laboratory's (AFRL) Minority Leaders Program (MLP), now referred to as the AFRL Minority Leaders Research Collaboration Program (ML RCP), has been successful in bringing together talented students and faculty members from across the United States to work with Government scientists and engineers in a mentor/protégé’ structured environment. Through this partnership, research capabilities and educational opportunities at Historically Black Colleges and Universities and Minority Institutions (HBCC/MI) were enhanced as well as a strong academic network formed. Basic and applied research efforts in support of AFRL have focused on advancing critical Air Force and national research areas such as nanotechnology, electro-optical materials, composites, and manufacturing technologies.

This program began in 2005 with eight schools involved and has grown to its current status of 37 university participants. Hundreds of university professors and students from undergraduate to doctoral candidates have been involved in the program throughout its existence. Contractual support has primarily been provided to the Materials and Manufacturing and Sensors Directorate of AFRL, but additionally the Information, Aerospace Systems, and Airman Systems Directorates have also participated. Universal Technology Corporation, a small business (Dayton OH), has served as the primary contractor for this effort since 2005 responsible for the execution of the program. Assisting UTC was Clarkson Aerospace, a small disadvantaged business from Houston TX, who coordinated the funding to the universities and provided additional technical and management support. The current contract comes to an end March 2019. This program has primarily been funded with Congressional intent funding. The Government has been working diligently to continue this program and are working through several options. For those of us involved in the program, it has been a privilege and honor to work with the Government and the schools, but most importantly the students. The intent of the program is to energize minority students who were US citizens to pursue studies in the areas of science and engineering. Through the years, we have seen that happen. Many students had the opportunity to visit Wright-Patterson AFB and Rome NY and work side by side with Government scientists and engineers during the summer months. Consistently at the end of their internships, students expressed their excitement to continue on with the research at their schools and were contemplating futures in the Science and Engineering spectrum – whether it be as a civil servant, DOD contractor, or industry related field. The reinforcement of the significance of these career fields has more than been prevalent throughout the existence of this program. Students were given access to amazing research laboratories and researchers at these locations and were able to participate in activities that otherwise might not have been possible. Likewise, faculty members across the United States also benefited from working with AFRL and welcomed the opportunities provided their students. This program also resulted in increased grants and contracts being leveraged by the ML RCP for the schools. For AFRL, this program provided new sources of quality research and increased the pool of prospective candidates for employment while giving AFRL opportunities to increase diversity in their workforce. Working with students and faculty members from varied backgrounds, contributed to innovative thoughts from culturally and scientifically diverse sources.

In addition to the efforts and opportunities this program afforded so many, we also want to thank the many, many AFRL researchers who took their time and expertise to share with the many students. In addition to summer internships, AFRL researchers participated in monthly and often bi-monthly teleconferences reviewing the project work and offering