2003-2004 ONR Research Teams

Computer Networks, Mentor: Mr. Chris Edwards
Willie Gilchrist, II | Jerome Mitchell | Paula Harrell
Eunice Smith | Nelson Veale

GLOBE, Soil, Atmosphere, & Hydrology Protocols
Mentor: Mr. Ervin Howard
Dana Brown | Brandi Brehon | Carl Seward

Physics of Remote Sensing, Mentor: Dr. Lei Zhang
Demetrius Rorie | Marcos Fabio | Darry Saunders
Patrick Shealey | Rodney Stewart | Erica Pinkney
Linwood Creekmore

Satellite Imagery, Mentor: Mrs. Keisha Wilkins
Anthony Anderson | Willie Brown, Jr. | Danielle Graves
Jasmine Kearney | Napoleon Paxton | Karitsa William

Multimedia, Mentor: Mr. Jeff Wood
Joanelle Baptiste | Zaccheus Eley | Je'aime Powell

ONR Students attended this year's US Black Engineers Magazine's Women of Color Conference in Nashville, Tennessee as guests of Dr. Linda Hayden. Dr. Hayden was presented the Emerald Award for Education. She was nominated for this award by Dr. Robert Gisner and Mr. Charles Luther of ONR.

Office of Naval Research

800 North Quincy Street
Arlington, Virginia 22217-5660

Dates to Remember

http://nia.ecsu.edu/nrts/nrtsevent.html

Internship Roundtable
3:30 pm 116 LH October 30, 2003

CERSER Distinguished Lecture Series and Remote Sensing Training
Dr. Sivaprasad Gogineni, University of Kansas
November 14-15, 2003

LS-LAMP Undergraduate Research Conference
New Orleans, LA, November 21-23, 2003

IEEE Southcon 2004
Orlando, Florida, January 13-15, 2004

IEEE-GRSS Distinguished Lecture Series and Remote Sensing Training
Dr. Keith Raney, JHU Applied Physics Laboratory
March 2, 2004

ACM-SIGCSE
Norfolk, VA, March 3-6, 2004

IEEE-USA Leadership Workshop (PACE Workshop)
Atlanta, Georgia, March 19-21, 2004

SOARS Conference
Fayetteville, NC, March 26-27, 2004

IEEE SoutheastCon 2004
Greensboro, North Carolina, March 26-28, 2004

Final ONR Oral Reports
April 8 and 10, 2004

URE in Ocean, Marine, and Space Science: ECSU
May 17 - July 9, 2004

ADMI Conference
May 20-23, 2004

Earth System Science Academy
June, 2004

IGARSS Conference
Anchorage, Alaska, September 20-24, 2004

For more information visit our website: http://nia.ecsu.edu/onr/onr.html
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Grant # N00014-98-1-0749 Grant # N00014-99-1-0990

NERT

2003-2004 Program Highlights and Summer Research Abstracts

Carl W. Seward
Mentor: Dr. Ernest Stitzinger
Internship: Minority Graduate Education – Summer Research Experience (MGE – SRE), National Science Foundation and North Carolina State University
Title: Investigating Methods of the Hill, RSA, and ElGamal Cryptosystems To Determine Security Levels of Encrypted Messages

Cryptography is the study of techniques that can be used to disguise a message so that only the intended recipient of a message can remove the disguise and read the message. The simplest way to disguise a message is to replace every occurrence of each specific character with a different character, for which such methods are known as substitution ciphers. However, since these ciphers are relatively easy to decrypt from the encryption, it can be asked if there exist other methods, methods from a mathematical prospective, which can raise the level of security of an encrypted message.
In this research, the investigator studied methods of three cryptosystems to determine which method provided the most relative security for encrypted messages. This was done by first studying elementary algebraic cryptosystems to understand their defined properties, followed by investigating three methods of encryption. All three of these encryption methods were then used in the mathematical software package of Maple to show how this software package can be used to encrypt and decrypt messages.

Eunice Smith
Mentor: Dr. John P. Kizito
Internship: Microgravity Fluid Physics Branch, NASA Glenn Research Center
Title: Visualizing Data in Mathematical form for Various Biological Projects

Data is collected each day as a result of several numerical and physical experiments that are performed at the NASA GRC. The experimental data is then acquired with the aid of computer applications like LabView. Numerical data is very important; however, it is sometimes helpful to have a picture that explains the results. Fortran is a programming language used to perform numerical calculations to decipher what the data means. Visualization of the data is method used to give researchers a graphical way of explaining their findings. The overall goal of my research project was to design tools to visualize data. There are many software applications that have been designed primarily for the purpose of data visualization, but data is collected in various formats that may have a different structure from the required input format. Numerical data maybe collected in binary or ASCI format. The application may require the data to be converted into another format; the formats must be compatible to the applications. For example, Tecplot converts ASCI files to binary files before loading the data files to perform a task. Matlab is often used to display mathematical concepts and equations in the form of graphs. EnSight and

Fieldview also accept data and produce graphs and simulations. My assignment was to discover which computer application would provide us with the graphs and even small movies that were needed to display the results of the experiments.

Linwood Creekmore, III
Mentor: Ashwin Mahesh, Goddard Earth Science and Technology Center
Internship: Goddard Space Flight Center, Howard University Fellowship in Atmospheric Sciences, Washington, DC
Title: The Antarctic Standard Atmosphere

Climate models often rely on standard atmospheres to represent various regions. These broadly capture the important physical and radiative characteristics of the regional atmosphere, and become a common benchmark from which simulations can be undertaken. In 1972 standard atmospheric models were created for the tropical, mid-latitude summer, mid-latitude winter, sub-arctic summer, and sub-arctic winter regions of the planet. The Antarctic is the last un-represented region in the list of standard atmospheres currently available. Because the high southern latitudes represent an endpoint in terrestrial climate – this coldest and driest place on Earth – there are no similar regions from which data can be used to represent Antarctica. Moreover, the surface energy balance of the Antarctic is largely determined by the downward longwave radiation, as this is the least known and most variable of the contributing terms. The longwave depends on the atmospheric profiles of temperature and constituent gases. To represent this properly in climate models, profiles of Antarctica that capture the seasonal variations in the atmosphere must be created. Using radiosondes, ozonesondes, and other data from South Pole station, typical profiles for the four seasons will be put together. Together these will constitute the standard profiles of the atmosphere over the Antarctic Plateau. These will be fed into radiative transfer models to determine the sensitivity of climate model calculations to the input profiles.

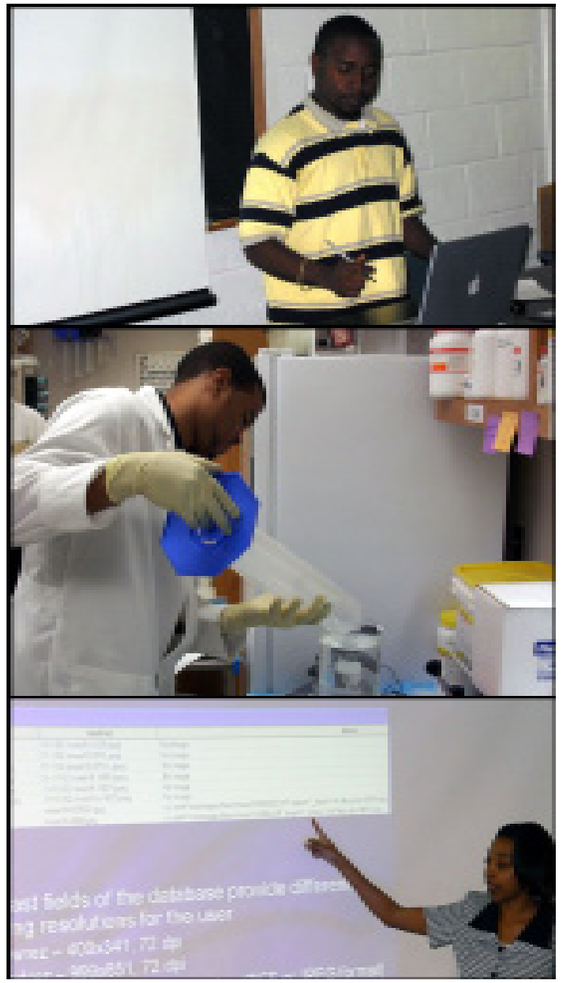
Zaccheus Eley and Danielle Graves
Mentor: Dr. Dwayne Williams
Internship: ECSU Undergraduate Research Experience in Ocean, Marine, and Space Science
Title: Science, Settlement and Remote Sensing: Locating the Remains of the Lost Colony in NE NC

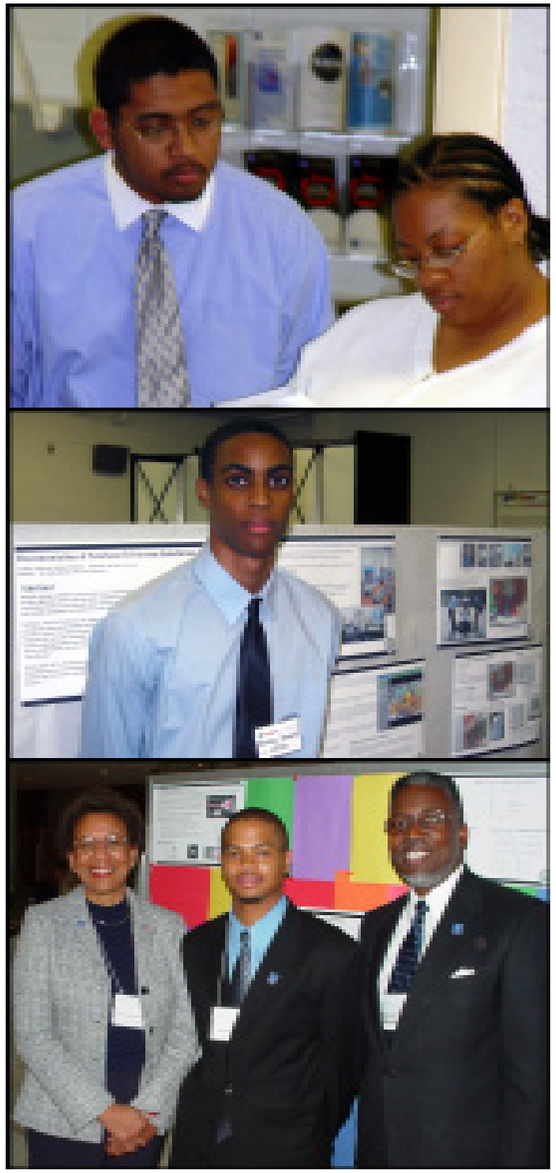
In the world of science, technology, and national security, remote sensing technology has emerged as a primary tool for retrieving and interpreting geographical data. Our research project, "Science, Settlement and Remote Sensing" aims to expand the application of remote sensing technology by answering the question: What happened to the "Lost Colony of Roanoke?" Our research takes an interdisciplinary approach to this 400 year old question by drawing on a wide-range of primary and secondary sources from history, geography, archaeology, and most importantly remote sensing technology. Challenging some of the key scholarly assumptions about the fate of the "Lost Colony," we argue that the remnants of the "Lost Colony" can located in Northeast North Carolina. In particular, our research strongly suggests that final fate of the "Lost Colony" can be traced to Buck Ridge near Roanoke Island.

Student researchers are shown with University of North Carolina President, Molly Corbett Broad

Photo Highlights

The Office of Naval Research Nurturing ECSU Research Talent program involves undergraduate mathematics and computer science majors in academic year team research activities. Research and training meetings began in early September and are held every Tuesday and Thursday through mid April. Research meetings start with an announcement period during which time students learn about internship opportunities, hear program announcements, give team reports, discuss travel logistics, and discuss goals of the program. Following the announcement period, students meet with faculty mentors or attend training on tools used for research. In addition, students spend 20 hrs/week in the undergraduate research computer laboratory completing task sheet requirements and research assignments. During the closing program, students make oral presentations of their research activities. The research teams are also required to complete written reports and to maintain a team web page. Shown below are highlights from the 2003 academic year and summer program. Also shown are Dr. Mickey Burnim, ECSU Chancellor and Dr. Carolyn Mahoney, Vice-Chancellor of Academic Affairs who sponsored student research presentations at the Council on Undergraduate Research "Posters on the Hill" in Raleigh, NC.





James Smith, Jr.
Vincent A. Davis, Jr.
Mentors: Walter Mitnick and Lisa Segal
Internship: John Hopkins University/APL - Mercury Surface, Space Environment, Geochemistry, and Ranging Mission (MESSENGER)
Title: Upgrading Messenger and Stereo Satellites

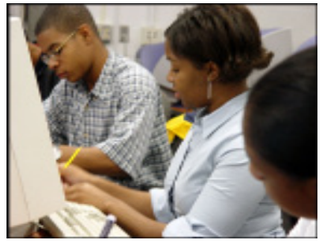
This project involved operating the Messenger and Stereo database system and working on upgrades to the system using Visual Basic. Messenger and Stereo are satellites due to be launched in 2003 and 2004, respectively. The database processes command and telemetry workbooks which have been checked out and resubmitted by workbook developers. When resubmitted, the workbook is first processed through the Prepare error checker, which if successful moves the file from the review to the checked folder and creates an error file of size 0. Next, the workbook is approved through a Netscape browser which sends an email to the submitter and moves the workbook from checked to pending. The workbook is then added to the total database of all command and telemetry workbooks for Stereo or Messenger. Next, the entire contents of the database are written out to an ASCII file which is then tested and distributed to users. Another program, "The Final Say," sends email to the appropriate administrators that the submitted workbook is valid and updates the flatfile Finder spreadsheet. The assignment has been to help streamline this process by adjusting "The Final Say" so that it batches files according to the scenario for which the workbook was submitted. Other projects involve making each part of the process give the user more information about the state of the workbook. In addition, the project included Perl/TK upgrades to the APL Epoch MOC.

Karitsa Williams
Mentor: Dr. S. Raj Chaudhury, NSU
Internship: Digital Earth Group. REESS Summer Internship Program, Norfolk State University
Title: Disaster Agency Readiness: Predicting And Preparing For El Nino, La Nina Southern Oscillation (ENSO) and North Pacific Oscillation (NPO)

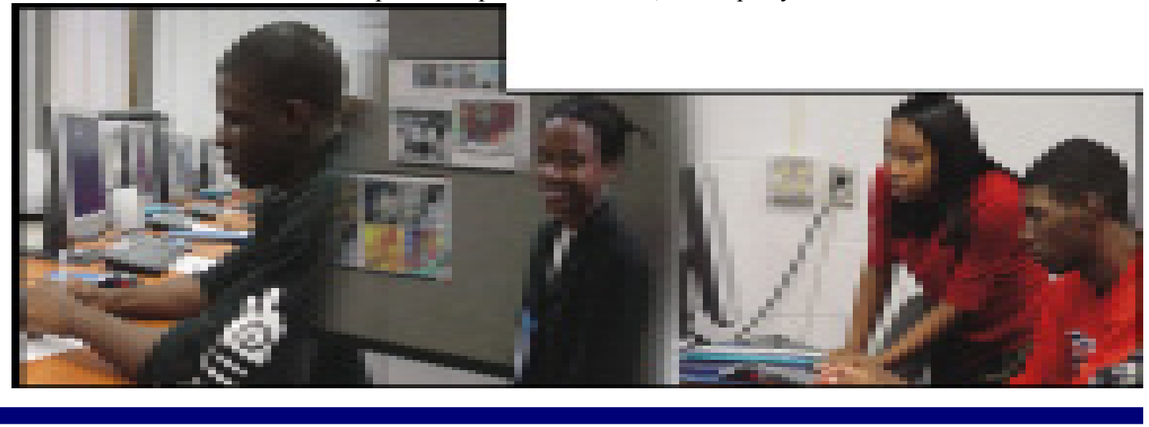
Digital Earth is a program created to view vast quantities of geo-referenced data on a multi-resolution 3-dimensional representation of the Earth. This program was designed to offer mass amounts of data to the public in a user-friendly format. The program is designed to teach through easy-to-use classroom modules. To demonstrate the usefulness of this program, we used satellite data to show/predict trends in El Nino Southern Oscillation (ENSO). We created a user-friendly, classroom ready module that will make this data easier to understand. El Nino Southern Oscillation (ENSO) is a disruption of normal atmospheric flow patterns in the tropical and southern hemisphere areas of the Pacific Ocean. ENSO can create substantial changes in sea-surface temperatures (SST) of the eastern and central equatorial Pacific. The ability to predict El Nino trends will have great societal and economical impacts. These impacts include increase awareness of environmental destruction and a decrease in economic loss. In order to create a working module for students and faculty to use, we utilized information on ENSO, North Pacific Oscillation (NPO), El Nino/La Nina, sea-surface temperature (SST), vegetation index data, and Heavy Precipitation Frequency (HPF) data. Also by using this information we searched for trends that will help us to determine whether the year to come will have an El Nino or a La Nina, high or low NPO, and high or low HPF. We also presented our findings in an easy to understand multi-dimensional model.

Willie Gilchrist, II
Mentor: Mr. Greg Cloutet
Internship: The Department of Interior Minerals Management Service, New Orleans, LA
Title: System Administration for the DOI Minerals Managements Service

A Systems Administrator at the Department of Interior (DOI), Minerals Management Service Agency (MMS) maintains and manages the workstations, network servers, software applications and data networks. He or she typically must be an expert with UNIX applications (understands Solaris 8), systems programmer/engineer (understands the systems programs and potentially modifies the operating system code) and network analyst. My objective this summer was to assist senior System Administrators in their network management duties (data storage, access management, network management, etc.). This summer I had the opportunity to be exposed a variety fundamental task that will enhance my career in becoming a system administrator. One of the my first task evolved Access Management; Access Management deals with a data program tracker name "MAGIC", use to manage all technical inventory at the DOI, MMS Agencies.



Then my next assignment consists of understanding Solaris 8 administration sufficient to modify the network server configuration, server setup, and custom Jumpstart setup.



Cory Hill
Mentor: Dr. Champion Deivanayagam
Internship: Center for Biophysical Sciences and Engineering, University of Alabama
Title: Expressing and Purifying Proteins Utilizing Various Growth Methods

Infectious bacteria, such as Listeria monocytogenes, are composed of a thick cell wall dotted with surface proteins designed to interact specifically with human cells as a first step towards establishing infections. These pathogens anchor themselves to the cell membrane of our body's cells and Sortase is a gram-positive bacterial enzyme that aids in the anchoring of bacteria to the cell wall of human cells. Without this outer weaponry, gram-positive bacteria could not invade people's throats, skin and other susceptible tissues. Sortase works by activating a five-amino acid tag present on many of the proteins localized on the bacterial cell wall, abbreviated LPXTG. It is this tag that is hooked directly into the cell wall of human cells, allowing infection. Sortase effectively cleaves the LPXTG motif near the middle before linking the remainder of the protein to the cell wall. We sought out to purify sortase in order to make crystals for research. From these crystals, researchers will attempt to produce a working model of a sortase inhibitor. This inhibitor would revolutionize the way in which we view bacterial anchoring. A fully-functional working model could lead to the global eradication of gram-positive bacterial infections, including Diphtheria, Listeria, Tuberculosis, Scarlet Fever, and Leprosy.

Ramatoulie Bah
Mentors: Dr. R. Rakhimov, Dr. N. Noginova
Internship: Electron Paramagnetic Resonance Laboratory, Norfolk State University
Title: Spin Wave Resonances in Colossal Magnetoresistance Manganite Thin Films

The purpose of this project is to study the properties of LaGa03 (doped with manganese of 50% and 80%) with the methods of Optical and EPR spectroscopy. LaGa03 has been studied using the possibility of switch magnetization by optical means (using light sensors to understand effect of light illumination in the material), we also will be studying the sample with respect to; magnetic field effect, spintronics, ferromagnetic resonance, under various degrees of light intensity, temperature and orientation. We have observed spin wave resonances (SWR) in La_0.7Sr_0.3MnO_3 (LSMO) thin films grown by MOCVD using ferromagnetic resonance. The SWR's depend on crystalline orientation as well as the degree of crystallinity. Elastic strain in magnetic thin films can change the magnetoelastic coupling, which can be related to the observed direction of magnetization. Here we will present our results in terms of lattice mismatch, induced strain and orientation in the magnetic field for these LSMO thin films.

Donald Charity
Mentor: Simon Julier
Internship: Naval Research Laboratory
Title: Battlefield Augmented Reality System

Embedded training (ET) is the integration of training scenarios within a relatively similar environment in which an actual operation will occur. ET equipment is commonly used to train tank and airplane operators in the field, but it is not ratably available for ambulatory individuals. To overcome this disparity, we adapted the US NAVY Battlefield Augmented Reality System (BARS) for embedded training. BARS is a mobile augmented reality platform that displays heads-up battlefield intelligence information to dismounted infantry personnel. BARS consist of a wearable computer, a wireless network connection, and a tracked see-through head mounted display (HMD). The computer generates graphics that, from the user's perspective, appear to exist in the surrounding environment. For example, a building could be augmented to show its name, a plan of its interior, icons to represent reported hazard locations, and the names of adjacent streets. The BARS embedded training system operates in natural environments (as compared to an artificial laboratory virtual reality simulation) with simulated forces that appear to exist and interact with the real world.

Golar Newby
Mentor: Ray Gilstrap, NREN NASA Ames
Internship: North Carolina A&T
Title: PCMon

NASA has always been driven to explore the frontiers of Space and better understand the planet in which we live. With eleven NASA centers/agencies spread over the United States the need to unify their efforts towards a singular goal becomes a challenge. The NASA Research and Education Network team has been working on a ways to offer better quality of service dynamically within and between centers. Using strategically placed monitoring computers within a network environment allows for the observation of network utilization, with the hopes of allowing another computer system to allocate more or less bandwidth for a particular application. I was tasked with testing the performance of the PCMon boxes using three different means of transmission: wireless, fast Ethernet, and OC-3. These tests where designed to validate possible problems related to the different modes of transmission for the network packets. With the project developing the concern of storage space for datasets became an issue. The migration of the datasets from several text files to a MySQL database provided much needed organization to the naming scheme and storage method. The issue of how much would the database be able to hold became another task. Using Perl and MySQL, massive amounts of data provided a means of testing the database system. The final issue of concern was security of the information collected by the various PCMon boxes. Zebedee provided a quick solution to the problem. Zebedee allows for the communication channel to be secure using Zlib compression, Diffie-Hellman key agreement and Blowfish encryption. With better communication channels between centers information such as data sent from the Mars rovers can have preferential treatment over the network allowing for faster transmissions between centers. Such advances well help in unification of NASA centers for future research endeavors.

Anthony Anderson
Mentor: Dr. Kevin Chu
Internship: ECSU URE in OMPS
Title: Correlations between Right Whale Distribution and Sea Surface Temperature

The survival of endangered species plays an important role in our environment. Right whales are highly endangered and are sometimes killed by boats or entanglement in fishing gear. We studied the relationship between right whales and sea surface temperature to see if it might be feasible to predict where the whales will be in order to alert boats. We used right whale sighting data from aerial surveys of waters near Massachusetts, USA. Sea surface temperature data was collected from NOAA's AVHRR satellites. We were only able to find eight clear satellite images among the days with right whale sighing data. This allowed only minimal quantities analysis. Nevertheless, we believe that it might be possible with more data to predict right whale distribution using remote sensing.

Tracey Ward
Mentor: Dr.Correigh Greene
Internship: NW Fisheries Science Center, Seattle
Title: Fishery Stock Assesment

During the summer of 2003 I participated in a research program with the National Oceanic and Atmospheric Association at the Northwest Fisheries Science Center in Seattle. My research was on the life span and abundance of juvenile salmon. The main focus of the program was directed to two types of salmon, the Coho and Chinook salmon. The first week of the internship was spent in the lab dissecting salmon from earlier catches of the year. During the dissection, the kidney, otolith (ear bone), stomach and fins of the fish were removed for future testing. Each part of the fish was measured and/or weighed and placed in small tubes to be kept on ice. I also spent time on the research vessel used to collect the sample salmon used for testing. The tow net was used to trawl the bottom of the Bellingham Bay and other waters along the Washington coast and inland waterways. The net was pulled behind the research vessel and a smaller boat to cover a large region of the water. After the net was brought up to the boat the catch was put into separate containers according to the tow number. The catch was sorted and the salmon was separated and kept on the boat while other species were measured, weighed, recorded, and thrown back. Some biopsies were performed on board of the research vessel. The remainder of my time in Seattle was spent in the office documenting the catches and putting them in spreadsheets according to site locations.

Nelson Veale
Mentor: Dr. Jeff Scroggs
Internship: NC State University, Minority Graduate Educational Research Program
Title: Simulating Epidemic Models of the Influenza Virus Using MatLab

MatLab is a technical computing program that allows users to do numeric computation, advanced graphics and visualizations, or high level programming. The main objective is to use matlab to develop programs that can simulate several epidemic models of the influenza virus using two ordinary differential equation models. We first derive the SIR epidemic model and a more complex model known as SEIRS model. These two models determined the number of people being susceptible to the virus, being infected by the virus, and actually recovered from the virus. Next, the two models are coded into matlab to give an approximated solution using numerical methods. Finally, data retrieved from the Center for Disease Control website and other resourceful information are use to create several epidemic models of the influenza virus. We hope that several simulations of the two epidemic models using the influenza virus will help us to gain understanding of how to predict the spread of various diseases.