

STEM in Avionics

Introduction

- Robert Sheffield M.S.E.E.
 - A.S. Drafting and Design Technology (2008)
 - Brevard Community College
 - B.S. Electrical Engineering (2011-2013)
 - Florida Institute of Technology
 - M.S. Electrical Engineering (2013-2014)
 - Florida Institute of Technology
 - “The Effectiveness of Multi-Band Beam-Nulling in Anti-Jamming GPS Applications Using Tri-Band Proximity-Fed Stacked-Patch Antennas”
 - Weather RADAR Hardware and Collateral Engineer.
(2014-Present)

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- **Avionics:**

The development and production of electronic instruments for use in aviation and astronautics. The term also refers to the instruments themselves. Such instruments consist of a wide variety of control, performance, and radio navigation devices and systems (Dictionary.com)

- Over 20,000 employees worldwide
- Annual Sales of \$4.98 Billion
 - 46% Commercial
 - 44% Government
 - 10% IMS (Information Management Services)

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Commercial Systems

MultiScan ThreatTrack™

<https://www.youtube.com/watch?v=zJDduGPvOEA>

STEM Opportunities (General)

- Engineers
 - Electrical
 - Mechanical
 - Systems
 - Software
 - Industrial
- Engineering Technicians
 - Electrical
 - Mechanical
 - Software
 - Test
 - Manufacturing
- Designers
 - Mechanical
 - PCB Designers
 - Drafters
- Leadership
 - Project Leadership
 - Project Management
 - Talent Management

Why Engineering?

Math
 $2+2=4$
fractions
multiplication
Geometry
 $3x+4y=28$

I'm an
~~ENGINEER~~
~~ENGINEER~~
~~ENGINEER~~
I'm good
with math

Engineering Skills

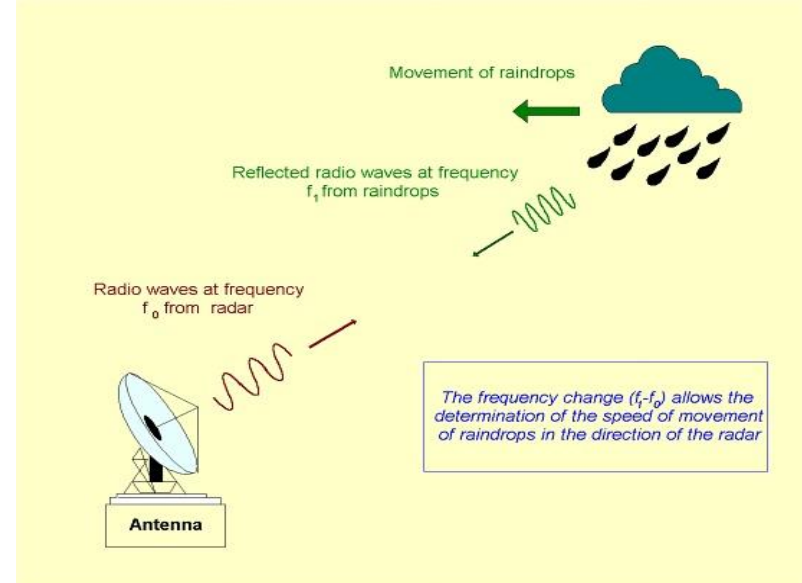
- Math
 - Algebra
 - Calculus
 - Statistics
- Technical Writing
 - Reports
 - Procedures
 - Analysis Documentation
- Physics
 - Newtonian
 - Electromagnetics
 - Quantum
- Communication
 - Team
 - Organization
 - Industry
 - Customer

Math and Physics

- Math and Physics go hand in hand.
 - If physics is the language of nature, math is the alphabet.
- Most Important math
 1. Algebra (It is the basis for all others)
 2. Calculus
 3. Statistics
- Most important Physics
 1. That depends?

Example

- RADAR
 - A RADAR works by transmitting pulses of Electromagnetic energy through an antenna, and then receiving the pulses that reflect off of any obstructions to their path.
 - The information contained in the pulses define the obstruction.



Example



What is a RADAR Mile?

- A RADAR mile is the time it takes for a transmitted pulse to travel one mile, reflect off a target, and travel back to the SOURCE. (A nautical mile is commonly used)
- How do we solve this?
- What do we know:
 - Electromagnetic waves travel at the speed of light in free space.
 - The Speed of light is 3×10^8 meters per second.
 - 1 mile = 1.60934 km
 - 1 Nautical mile = 1.15078 miles
 - Distance = rate X time

Solution

- How Far does the pulse travel?
 - 2 nautical miles
- How long does it take to travel 2 nautical miles

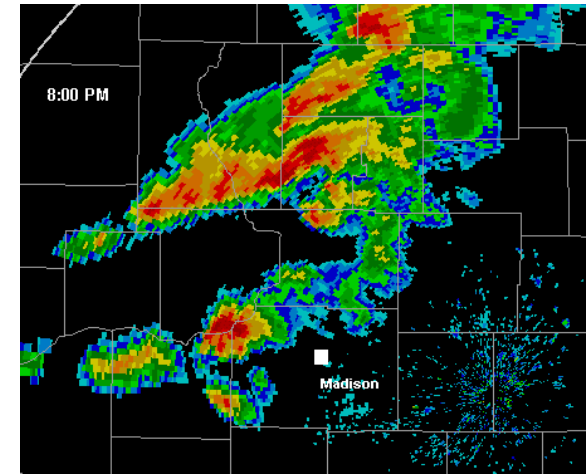
- $Distance = Rate * time \rightarrow time = \frac{Distance}{Rate}$

- $Distance(m) = 1 \text{ Nautical mile} * \frac{1.15078 \text{ miles}}{1 \text{ Nautical Mile}} * \frac{1.60934 \text{ km}}{1 \text{ mile}} * \frac{10^3 \text{ meters}}{1 \text{ km}} * 2$

Distance (m)= 3703.9926 meters

Solution

RADAR Mile



$$time(seconds) = \frac{Distance}{Rate} = \frac{3703.9926 \text{ meters}}{3 * 10^8 \text{ meters/sec}} = .00001234664 \text{ seconds}$$

$$time(seconds) = 12.34\mu s$$

Key Points

- Problem Solving
 - Define the Problem!!!!
 - State your knowns and your assumptions.
- Math
 - Basic Algebra
 - Dimensional Analysis
- Physics
 - Speed of Light
 - Properties of Electromagnetics
 - Could be more complex
 - Speed of target (Doppler Shift)
 - Turbulence (deviation)
 - Etc.



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Government Systems

F-35 Helmet Display System

<https://www.youtube.com/watch?v=w0btzIvISci>

Focus



Technical Writing

- 75% of Engineering is Paperwork
 - Procedures
 - Requirements and Specifications
 - Reports
 - Analysis
 - Reviewing documents

Technical Writing Ideas

- Have students write and review what someone else has written and provide appropriate feedback
 - Provide a simple template to follow
 - No need to reinvent the wheel
 - Enforces discipline in what is presented
 - The “audience” does not want to have to search for data – should be in the same spot from paper to paper
 - Have original paper with feedback and final draft provided to be graded
 - Being able to review what someone else has written and provide feedback is as important as being able to write!!
- Use appropriate style
 - Use complete sentences
 - Clear; Concise; Consistent
 - Appropriate sections and section titles
 - Normally, sections should be no more than a couple of paragraphs
 - Use white space to help highlight important verbiage
 - Appropriate references
 - Proper use of acronyms, including showing the term the first time the acronym is used and an appendix with a listing of all acronyms used
 - Glossary of technical terms

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Information Management Services

Rockwell Collins Virtual Avionics Procedure Trainer

<https://www.youtube.com/watch?v=CHfLOft5C4Y>

Communication



Building trust every day

Types of Important Communication

- Team:
 - Ideas
 - Difficulties
 - Schedule
 - Plans
- Organization
 - Plans
 - Schedule
- Industry
 - New focuses for technology
 - Directions for the future
- Customer
 - Customer Service

Communication Ideas

- Group Projects
 - Create small group assignments (even in class)
 - Assign groups of different personalities
 - Have every write a report on their experience as a member of the team
 - Grade “loosely” more weight towards the report than the outcome
- Presentations
 - When possible give the opportunity to stand up in front of the class
(It isn't everyone's cup of tea, but it is useful)

All STEM Careers



Building trust every day

Soft Skills



Building trust every day

Soft Skills

- Networking
 - Learn how to build on relationships
- Interpersonal Relationships
 - Learn how to work together with other to better each other
- Negotiation
 - Know how to assign value to a target

“Office” Skills

“Office” Skills

- Word Processors
- Presentation Software
- Spreadsheets
- Databases

In all STEM careers the use of these products are paramount.

Give the students chances to use Spreadsheets as often as possible

Get them typing.



Questions?





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