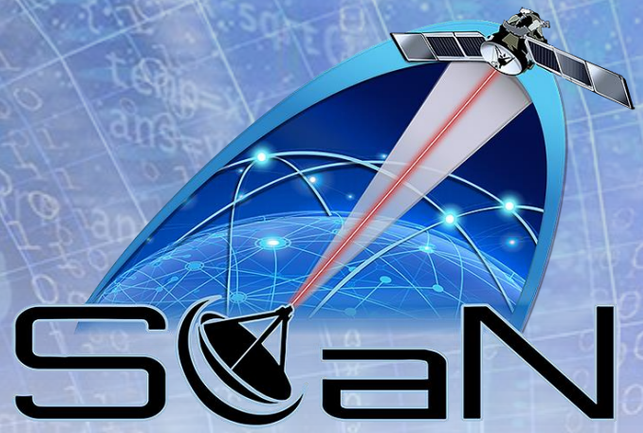
National Aeronautics and Space Administration



Space Communications and Navigation

Final Presentation

- **David Butler**
- Intern, NEN 453

Summer 2019

Introduction

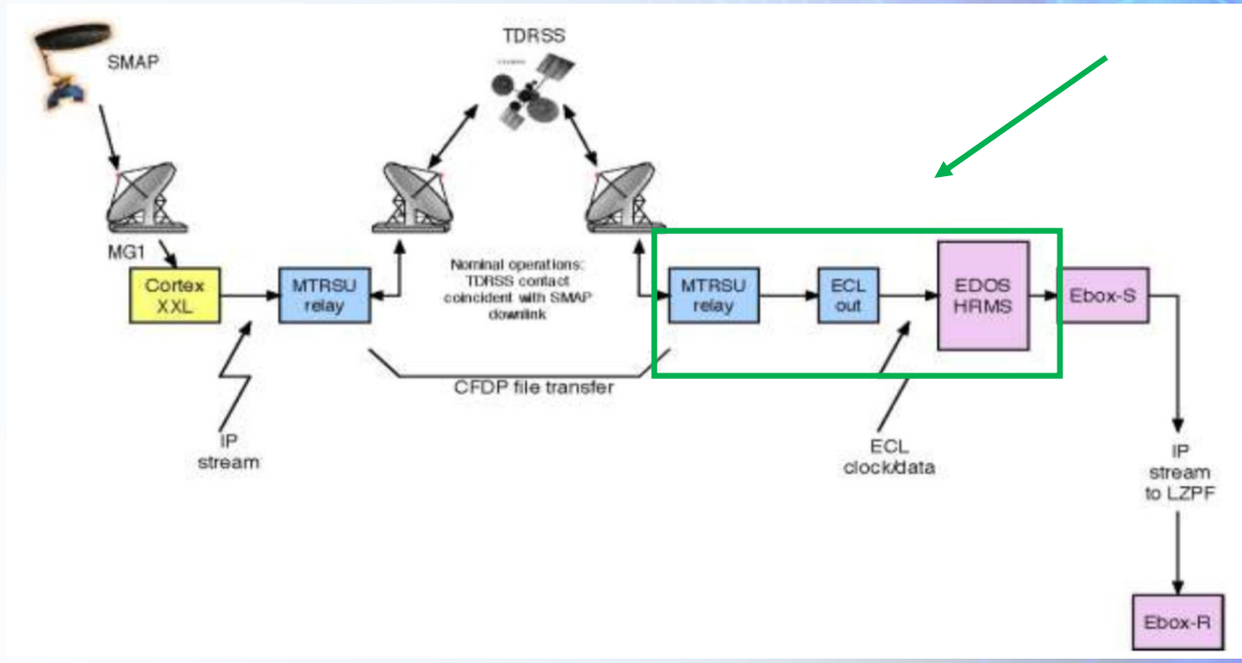
David Butler

- A.S. Computer Science, Tidewater Community College 2019
- Starting B.S. at Old Dominion University, majoring in Computer Science
- Mentor: Scott Schaire, Code 453 Near Earth Network (NEN)

Overview

- **Goal: raise efficiency rating for support of the Soil Moisture Active Passive (SMAP) mission.**
  - **Increased efficiency will reduce reliance on commercial services, currently averaging $113K/month, for this mission**
- **Review and update NEN schedule for increased efficiency for the McMurdo Tracking and Data Relay Satellite System (TDRSS) Relay System (MTRS)**
- **Perform loading study & propose action plan for MTRS**
  - **Upgrade hardware within multiple areas of MTRS**
  - **Recommend software upgrades to handle the increased load of the buffering system at White Sands Ground Terminal (WSGT)**

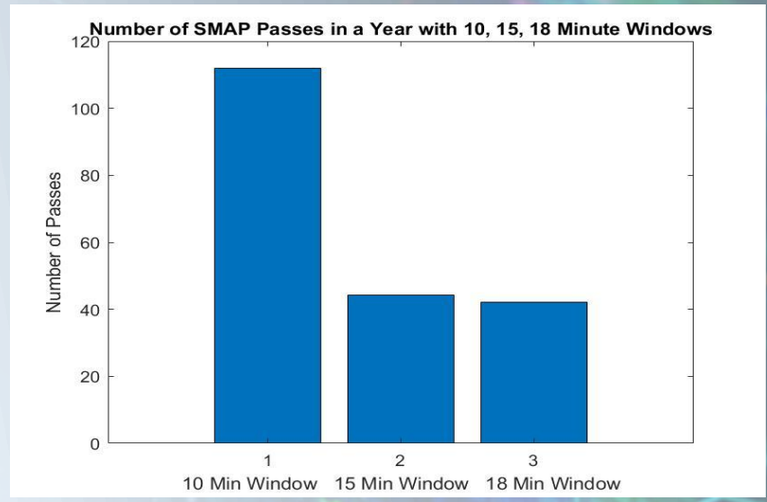
- **Background:**
  - **The issues with the buffer overflow are occurring at the White Sands.**
  - **SMAP makes 208 passes a month and currently MTRS only handles 48 of those passes.**



Methodology

- Adjusted project schedule using MS Project to adequately fit to the NEN's timeline for MTRS upgrade completion in 2020
- Used a partial vendor estimate to calculate the cost of the upgrade to the MTRS antenna drive system
- Performed loading study to determine appropriate data transmitting schedule from MTRS to WSGT and effects of increasing data transfer rate
  - Used MATLAB to handle variables latency, the window time of the TDRS spacecraft to support the SMAP mission, and the data transfer requirement from MTRS to WSGT
  - This model was to determine best length of contact time to meet current and proposed data transfer rates

Results and Analysis



- **Hardware Estimate:**
  - **Upgrade cost for the MTRS antenna drive system is ~$248K**
    - This is required to allow for faster tracking of spacecraft

- **Loading Study:**
  - **Loading study showed that an increase to the transfer rate from MTRS to WSGT would increase the efficiency of service for the SMAP mission**
    - This depends on the ability to increase the effective data transfer rate at WSGT from 100 Mbps to 300 Mbps
  - **Increased ability for tracking will allow for shorter and more frequent contacts**
    - Model showed best option for spacecraft contacts to be 10 minutes in length
    - Increasing contacts from 48 to 110 will reduce the need of support from commercial services by 43.6%, resulting in a cost savings of ~$63,700/month

Recommendation to Continue Research

- **The work is not finished!**
  - **Cost for increasing buffer**
  - **Development of the business case for investment in the upgrades**
  - **Further research into DR items from SCNS study that effects proficiency**

Takeaways

- **Benefits to the NEN**
  - Upgrades to enhance support of the SMAP mission at MTRS
- **Importance to NASA**
  - Reduces cost for use of commercial services
  - Increases ability to support increased science data
- **Ties into my career plans**
  - Demonstrated the importance of team work
  - Allowed me to learn new software such as Microsoft project, MATLAB, and STK
  - Enhanced my proficiency in Microsoft Excel
  - Taught me project management

My Next Steps

- **Professional Goal:**
  - I would like to work at NASA as a software developer, more specifically with Satellite communication
- **Academic Goals:**
  - Academically, my goal is to get a bachelors in computer science and later go for my masters
- **Changes brought on by research this summer:**
  - The work that I did this summer, has steered me in the direction of enjoying satellites/communications.
  - I got a better understanding of the role that satellites play in our everyday life

Finally…

QUESTIONS?

Decade of Light

www.nasa.gov/SCaN