
# System Integration, Test & Launch Engineering Internship

*Peter J. Bloch*

*Honors College, Oregon State University*

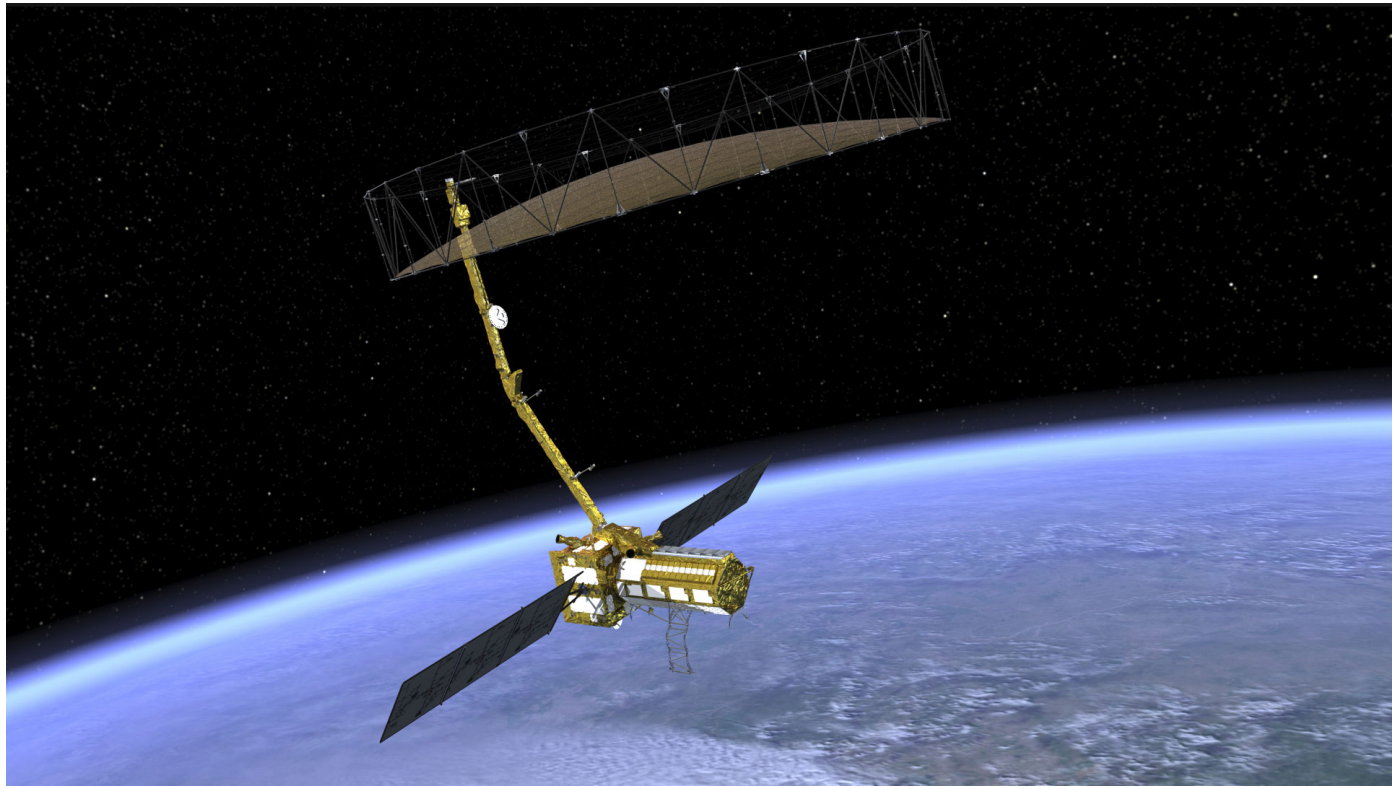
21 Aug 2019

# Who Am I?

- Oregon State University
  - Honors Bachelor of Science
  - Computer Science Major, Applied option with an intended focus on Robotic Intelligence
  - Graduating June 2022
  - Oregon State University Men's Lacrosse Club

# NISAR (NASA ISRO Synthetic Aperture Radar)

- Systems Integration, Test & Launch Operations, Group 313B



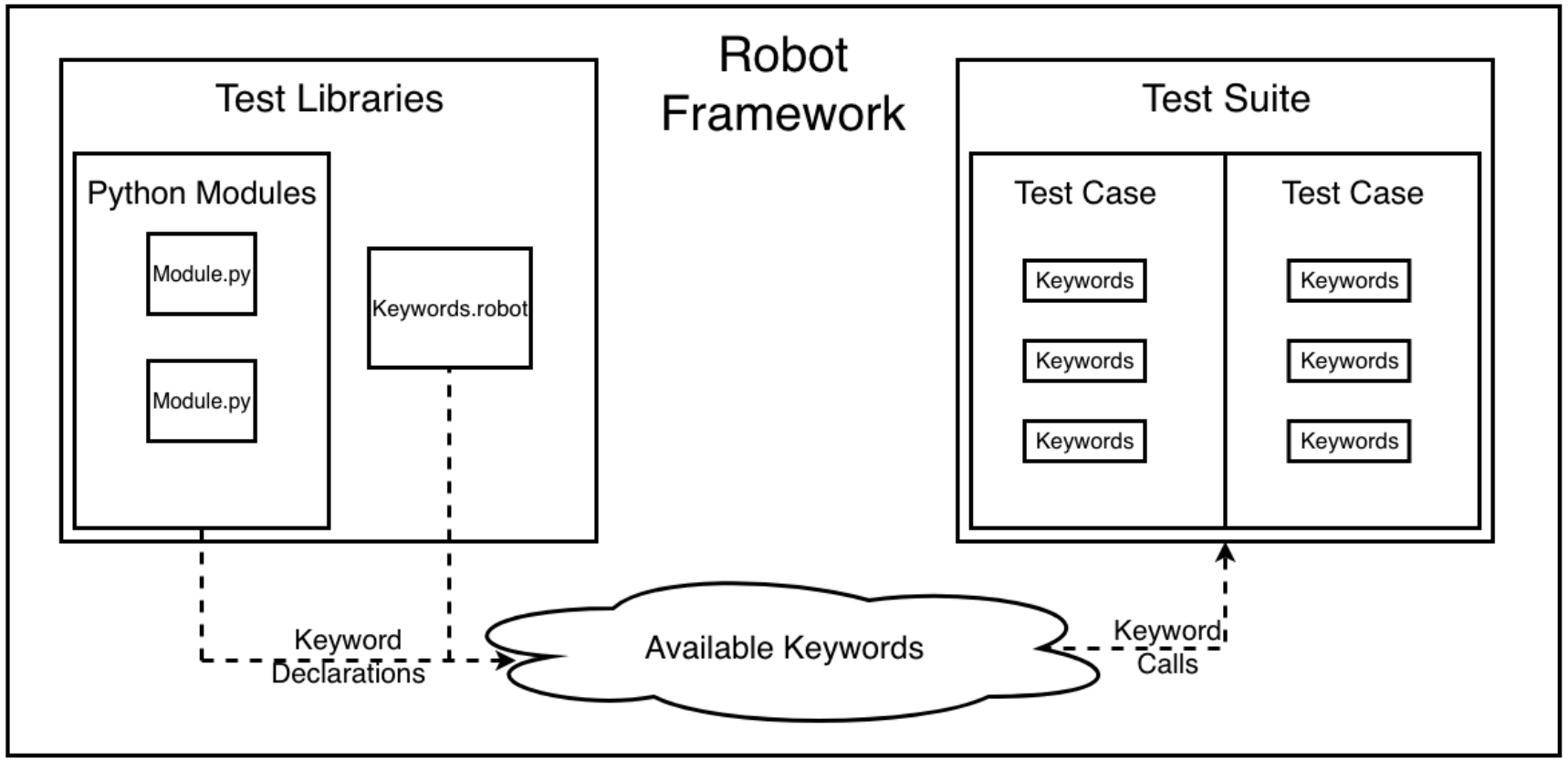
Jet Propulsion Laboratory
California Institute of Technology

# System I&T Projects

- Test automation with Robot Framework
- 306 Hi-bay cable management & application development
- Smaller projects:
  - Scripting
  - NISAR SIT 3/4 wiki page development

# Robot Framework Background

- Keyword-based test automation framework (Python)
  - Allows for automated procedure execution
  - Allows access to powerful software libraries without extensive programming knowledge




**Drawing created by Nick Zhao, Intern**

# Implementation on Workstation Test Set

- WSTS
  - Benefits: Test reporting, **output.xml** file – important.

REPORT

**TEST1 Log**

Generated
20190723 20:58:56 UTC+00:00
13 days 1 hour ago

**Test Statistics**

| Total Statistics | Total | Pass | Fail | Elapsed | Pass / Fail |
|---|---|---|---|---|---|
| Critical Tests | 6 | 5 | 1 | 00:08:54 | |
| All Tests | 6 | 5 | 1 | 00:08:54 | |

| Statistics by Tag | Total | Pass | Fail | Elapsed | Pass / Fail |
|---|---|---|---|---|---|
| station-sys | 5 | 4 | 1 | 00:08:37 | |

| Statistics by Suite | Total | Pass | Fail | Elapsed | Pass / Fail |
|---|---|---|---|---|---|
| TEST1 | 6 | 5 | 1 | 00:08:55 | |
| TEST1.01 Wsts Start | 3 | 3 | 0 | 00:06:12 | |
| TEST1.02 Setup and Init | 3 | 2 | 1 | 00:02:43 | |

**Test Execution Log**

SUITE **TEST1** 00:08:55.389
Full Name: TEST1
Source: /home/nzhao/Documents/robot_framework/Tests/TEST1
Start / End / Elapsed: 20190723 20:50:01.248 / 20190723 20:58:56.637 / 00:08:55.389
Status: 6 critical test, 5 passed, 1 failed
6 test total, 5 passed, 1 failed

SUITE **01 Wsts Start** 00:06:12.427

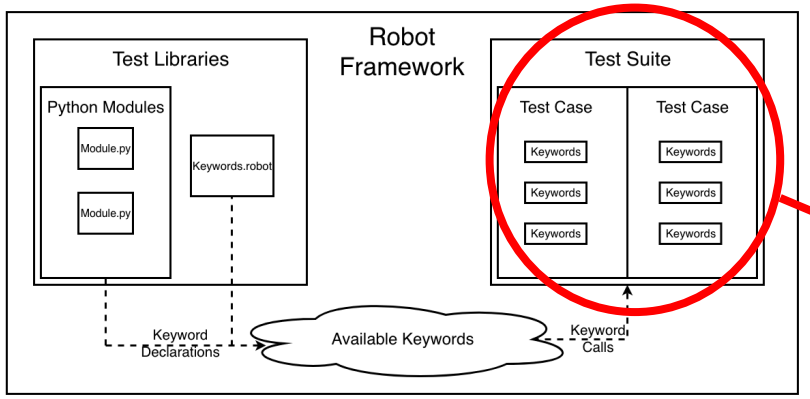
SUITE **02 Setup and Init** 00:02:42.937
Full Name: TEST1.02 Setup and Init
Documentation: Sends commands to VxWorks, waits for user input to power on and configure the SSR.
Source: /home/nzhao/Documents/robot_framework/Tests/TEST1/02_Setup_and_Init.robot
Start / End / Elapsed: 20190723 20:56:13.698 / 20190723 20:58:56.635 / 00:02:42.937
Status: 3 critical test, 2 passed, 1 failed
3 test total, 2 passed, 1 failed

TEST **Initialize MTAK Connection** 00:00:16.638

TEST **Send VxWorks Commands** 00:00:20.201

TEST **Configure SSR** 00:02:06.081
Full Name: TEST1.02 Setup and Init.Configure SSR
Documentation: Configures the SSR
Tags: station-sys
Start / End / Elapsed: 20190723 20:56:50.553 / 20190723 20:58:56.634 / 00:02:06.081
Status: FAIL (critical)

# Example Robot Test Suite




```
*** Settings ***
Library     Process
Resource    ../Libraries/Keywords.robot

*** Test Cases ***

Start WSTS
    Start WSTS

Wait until Cutecom is detected to be running
    Wait Until Cutecom is Running

Wait until the "FILES Sync all done" EVR appears in Cutecom
    Wait Until Files Have Synced

Initialize MTAK Connection
    Import ATLORobotLibrary

Send Test Command to Cutecom
    Send Command  VxWorks     A   Hello World

Close WSTS
    Close WSTS

```

# What is Suite-to-docx?

```
*** Settings ***
Documentation     Performs the checkout of the Digital Sun Sensor Assembly-A
...               (DSA-A)

Metadata          Author    Robert Castillo (rcastill@jpl.nasa.gov)
Library           Remote    http://127.0.0.1:9000

*** Test Cases ***
Record system state before DSA-A power on
    [Tags] station-sys
    Verify EHA    PWR-5253    PWR-CA2-20-ACT-DSA_A_Power    OFF          STATUS

Send command to power on the DSA-A
    [Tags] station-cmd
    Send Command  AMPCS    A    ACS_DSA_POWER,A,ON
    # Injection is TESTSET only
    Verify EHA    PWR-5253    PWR-CA2-20-ACT-DSA_A_Power    ON           STATUS
    Verify EHA    ACS-0047    dsa_a_cmd_state               ON           STATUS

Send command configure the DSA-A to read from Head 1
    [Tags] station-cmd
    Send Command  AMPCS  A    ACS_SET_DSA_MODE_MANUAL,A,H1
    Verify EHA    ACS-0117    dsa_a_cmd_current_head    H1               STATUS
    Verify EHA    ACS-0116    dsa_a_cmd_mode            MANUAL_MODE      STATUS
    Verify EHA    ACS-5033    dsa_hd_sel                DSA_HEAD_1       STATUS
    Verify EHA    ACS-5034    dsa_hd_cmd                DSA_HEAD_1       STATUS
    Verify EHA    ACS-5036    dsa_mode                  COMP_MODE        STATUS
    Verify EHA    ACS-5037    dsa_pwr_sta               PWR_ON           STATUS

Send command to configure the DSA-A to AUTO Mode
    [Tags] station-cmd
    Send Command  AMPCS  A    ACS_SET_DSA_MODE_AUTO,A
    Verify EHA    ACS-0116    dsa_a_cmd_mode            AUTOMATIC_MODE   STATUS
    Verify EHA    ACS-5036    dsa_mode                  AUTO_MODE        STATUS
    Verify EHA    ACS-5037    dsa_pwr_sta               PWR_ON           STATUS

Record system state before DSA-A power off
    [Tags] station-cmd
    Verify EHA    PWR-5253    PWR-CA2-20-ACT-DSA_A_Power    ON           STATUS

Send command to power off the DSA-A
    [Tags] station-cmd
    Send Command  AMPCS  A    ACS_DSA_POWER,A,O
    Verify EHA    PWR-5253    PWR-CA2-20-ACT-DSA_A_Power    OFF          STATUS
```

PBAT PXXXXX, Initial _____ ___/___/___ __:__
<PROCEDURE_NAME> Procedure January 1, 2000

| STEP | STATION | OPERATION | VERIFIED |
|---|---|---|---|

**6 M2020 DSA-A CHECKOUT**

Performs the checkout of the Digital Sun Sensor Assembly-A (DSA-A)

6-1 SYS Record system state before DSA-A power on _____

PWR-5253 PWR-CA2-20-ACT-DSA_A_Power _____ (OFF STATUS)

6-2 CMD Send command to power on the DSA-A _____

**AMPCS-A> ACS_DSA_POWER,A,ON**

PWR-5253 PWR-CA2-20-ACT-DSA_A_Power _____ (ON STATUS)

ACS-0047 dsa_a_cmd_state _____ (ON STATUS)

6-3 CMD Send command configure the DSA-A to read from Head 1 _____

**AMPCS-A> ACS_SET_DSA_MODE_MANUAL,A,H1**

ACS-0117 dsa_a_cmd_current_head _____ (H1 STATUS)

ACS-0116 dsa_a_cmd_mode _____ (MANUAL_MODE STATUS)

ACS-5033 dsa_hd_sel _____ (DSA_HEAD_1 STATUS)

ACS-5034 dsa_hd_cmd _____ (DSA_HEAD_1 STATUS)

ACS-5036 dsa_mode _____ (COMP_MODE STATUS)

ACS-5037 dsa_pwr_sta _____ (PWR_ON STATUS)

6-4 CMD Send command to configure the DSA-A to AUTO Mode _____

**AMPCS-A> ACS_SET_DSA_MODE_AUTO,A**

ACS-0116 dsa_a_cmd_mode _____ (AUTOMATIC_MODE STATUS)

ACS-5036 dsa_mode _____ (AUTO_MODE STATUS)

ACS-5037 dsa_pwr_sta _____ (PWR_ON STATUS)

6-5 CMD Record system state before DSA-A power off _____

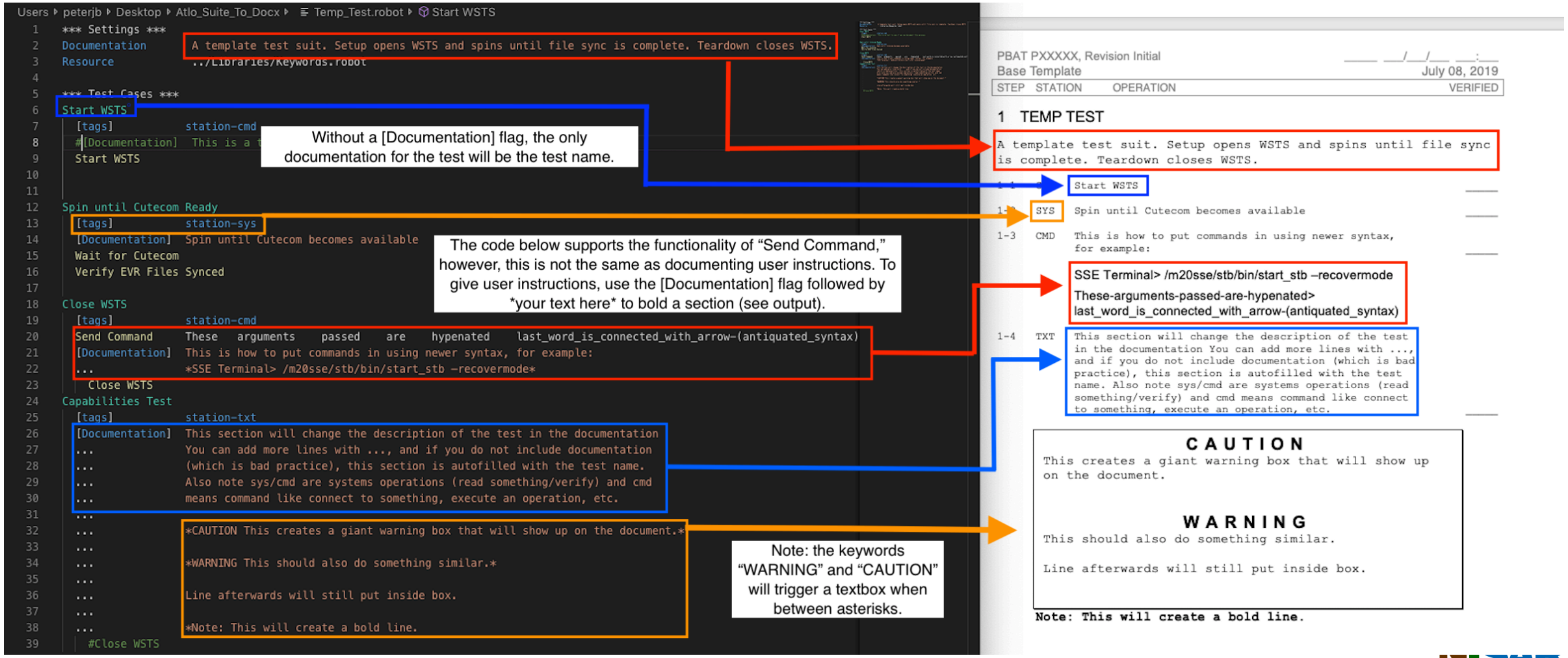
PWR-5253 PWR-CA2-20-ACT-DSA_A_Power _____ (ON STATUS)

Page 17 of 21

*The technical data in this document is controlled under the U.S. Export Regulations; release to foreign persons may require an export authorization.*

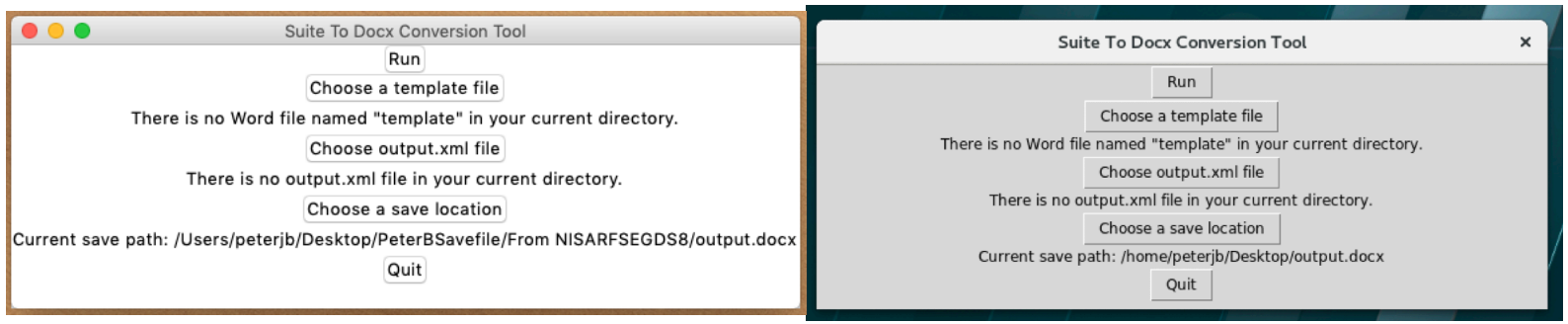
Legend: Documentation, Step-Station, Station, Verify EHA, Commands

# Suite-to-docx Capabilities



# My Contribution

1. Took the Mars2020 code, updated it, and implemented it for NISAR
2. Instructing my team and others how to use it, and the potential benefits
3. Writing a Graphical User Interface (GUI)
4. Configuring Python Virtual Environments
5. Documentation




Shown: GUI for Suite to Docx

# Manual vs. Automatically Generated



STEP STATION OPERATION VERIFIED

## 5 MISSION TESTBED STARTUP PROCEDURE

If the racks are powered off refer to Appendix A (**POWER SSE RACKS**) to power on the racks.

5-1 GDS On the GDS SMAPFSWTBMPCS1 workstation, open a new Terminal window and verify that "CommandBlockGen" is *not* running, by issuing the following command and observing that "CommandBlockGen" is not listed as one of the running java programs: _____

**ps -ef | grep java**

5-2 SSE On the SMAPFSWTBSSE workstation, open a new Terminal window and verify that "smapfswtbsse" is *not* running, by issuing the following command and observing that "smapfswtbsse" is not listed as one of the running python programs: _____

**ps -ef | grep python**

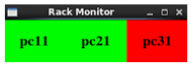
### 5.2 Initialize Simulation and Support Equipment (SSE)

5-3 SSE On the SMAPFSWTBSSE workstation, to monitor the racks before SSE software initialization, via the Terminal window, send: _____

**/proj/nisar/sse/CDHTB/bin/rcmon &**


The Rack Monitor window will pop up.

5-4 SSE In the Rack Monitor Window, verify that pc11 and pc21 (for Racks 1 and 2) are GREEN: _____




NOTE: SMAP had a third Rack, but NISAR does not. So, pc31 will stay red, as it is N/A.

5-5 SSE Via the Terminal window, send: _____

**/proj/nisar/fsw/tools/bin/cutecom198 &**

The CuteCom window will pop up:






STEP STATION OPERATION VERIFIED

## 2 MISSION TESTBED STARTUP PROCEDURE

If the racks are powered off refer to Appendix A (POWER SSE RACKS) to power on the racks.

### 2.1 Setup

2-1 GDS On the GDS npdsdwn1 workstation, open a new Terminal window and verify that "CommandBlockGen" is not running, by issuing the following command: _____

ps -ef | grep -i CommandBlockGen

**NOTE: alternatively, ps -ef | grep java would show the user all of the running java applications...**

2-2 SSE On the SMAPFSWTBSSE workstation, open a new Terminal window and verify that "smapfswtbsse" is not running, by issuing the following command: _____

ps -ef | grep python | grep smapfswtbsse

**NOTE: alternatively, ps -ef | grep python would show the user all of the running python applications...**

### 2.2 Initialize Simulation and Support Equipment(SSE)

2-3 SSE On the SMAPFSWTBSSE workstation, to monitor the racks before SSE software initialization, via the Terminal window, send: _____

/proj/nisar/sse/CDHTB/bin/rcmon &

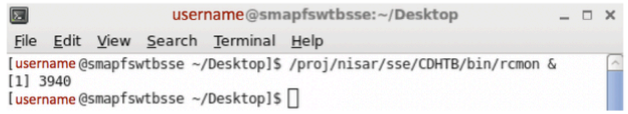
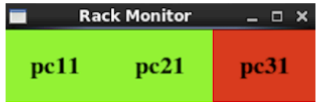


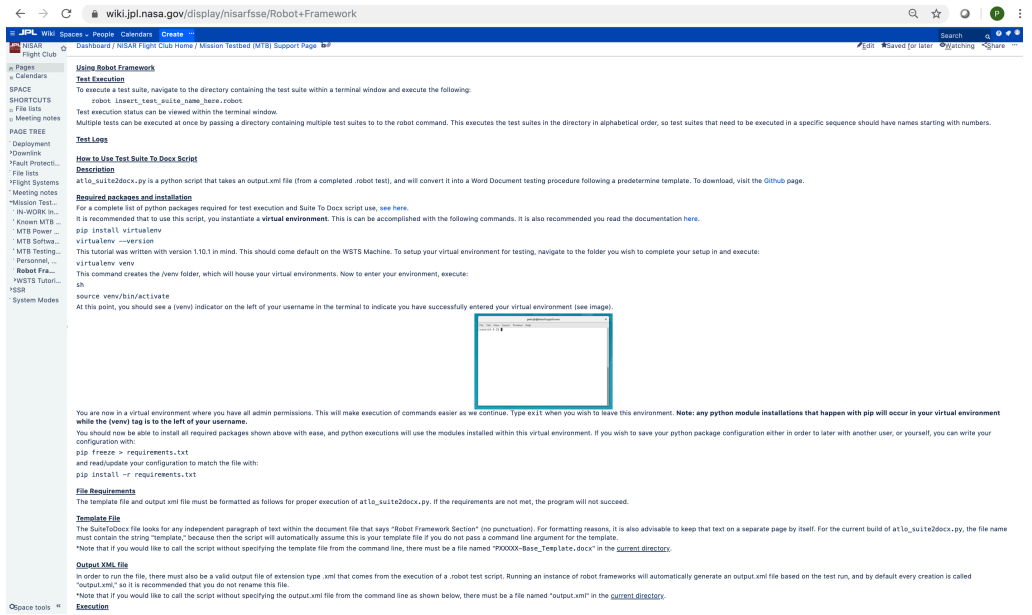

Figure 1-1: image one caption

2-4 SSE In the Rack Monitor Window, verify that pc11 and pc21 (for Racks 1 and 2) are GREEN: _____



# Challenges with Suite-to-docx

- Learning what was “under the hood”
- Operating Systems
- Documentation of code

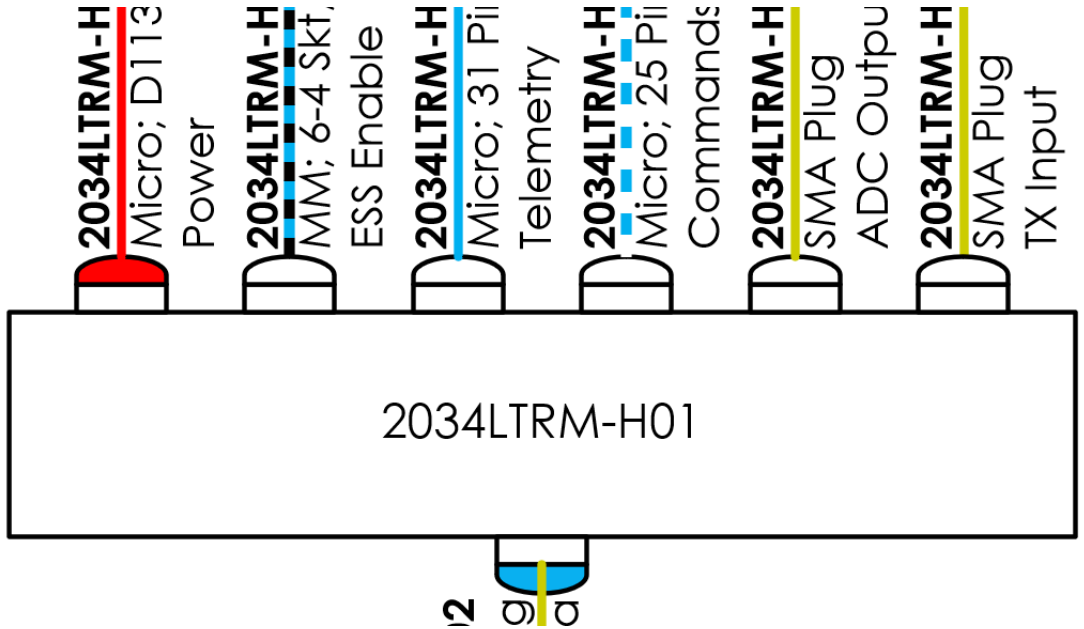



- Execution on different systems with different Python environments
  - Package Installation
  - Virtual Environments

# SIT Scripting - Microsoft Visio

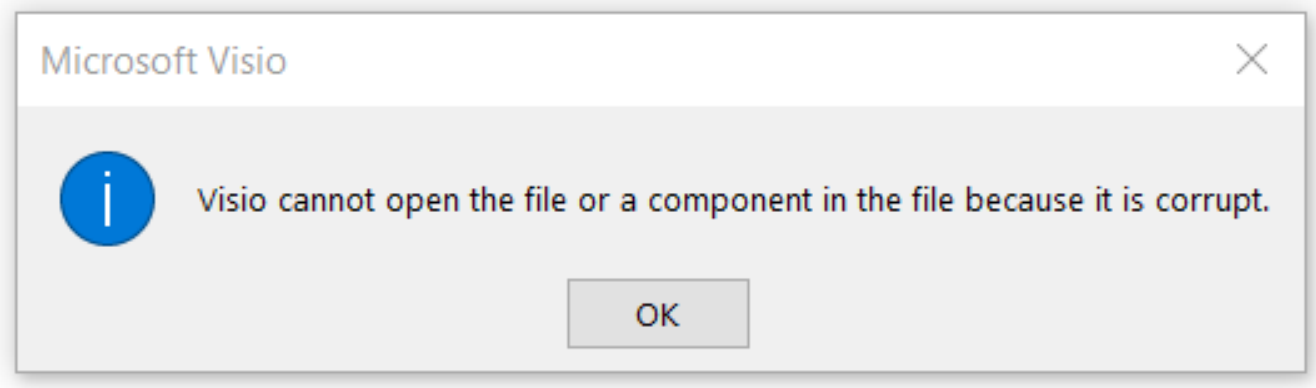
- Procedurally updating Microsoft Visio File to reflect the output of Institutional Mate/Demate Tool

- Tracing the data
- Locating integration of Mate/Demate Data
- Identifying which shape must be updated
- Updating that color



# Challenges with Visio Script

- Lack of solid documentation on Microsoft Visio structure
  - Word vs. Visio
- File Corruption during save due to imperfect encoding
- Time



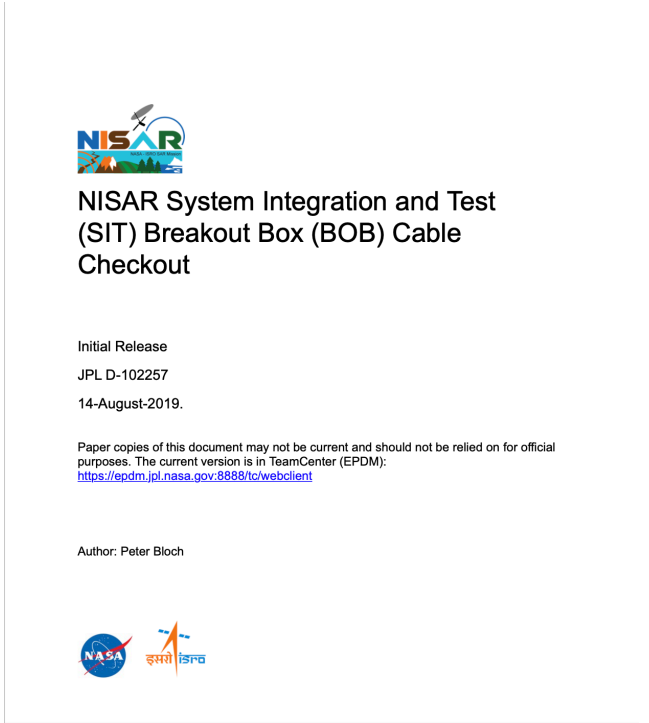

- Next steps determined

# Cable Management & Inventory

- Built an inventory for SIT Breakout Box (BOB) Cables
  - Buzzed out & organized new cables
    - Verified continuity, no shorts, and proper isolation.
  - Updated which cables we were missing
    - Allowed team to determine what was still needed
  - Created an online database.

# Cable Management & Inventory

- BOB Cable Inventory & checkout system
  - Released the current inventory document to EPDM and placed a physical copy in 306 Hi-bay
  - Wrote a Python application to manage inventory and update changes on the database
  - Will be used to automate BOB Checkout between the various NISAR testbed locations.



NISAR System Integration and Test (SIT) Breakout Box (BOB) Cable Checkout

Initial Release

JPL D-102257

14-August-2019.

Paper copies of this document may not be current and should not be relied on for official purposes. The current version is in TeamCenter (EPDM):
https://epdm.jpl.nasa.gov:8888/tc/webclient

Author: Peter Bloch

# Raspberry Pi Inventory (“Pinventory”)

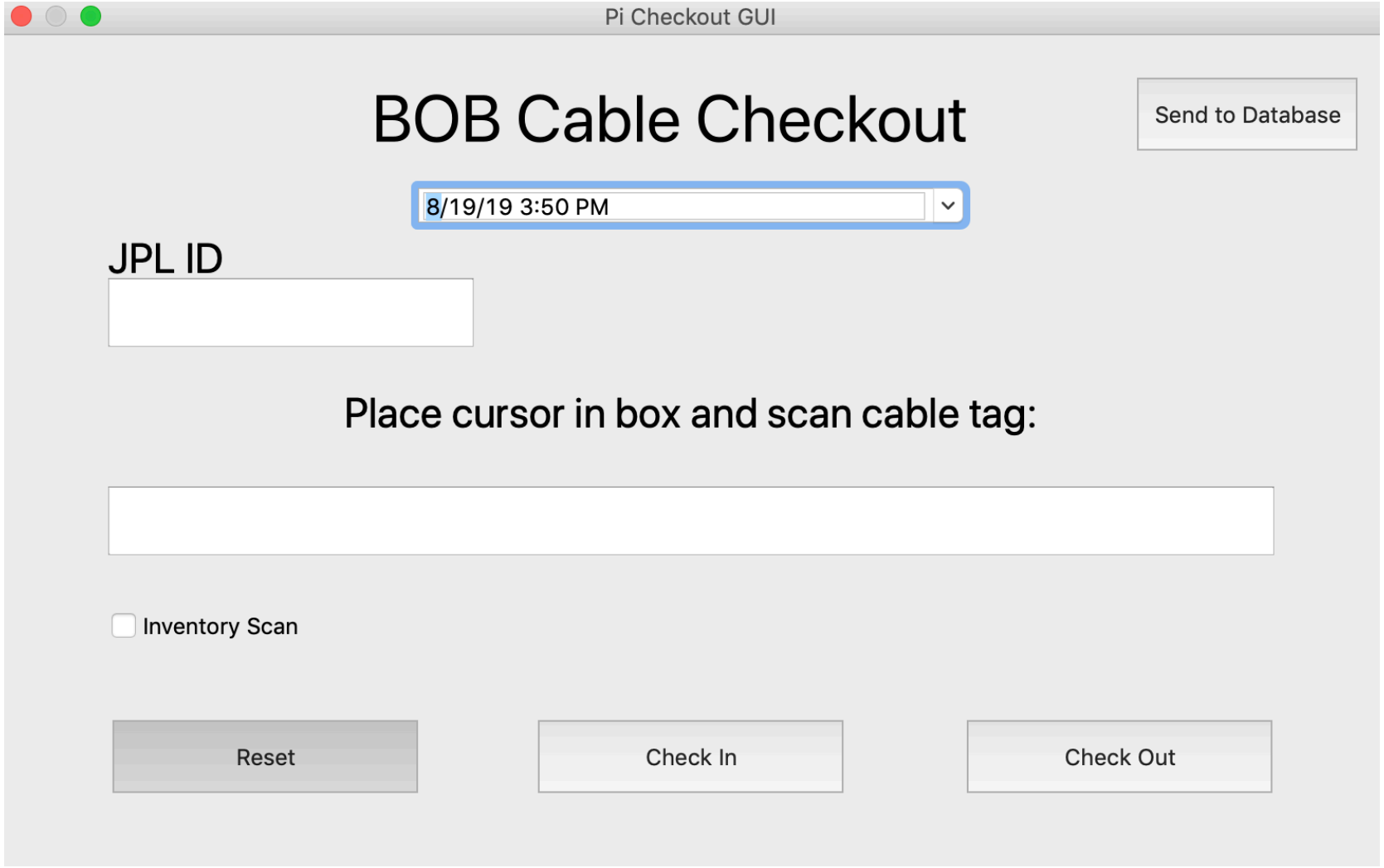
Scanner Test

File Edit View Insert Format Data Tools Add-ons Help Last edit was yesterday at 1:05 PM

Share

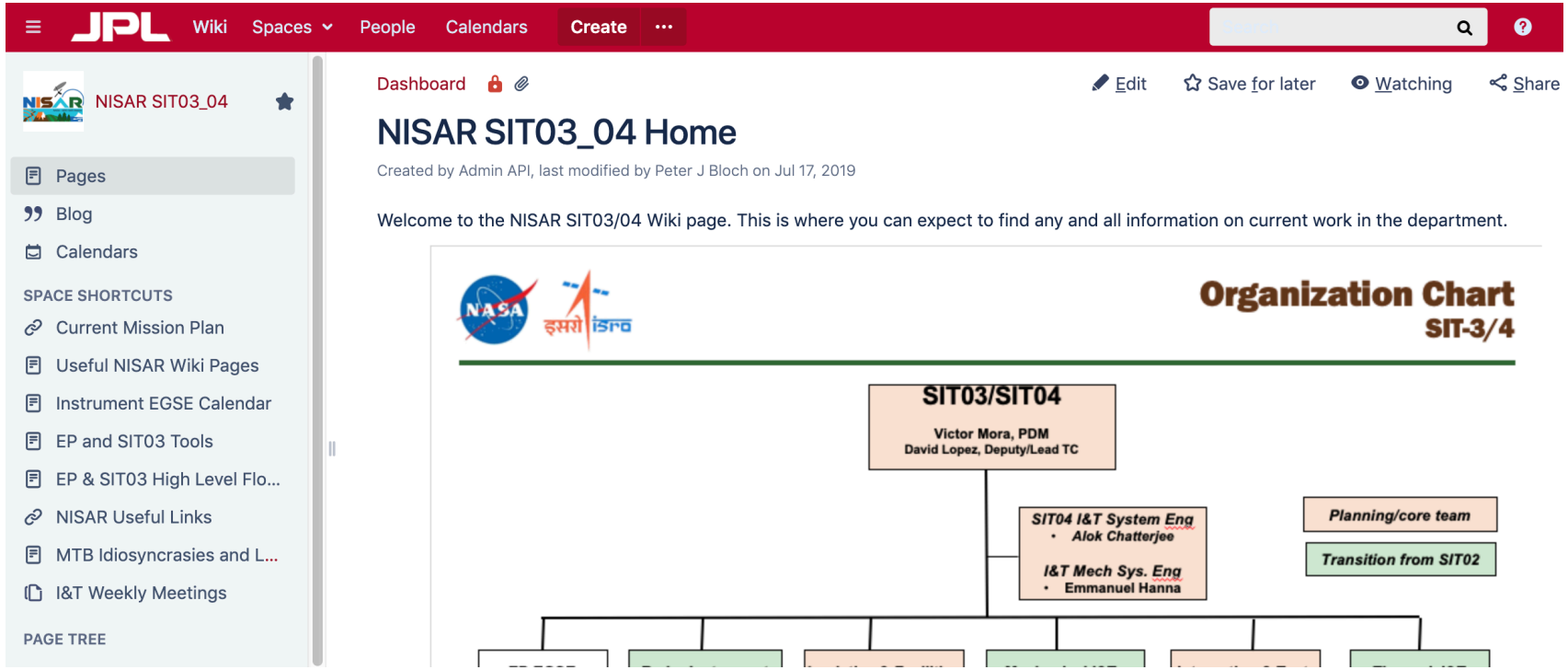
| | A | Harness | Connector | Version | QR Code | Barcode 128 | | |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | W2007H001 | W2007H001-J01 | 2.01 | | | | |
| 3 | | W2007H002 | W2007H002-J10 | 1.00 | | | | |
| 4 | | W2007H003 | W2007H002-J11 | 1.00 | | | | |

# Application for BOB Cable Checkout



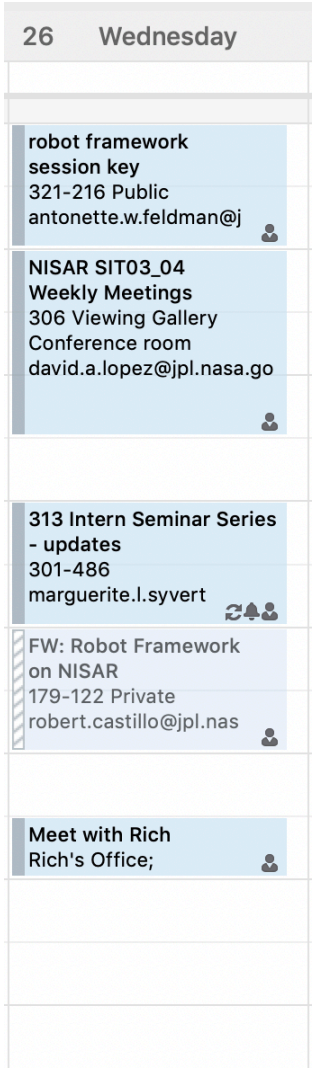
# Wiki – One Stop Shop for Test Engineers

- Created, populated, and managed Wiki
- Centralized all the tools and calendars for the team
- Added links to important documentation



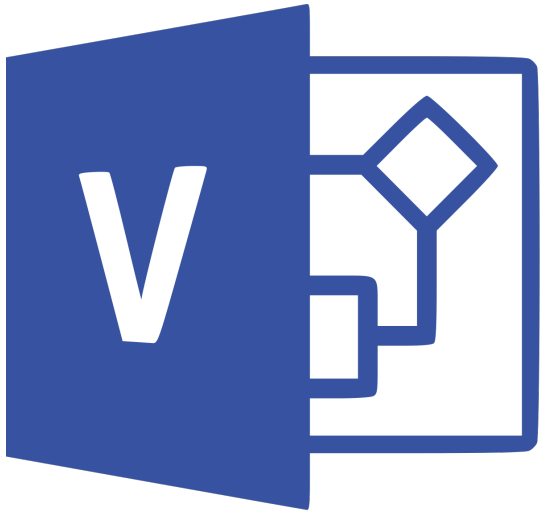
# Lessons Learned

- **Time Management**
- Effective Communication
- How to ask for help



# Technical Skills Learned

- Robot Framework
- Raspbian Application Development
- Building a GUI in Python
- Microsoft Visio



- Improved my abilities:
  - Python Scripting
  - Excel

# Acknowledgements


- Victor Mora, *Mentor and SIT 3/4 Manager*
- David Lopez, *Deputy SIT 3/4 Manager*
- Eisha Tyler, *SIT Electrical Lead*
- Toni Feldman, *EP V&V Lead*
- James Roberts, *EGSE Software Lead*
- Ronald Kinslow, *Group Supervisor 313*
- Robert Castillo, *M2020 POC*
- Nick Zhao, *Fellow Intern*
- Blaire Weinberg, *Fellow Intern*

- Everyone not listed from NISAR SIT & MTB team

# Acknowledgements



JPL

**Jet Propulsion Laboratory**
California Institute of Technology

# Questions?