Environmental Control System Software & Hardware Development
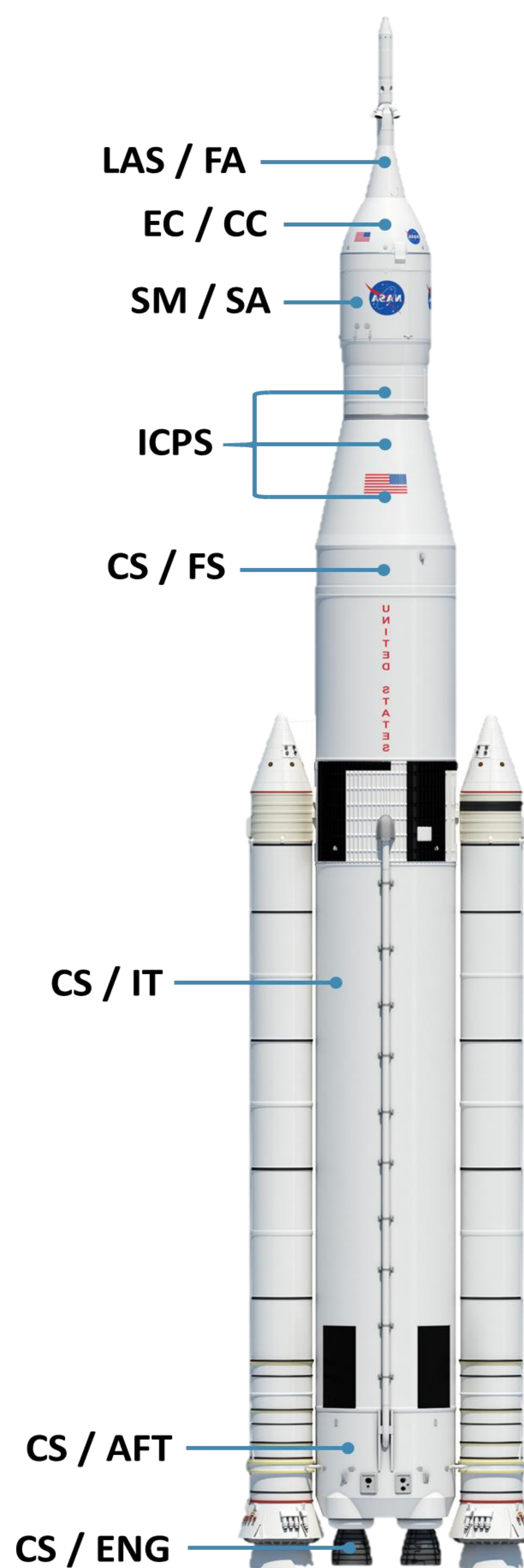
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Background

- Bachelor's Degree in Mechanical Engineering (2015)
- Graduate Research Assistant at the Center of Space Exploration and Technology Research

SLS ECS Interfaces

LAS / FA
EC / CC
SM / SA
ICPS
CS / FS
CS / IT
CS / AFT
CS / ENG

Acronym	Description
LAS / FA	Launch Abort System / Faring Assembly
EC / CC	Environmental Chamber / Crew Cabin
SM / SA	Service Module / Spacecraft Adapter
ICPS	Interim Cryogenic Propulsion Stage
CS / FS	Core Stage / Forward Skirt
CS / IT	Core Stage / Inter Tank
CS / AFT	Core Stage / Aft
CS / ENG	Core Stage / Engines

Figure 1. SLS ECS Interfaces

Introduction to ECS

ECS Hardware

- Provides controlled purge to SLS Rocket and Orion spacecraft
- Provide mission-focused engineering products and services to a broad set of programs at Kennedy Space Center

ECS Software

- NASA requires Compact Unique Identifiers (CUIs)
  - Fixed-length identifier used to identify information items
- CUI Structure
  - Composed of nine semantic fields that aid the user in recognizing its purpose
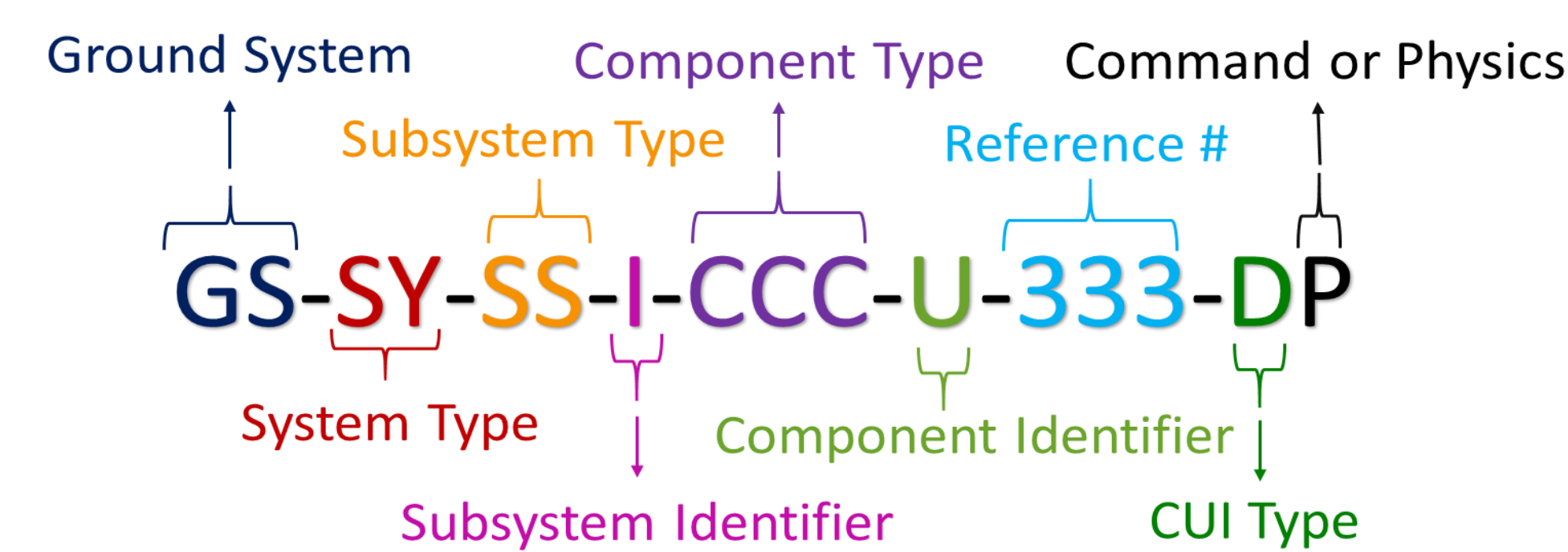
Ground System — Component Type — Command or Physics
Subsystem Type — Reference #

GS-SY-SS-I-CCC-U-333-DP

System Type — Component Identifier
Subsystem Identifier — CUI Type

Figure 3. CUI nomenclature

Figure 2. Standby Blower

Role and Tasks

Main team role and responsibility

- Assist the NE-M3 team to develop and test the MPPU and Launch Pad ECS software
- Perform Refrigeration Load Calculations of the KSC Launch Pad 39-B

Completed and Current Tasks

1. Create and/or modify MPPU software CUIs to meet NASA standards (Spring 2016)
2. KSC Launch Complex 39-B Environmental Control System refurbishment Refrigeration load calculation due to new blowers (Summer 2017)
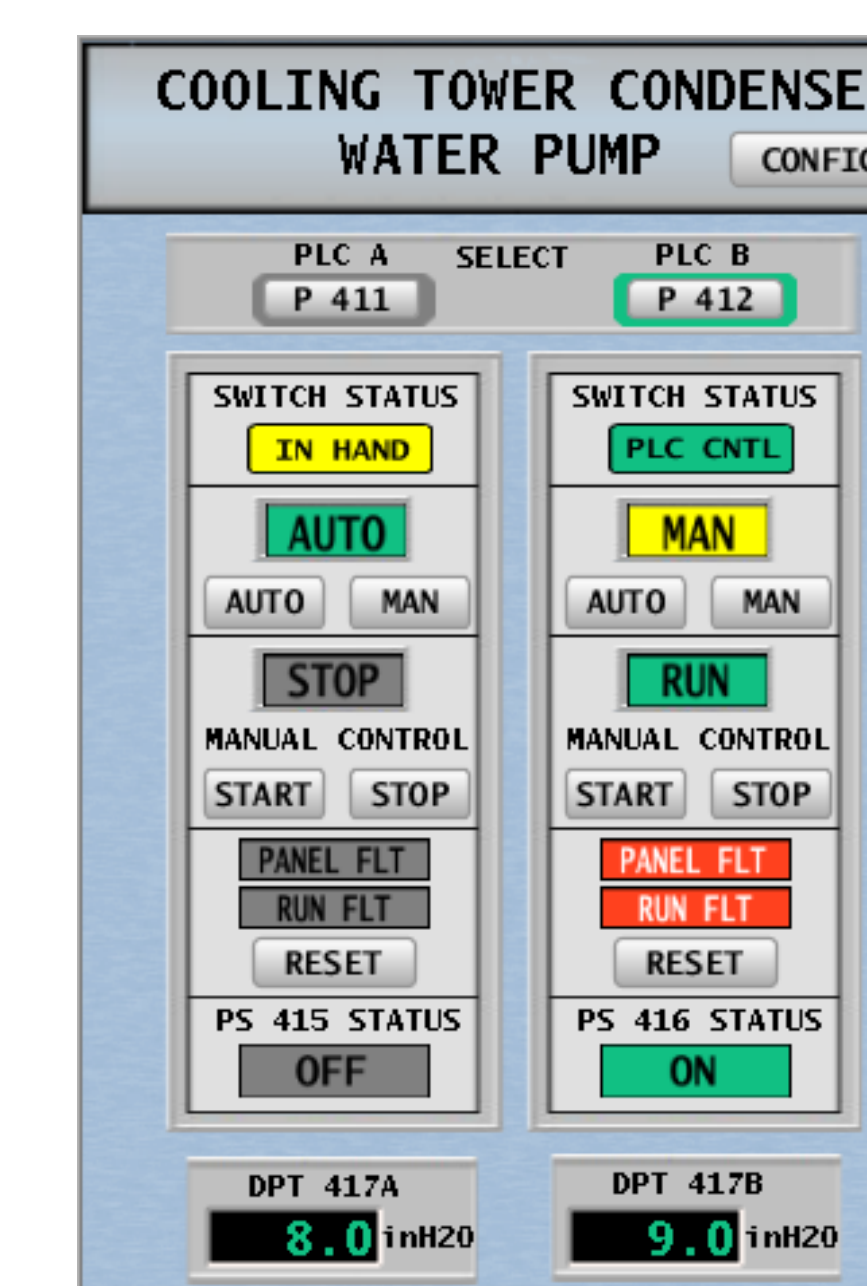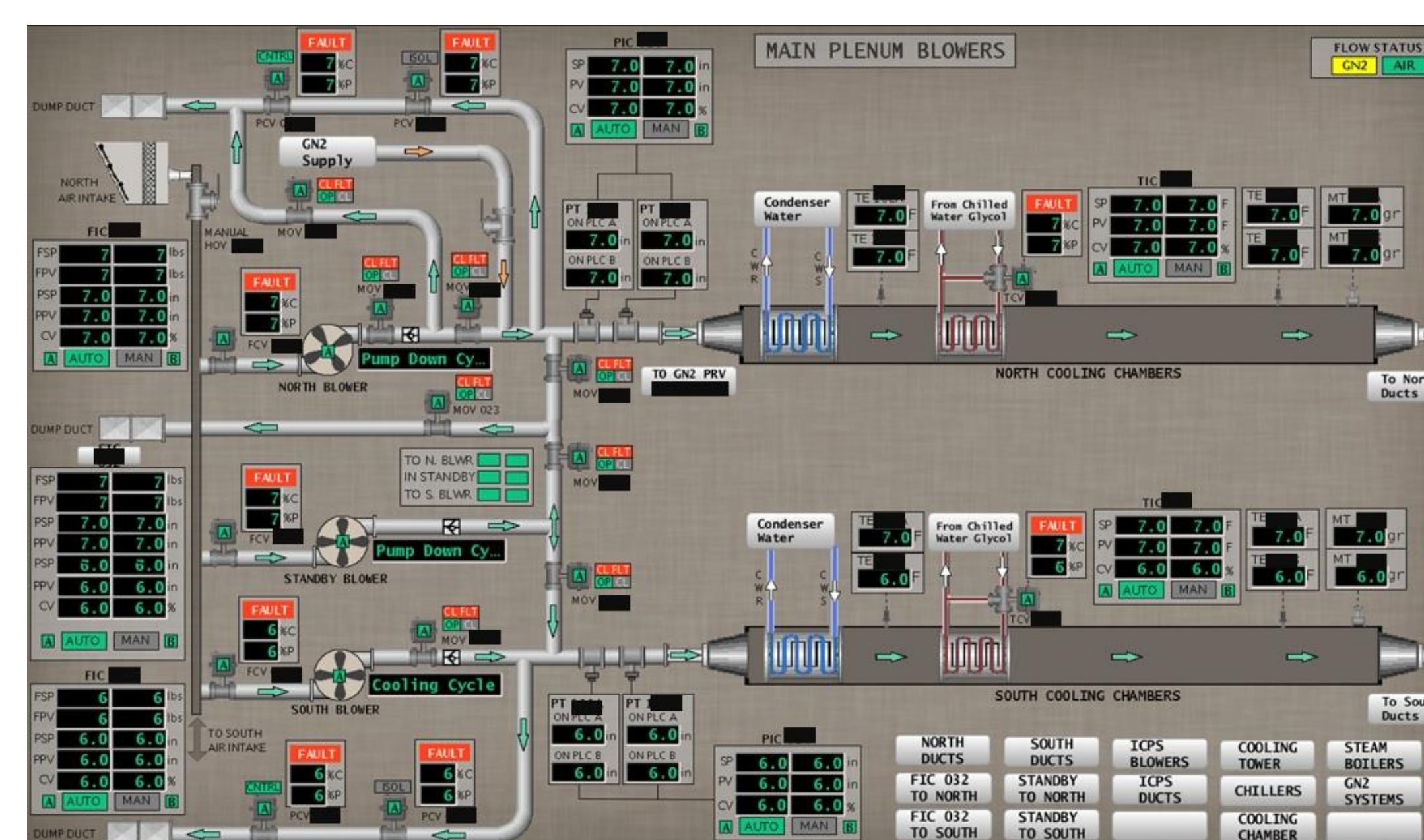
Figure 4. Launch Pad ECS Remote Screen Examples (Credit: J.Wilkas)

Accomplishments / Conclusion

Main Accomplishments:

- ~300 MPPU software CUIs were verified with the PLC software/code and engineering spec drawings
- Remote screens were created for use in the LCC
- Learned the basics AFT software to perform flow analysis
- Complete understanding of the MPPU and Launch Pad ECS system

Conclusion:

- ✓ Helped the NE-M3 team to advance the effort to complete and verify the MPPU and Pad ECS software
- ✓ Experience with ECS = ready to provide invaluable support for the team when converted
- ✓ Mechanical understanding of refrigeration systems is vital for software development

Future Directions

- MPPU software regression test – final verification
  - Test against hardware
  - MPPF, LASF, and transporter
- Launch Pad ECS initial software revision
- ➢ Personal: Graduate December 2017 with my M.S Mechanical Engineering

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- Mentors: Armando Maiz, Drew Gillespie
- Others: Ted Moore, Zoe Sampson, Stephen Camick, Greg Rawl

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Contact Information

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