



Engineering Directorate Software Robotics and Simulation Division

Summer Internship Exit Presentation

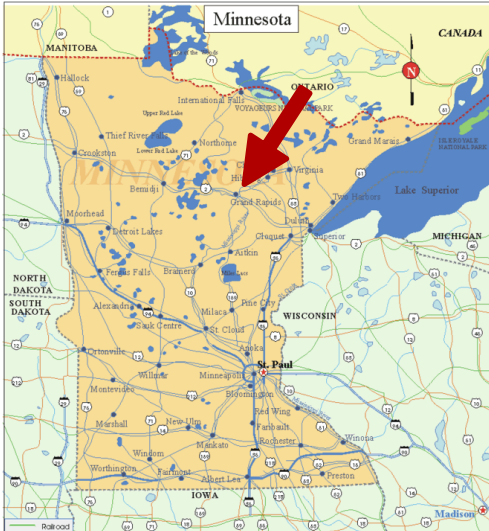


ER5: Dynamic Systems Test Branch

June 8 – August 14, 2015



About Me



Hometown: Grand Rapids, MN



- BS in Physics, Emphasis in Medical Physics (2014)
- Minor in Astronomy



Areas of Interest for future work/research

- Biomedical
- Robotics
- Propulsion

Personal Interests

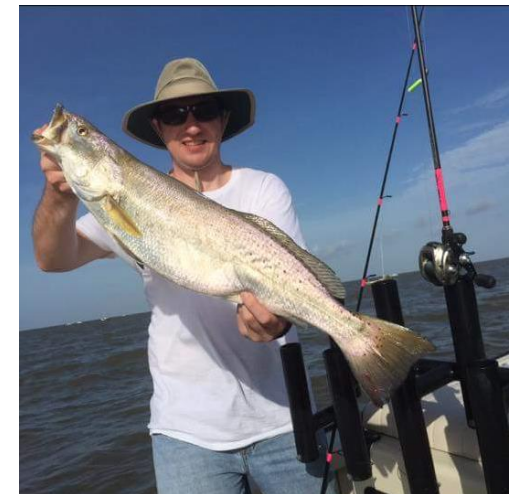
- Soccer
- Hunting
- Fishing



Home



- Graduate Student, pursuing MS in Electrical Engineering
- Emphasis in Control Systems





Agenda



- ER5 Projects
- Takeaways
- Future Plans



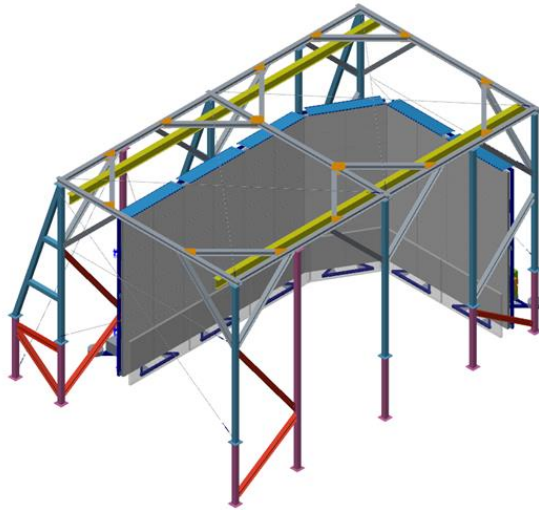
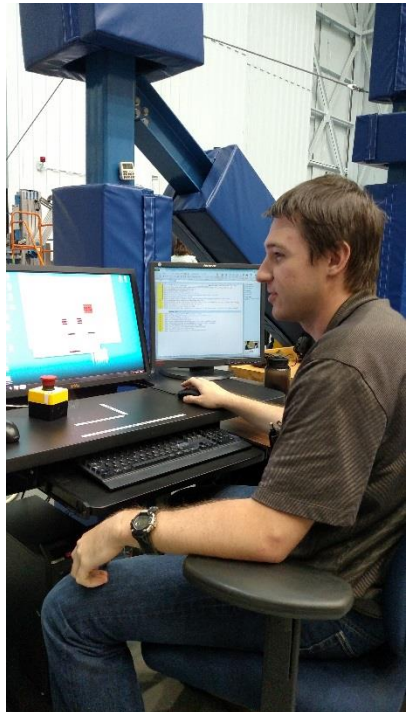


ER5 Projects



Projects

- ARGOS Operator Training
- Power Distribution of Future Video Wall for ARGOS
- Service Robot





ARGOS Operator Training



➤ Trained as an ARGOS operator

- Supported two days per week
- Supported for R2 and SAFER testing

➤ Setup

- Follow documented procedure for proper startup
- Different payloads

➤ Operate

- Maintain vigilance on the control system and the payload

➤ Shutdown

- Follow documented procedure for proper shutdown



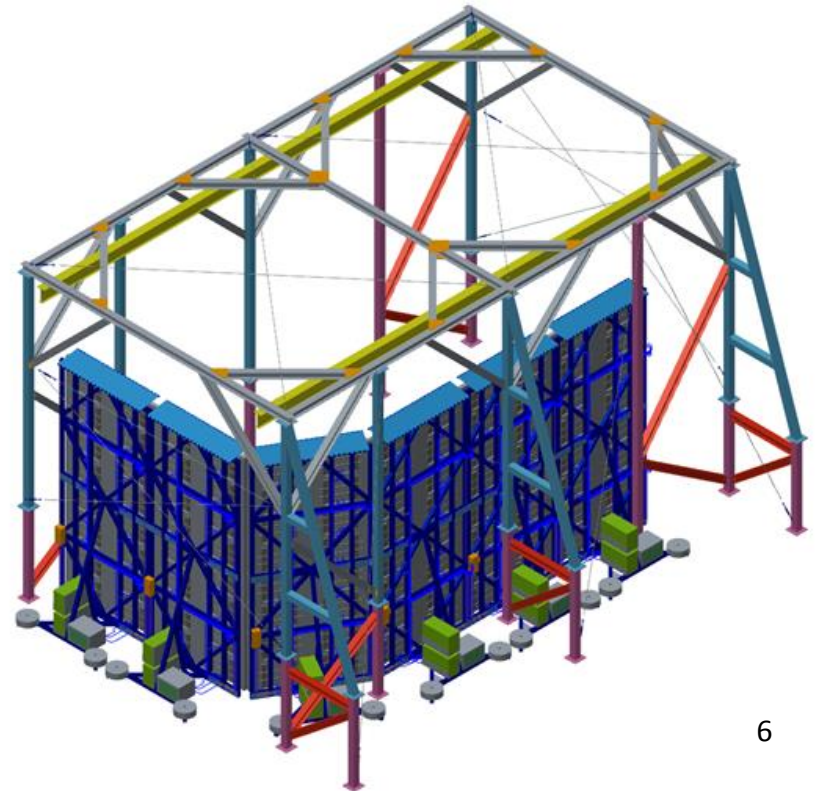
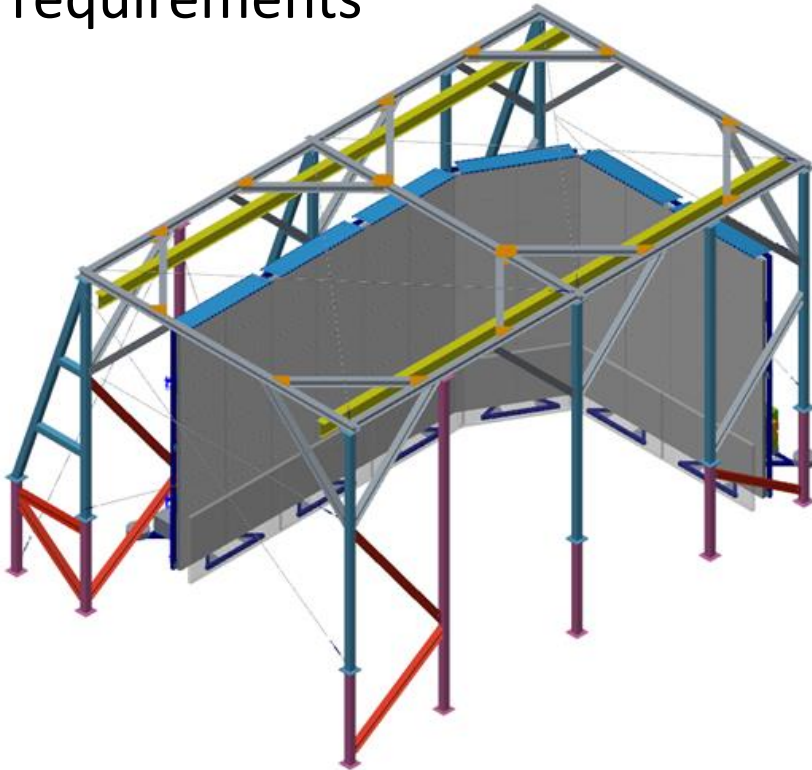


Video Wall Project



- Video Wall consists of 6 video towers
- Power distribution design for towers
- Selected parts from given requirements

- Collaborated with:
 - Larry Dungan, Electrical Engineer
 - Frank Delgado, Project Manager/Software Designer
 - Bryan Griffith, Mechanical Engineer

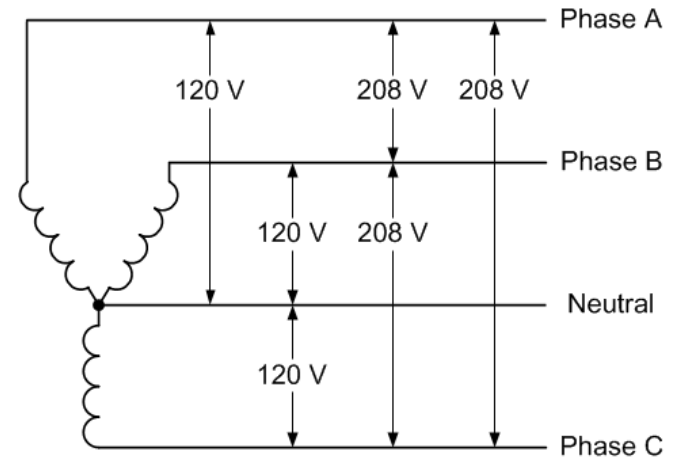




Power Distribution



- Only custom electrical design is the power distribution
 - Other connections are computers and monitors
- Utilize 3-phase 208VAC
 - Allows three 120VAC single-phase
- Adequate 208VAC is available in the facility for 2 video walls in support of initial deployment
- Minimizes electrical cables from video wall to facility
- UPSs were used for power conditioning
 - Also provides power backup due to 208VAC power sags in Building 9
- Equal distribution of loads across available power





Power Distribution



- Break down of power on three breakers

Circuit 1	Hardware	Max Power (W)	Quantity	Wattage (W)	Current (A)
	Monitor	200	4	800	7
	Computer	1100	1	1100	9
			<i>TOTAL</i>	<i>1900</i>	<i>16</i>

- Breaker selection based on data is 20A

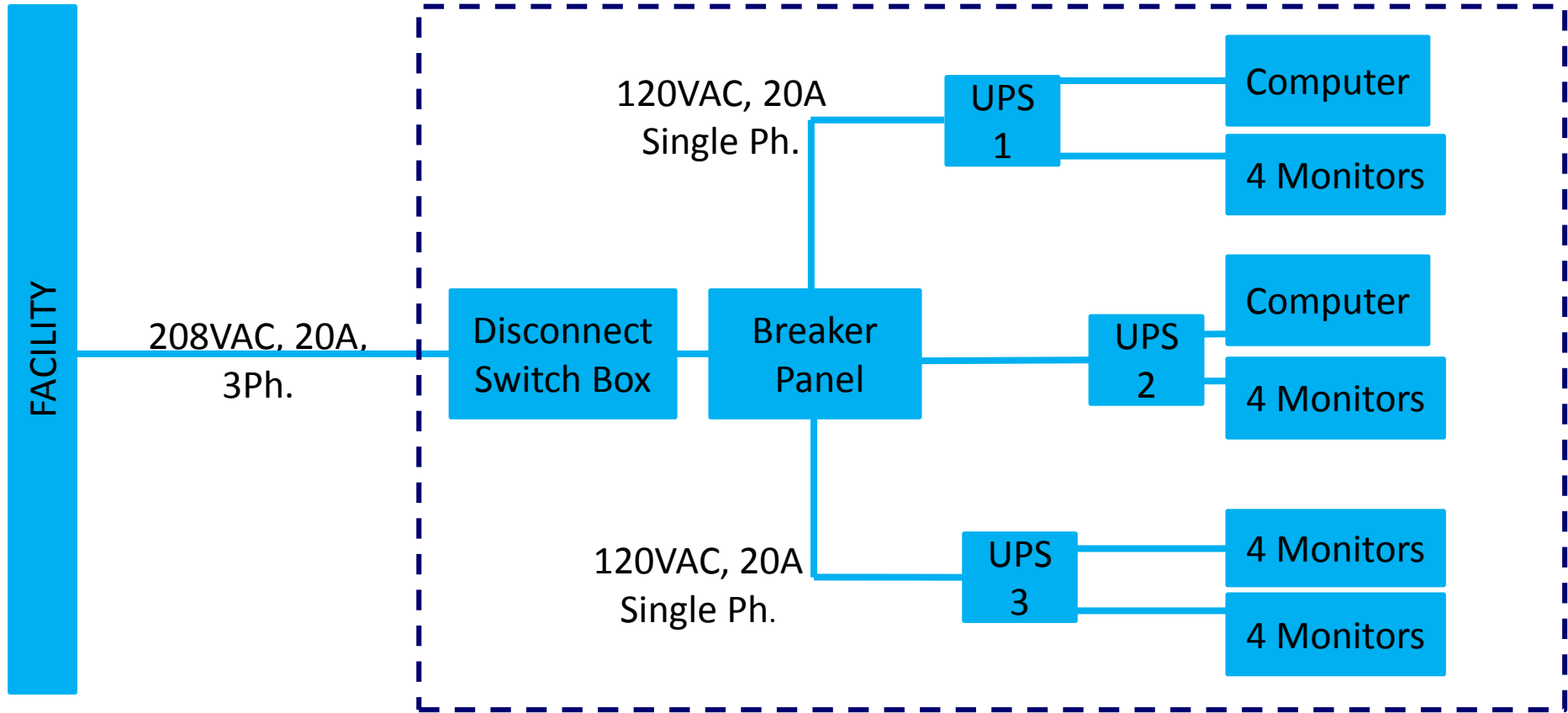
Circuit 2	Hardware	Max Power (W)	Quantity	Wattage (W)	Current (A)
	Monitor	200	4	800	7
	Computer	1100	1	1100	9
			<i>TOTAL</i>	<i>1900</i>	<i>16</i>

- Wire size per National Electric Code is 12AWG solid core copper wire

Circuit 3	Hardware	Max Power (W)	Quantity	Wattage (W)	Current (A)
	Monitor	200	8	1600	14
	Computer	1100	0	0	0
			<i>TOTAL</i>	<i>1600</i>	<i>14</i>

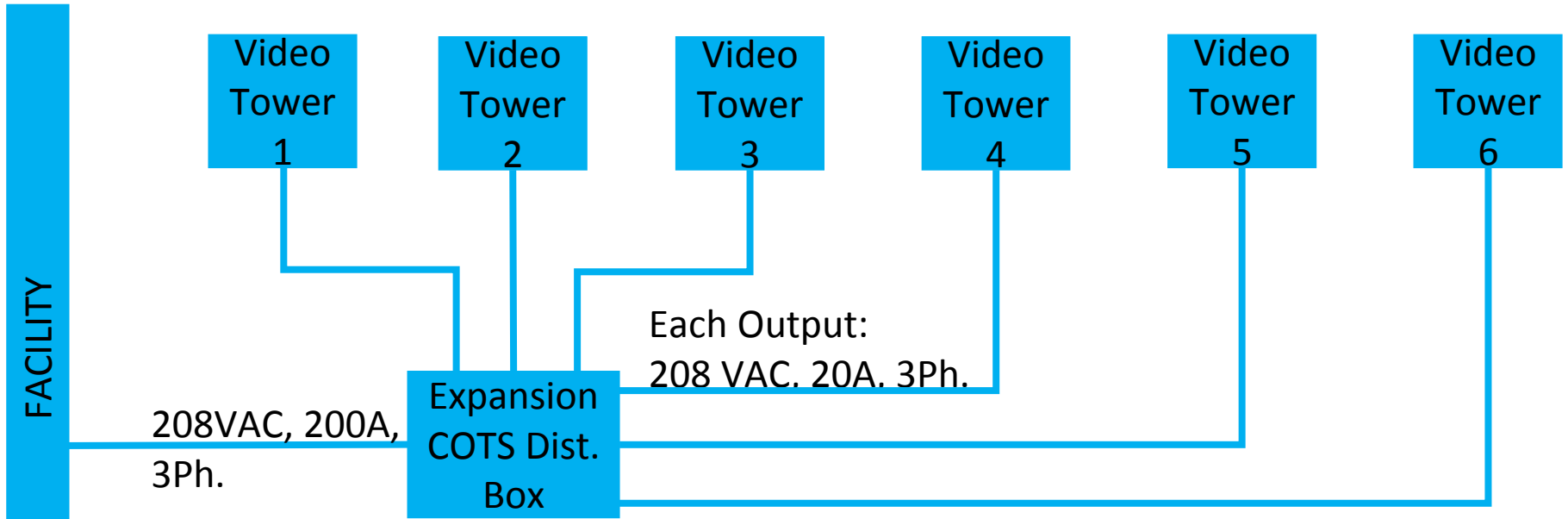


Block Diagram: One Video Tower





Block Diagram: Multi Video Towers



DB200N1J10DM-63

- COTS
- Used at concerts, festivals, etc. for power distribution
- Available for purchase

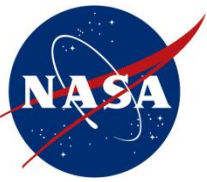


Service Robot Project



Goal:

- Build, program, and demonstrate a working service type robot
- Future usage in a new ER5 education outreach program
- Used VEX robotics kit to design service bot
- Tested different software to program the robot
- Programmed bot with RobotC software
- Demonstrated service bot to Office of Education at JSC



Software: RobotC



Advantages

- Simple Visual Programming Language (VPL) blocks
- Generates C code from the VPL blocks of code
- Drag and drop features all C code generation
- Real-time debugging features
- Multiple programs in one slot of robot brain

Disadvantages

- Some code writing experience is needed

```
1 Start program
2 setTouchLEDColor ( touchLED, colorYellow );
3 wait ( 2, seconds );
4 setTouchLEDColor ( touchLED, colorGreen );
5 wait ( 2, seconds );
6 setTouchLEDColor ( touchLED, colorNone );
7 moveMotor ( clawMotor, 30, degrees, 20 );
8 Search for Object
9 repeatuntil ( getColorProximity(colorDetector) >= 200 ) {
10 forward ( 90, degrees, 35 );
11 setTouchLEDColor ( touchLED, colorRed );
12 }
13 setTouchLEDColor ( touchLED, colorBlue );
14 stopMultipleMotors ( leftDriveMotor, rightDriveMotor, );
15 After Object is located:
16 Approach object and align it
17 forward ( 115, degrees, 30 );
18 wait ( 1, seconds );
19 Grab Object
20 setMotor ( clawMotor, 50 );
21 moveMotor ( clawMotor, 85, degrees, 35 );
22 Ifff Object
```

```
1 #pragma config(Sensor, I2C0, touchLED, sensorRV16Q_LED)
2 #pragma config(Sensor, P0RT1, colorDetector, sensorRV16Q_ColorIDColor)
3 #pragma config(Sensor, P0RT2, gyroSensor, sensorRV16Q_Gyro)
4 #pragma config(Sensor, P0RT3, distance0, sensorI2C)
5 #pragma config(Sensor, P0RT4, bumper0, sensorRV16Q_Touch)
6 #pragma config(Motor, mtr001, leftDriveMotor, motorRV16Q_openLoop_driveLeft, encoder)
7 #pragma config(Motor, mtr002, rightDriveMotor, motorRV16Q_openLoop_reversed_driveRight, encoder)
8 #pragma config(Motor, mtr003, clawMotor, sensorRV16Q_openLoop, motor)
9 #pragma config(Motor, mtr004, clawMotor, sensorRV16Q_openLoop, motor)
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Takeaways



- Altium Software
 - Block diagrams for power distribution
- VEX Software
 - Modkit
 - RobotC
 - EasyC
- Networking at JSC
 - Interns and Co-ops
 - Coworkers and other employees
- Formal presentation of results
- Prioritizing and time management
- Working in a team setting
- Attended lectures and tours





Future Plans



- Apply for more opportunities at NASA - JSC
- Full time positions at JSC or contracting companies
- Possibly more schooling after Master's degree



THANK YOU!



Caitlin Nolby

Marissa Saad

North Dakota Space
Grant Consortium



Questions



How long have you been at NASA R2?

