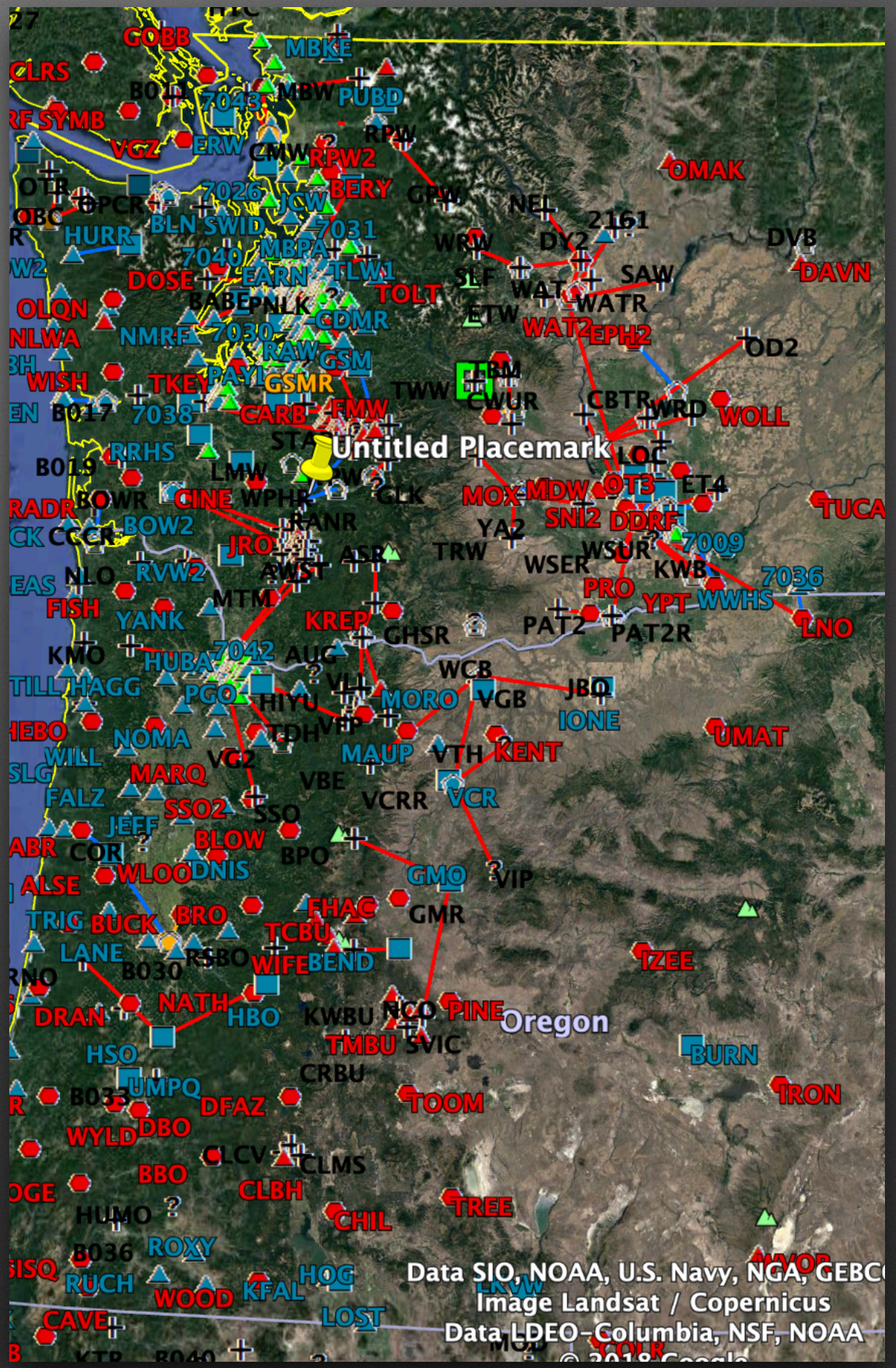
Seismic station power

Climate

Coastal
Temperate Rain forests
Rain shadow zones
Simi arid zones
Alpine climate

Conifer trees



Alpine Sesimic stations

Constrained by visual impacts in parks.
Snow levels
Lots of solar above 6k feet.

Weather is primarily below 6k feet.

Hi Mt Seismic

Low land Seismic

Post and power

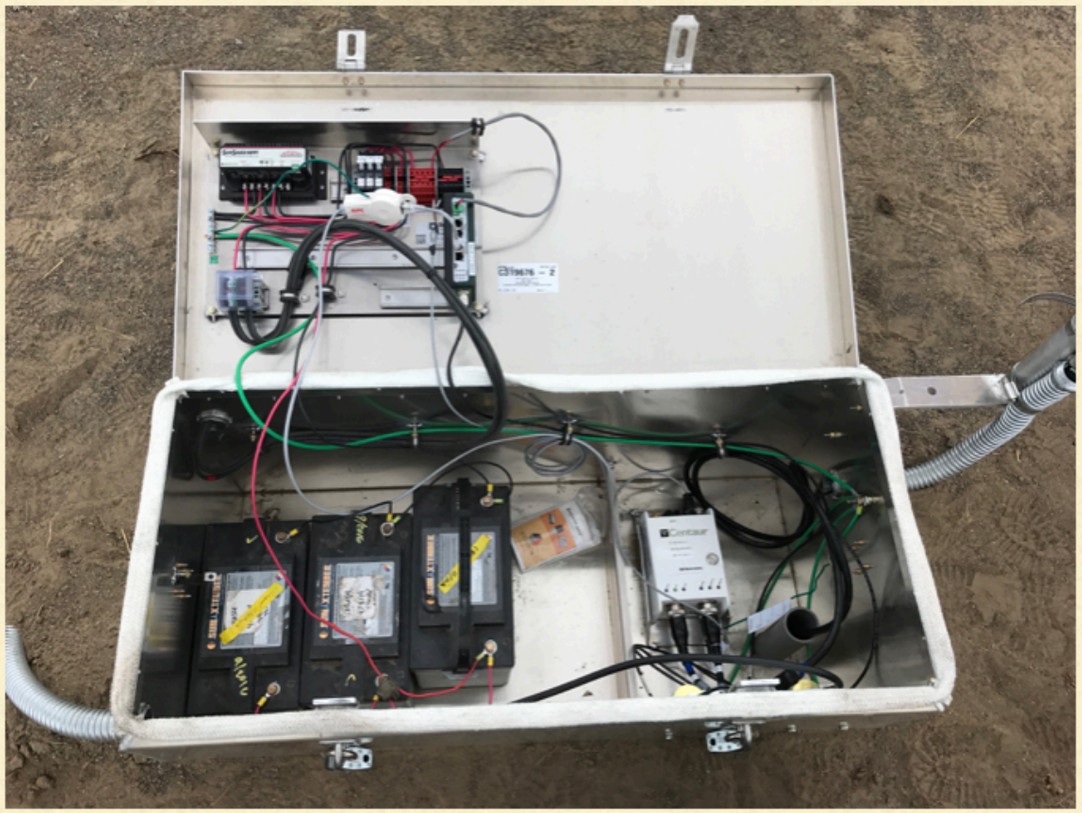
Prepping a TA site

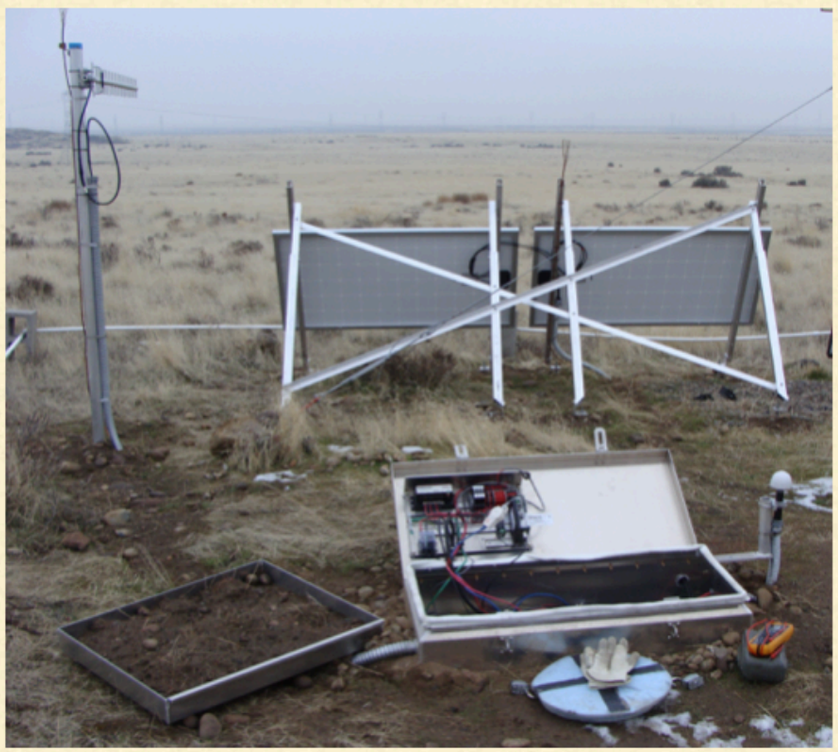
Lowland Seismic

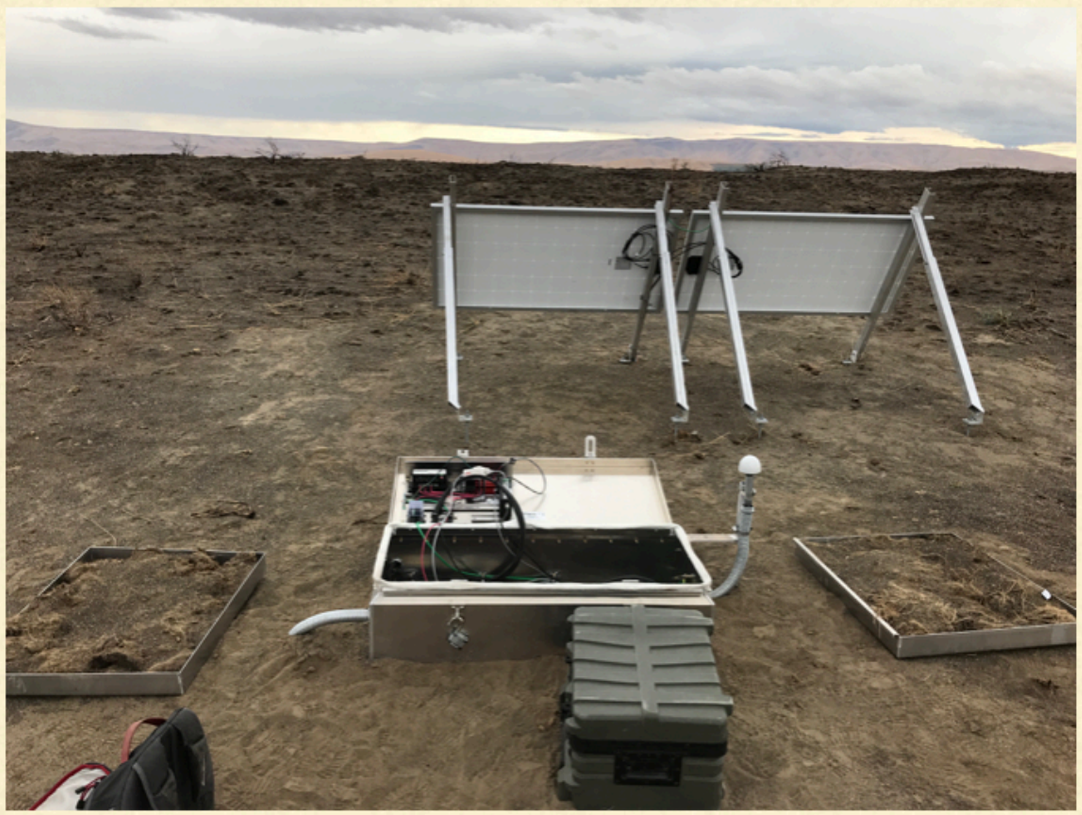
TA site

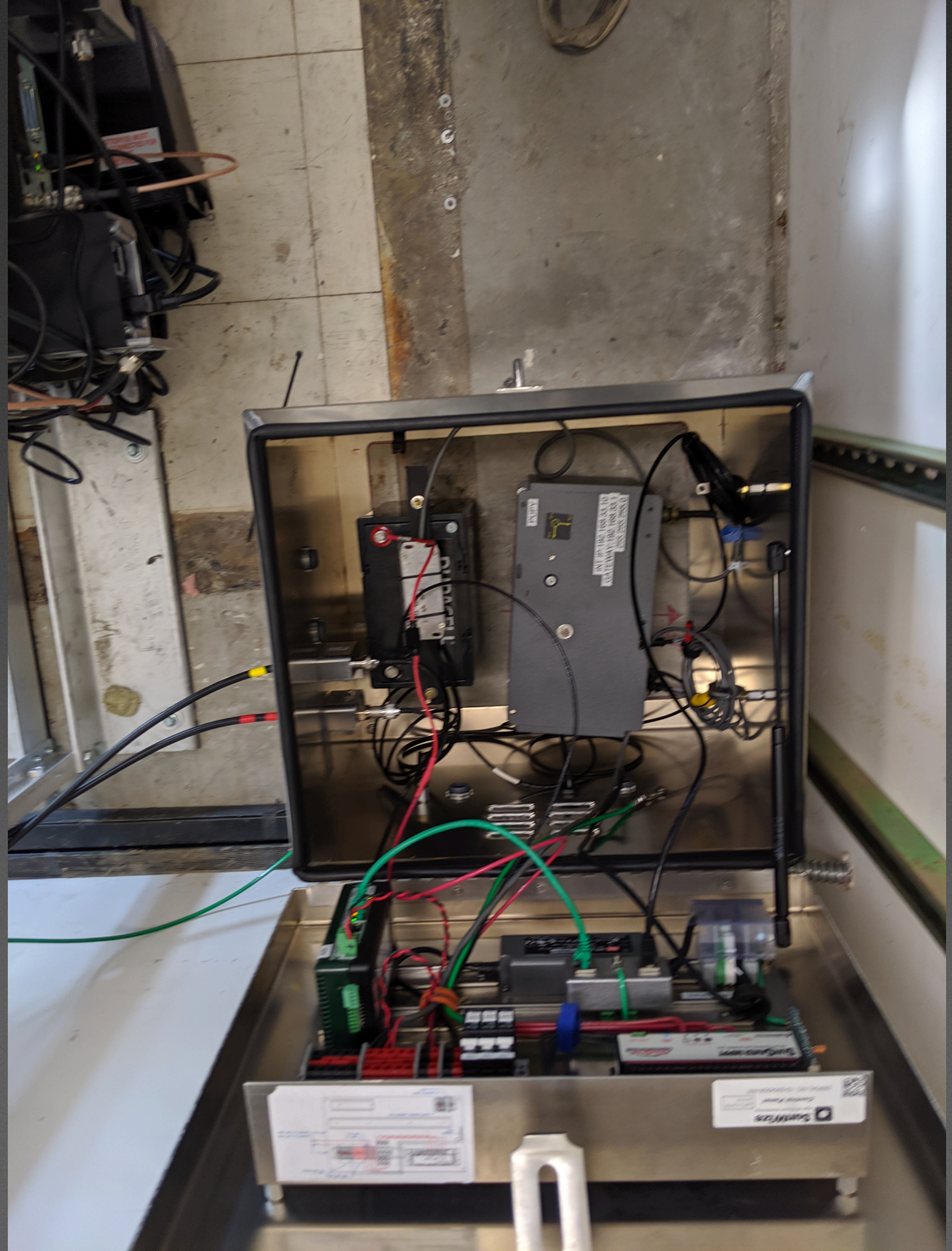
Desert Installation

DOE, fire related funding





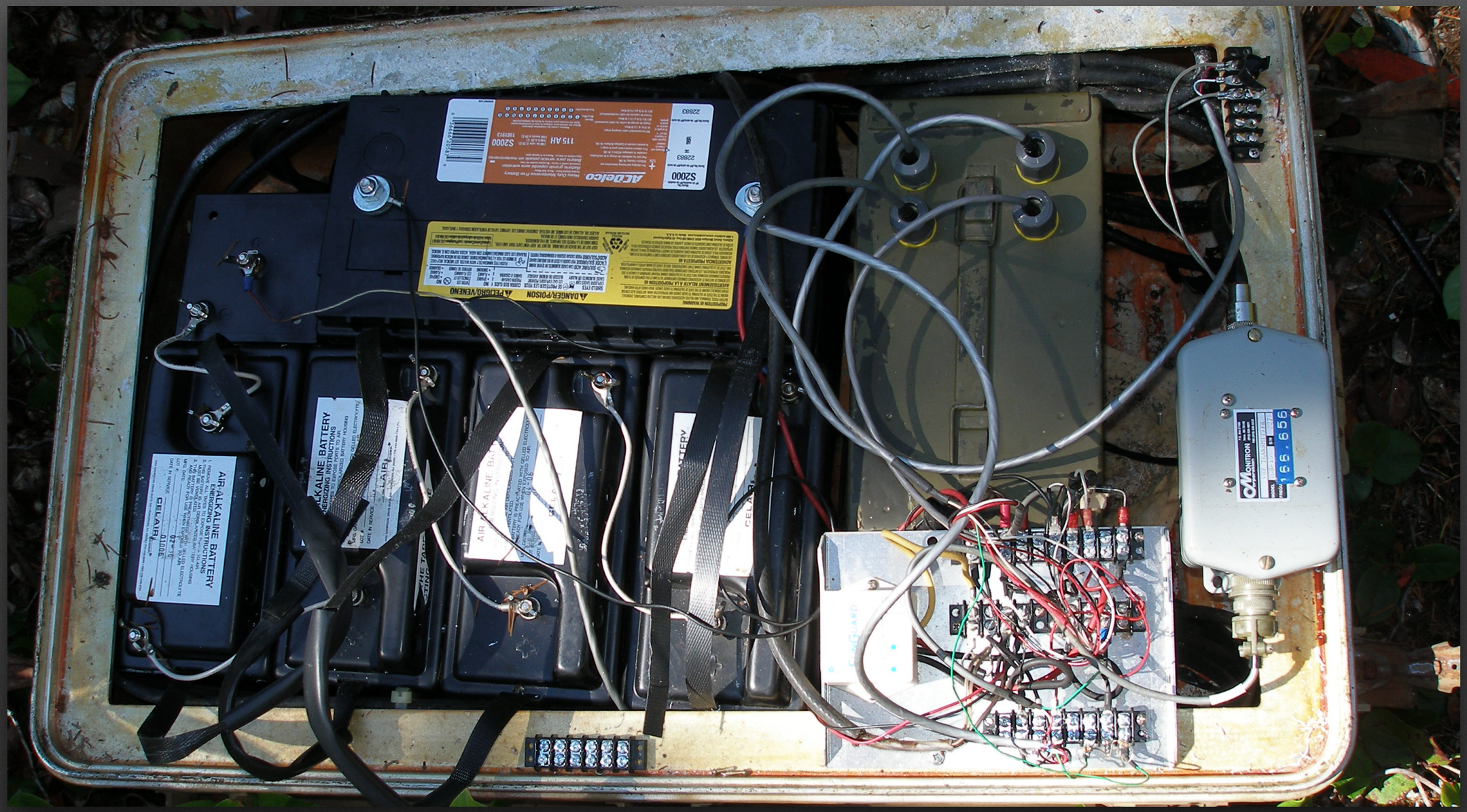




Where did we come from and where are we going

Our beginings originated with analog systems and calculated PV power systems.
Meaning our budgets were less and solar was expensive.

Analog

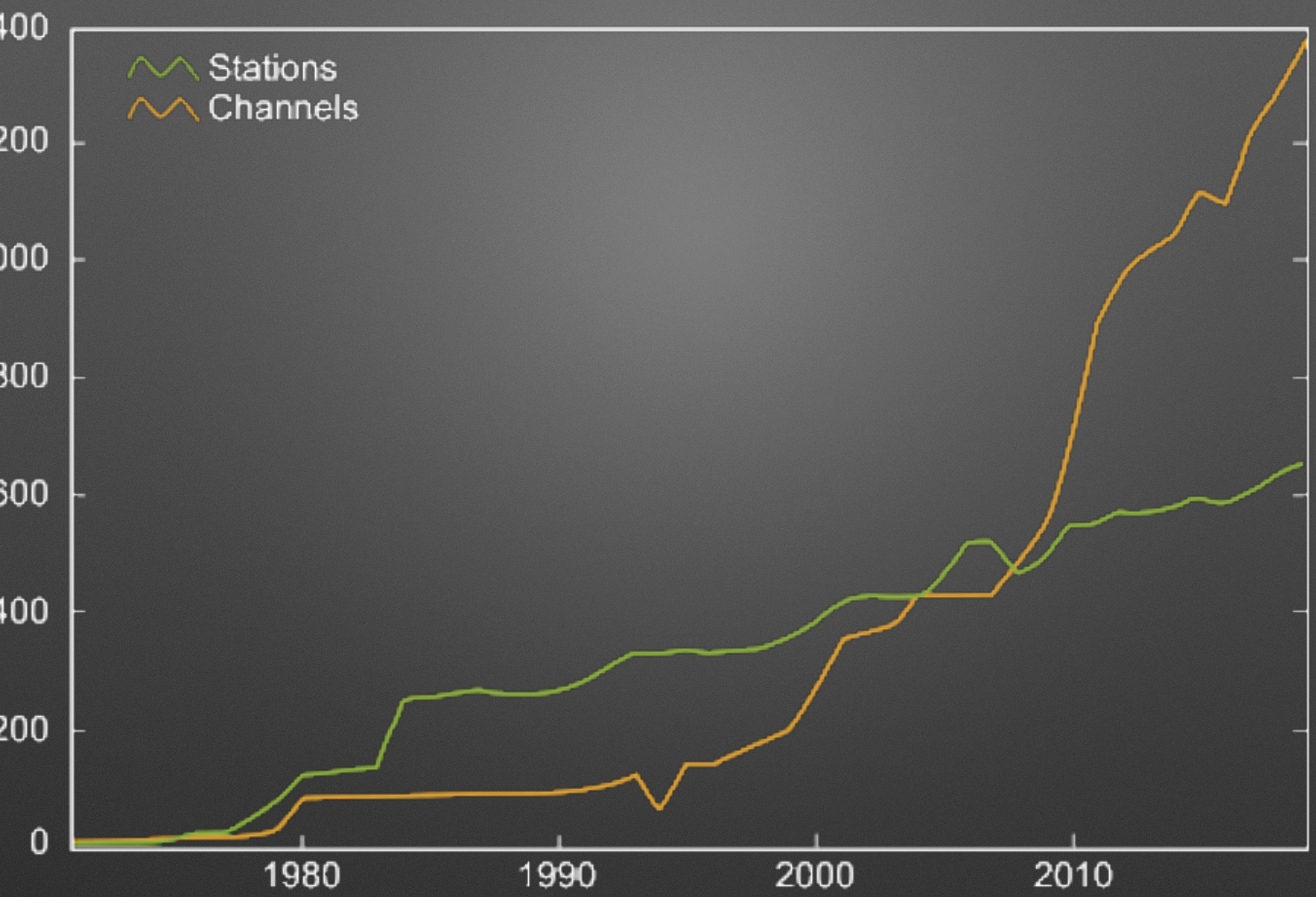


Aircell pack, SLA, wire management issues.

1 Watt station

What has changed

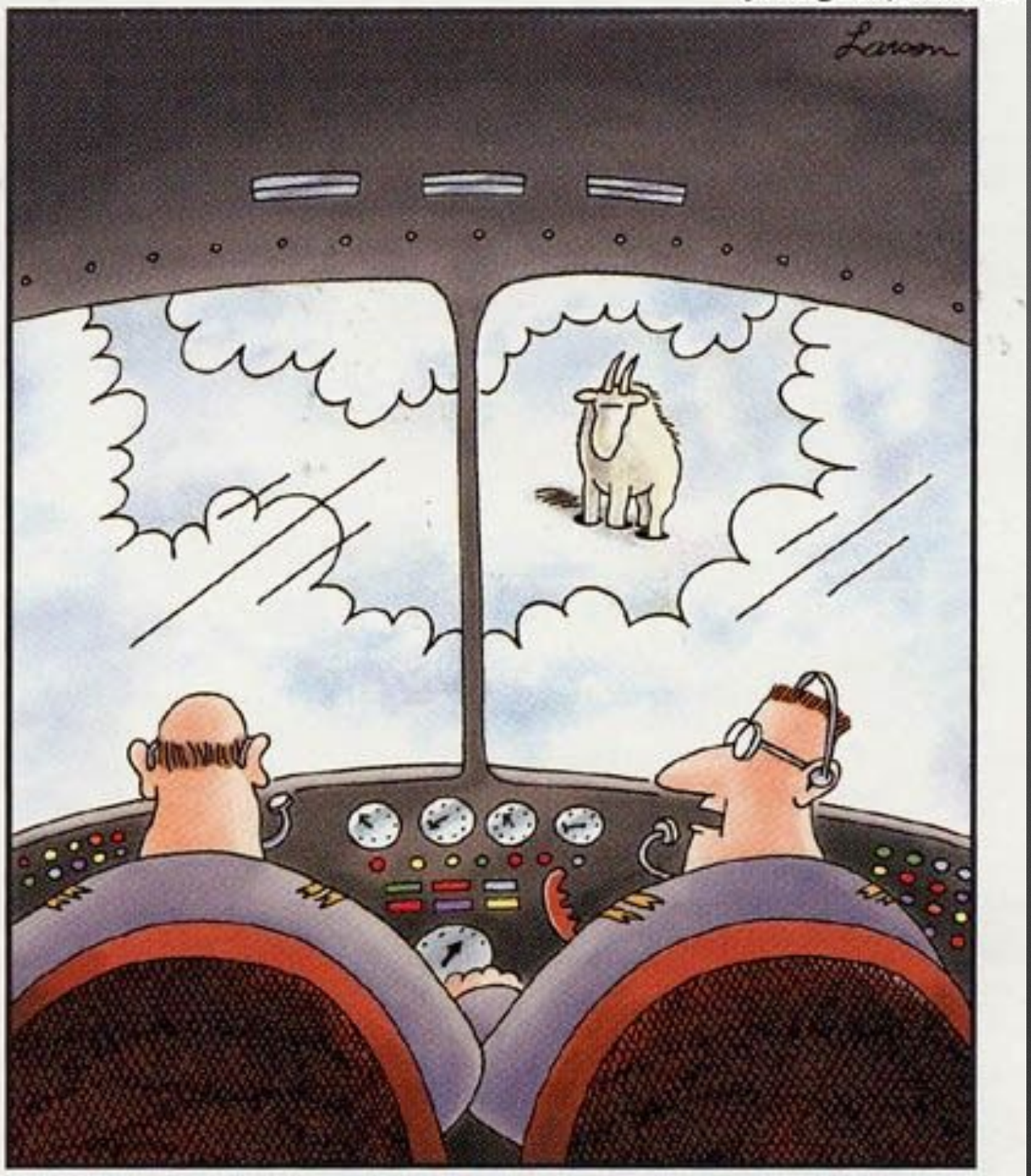
- Standards; build standards, Scalability.
    - Minimum Solar watts, Minimum amphours, grounding standards, site design management.
        - Creating time
- PV efficiency
- Solar controller efficiency
- Batteries,,,, Still pretty much the same. When relating to PNSN seismic stations.


Stations
Channels
400
200
000
300
600
400
200
0
1980
1990
2000
2010

Upgrades, Upgrades

- Eye on EEW
- Station run time expectations.
- Significant funding increase for upgrades and new stations
- We ask manufactures for lower power instruments
- Manufactures were slow to respond to lower power needs.
- In the mean time we engineer our power systems to support high power consumption.
- Manufactures catch up with low power system.

jokeOverflow.com



"Say … what's a mountain goat doing
way up here in a cloud bank?"

Our first Swingset build

Steel pipe, one solar panel, Steel enclosure, Heat issues

Our preferred battery

- We’re still using the same batteries we did in 2010.
- We still build for nominal 10Watt station.
- Why, energy density hasn’t increased for basic battery needs. Advancements have been made, but the advances don’t credit our basic seismic station needs.
- They’re reliable, inexpensive, easy to install and easy to replace. Within lowland seismic.
- Lowland Seismic doesn’t need to transport batteries on Helicopters for the most part. When we do transport batteries on helicopters the deliver system works just fine.
- Lithum?

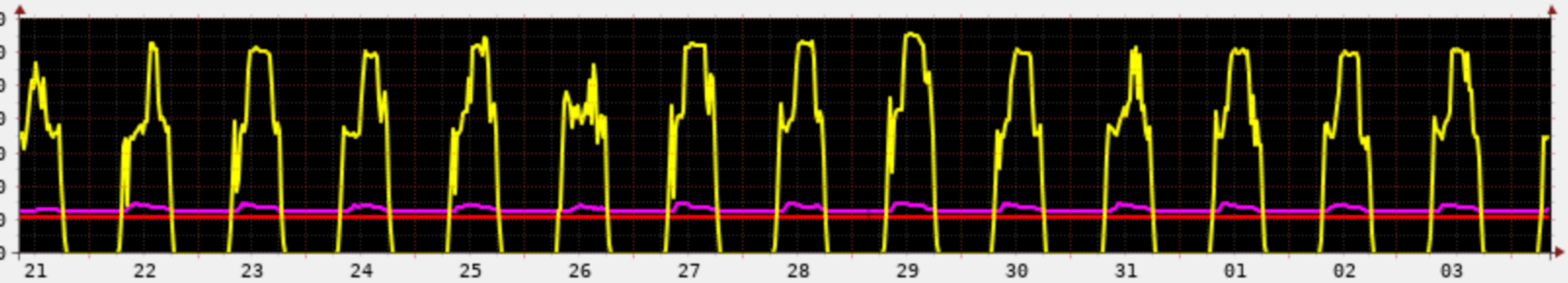
PV systems

- Solar panel efficiencies have increased. How much, depends on the context of the question and who you ask!
- Solar panels cables have simplified.
- Solar prices have continued to go down. The price of solar is now less of an issue than the structure needed to mount the panels.
- Getting certification for solar systems might be a good idea.
- Is anyone using higher efficiency panels?

Solar controllers

- Maximum Power Point Tracking vs PWM.
- Taking advantage of higher PV voltages
- SOH monitoring of the PV system
- Flexible PV vs battery systems

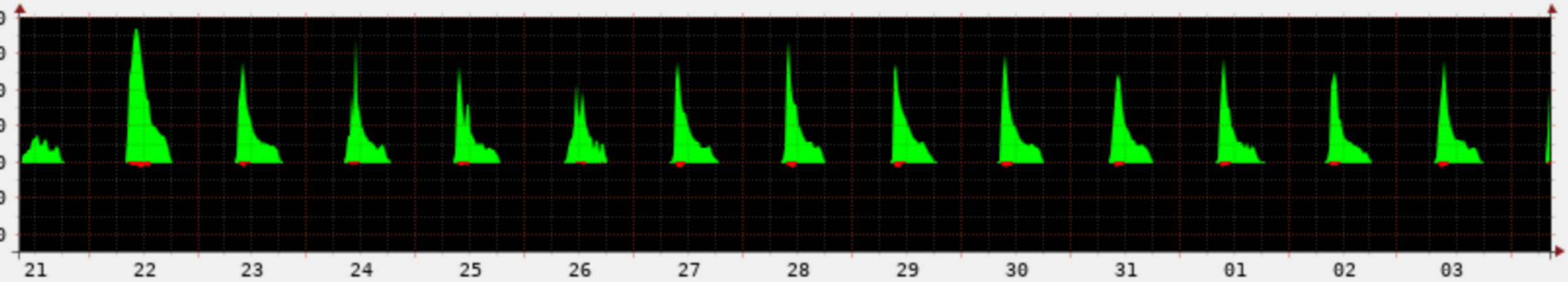
Station FMW MPPT Solar Controller Data



) voltage is a load current compensated, Low Voltage Disconnect.
ine is a constant set point, but may adjust based on loading.
Last:11.00
: Last:13.16 Avg:13.25 Max:15.00 Min:12.56
by Last:35.10 Avg:20.51 Max:65.72 Min:0.00

Mon Nov 4 08:30:06 PST 2019

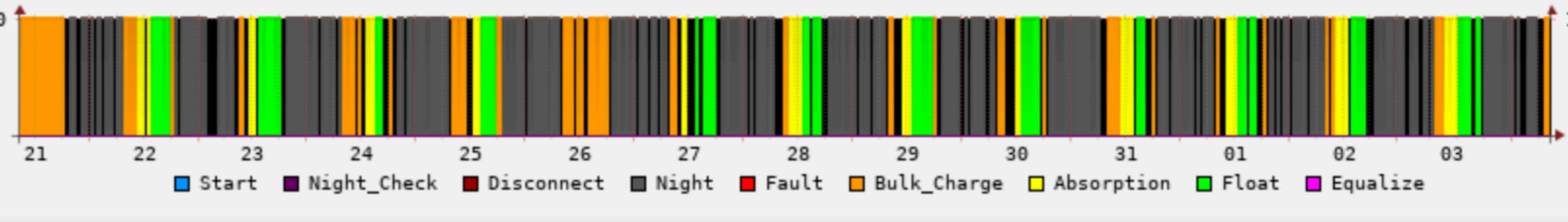
Station FMW MPPT Solar Controller Data



harge values are of positive value,(shown on the +y axis). Iload are negative,(shown on the -y axis).
rge Last:4.00 Avg:0.74 Max:7.42 Min:0.00
] Last:-0.21 Avg:-0.02 Max:-0.28 Min:-0.00

Mon Nov 4 08:30:06 PST 2019

Station FMW MPPT Solar Controller Data



Last:

Power ground

- Repeating grounding systems
- Grounding is both a physical fundamental and a well understood component.
    - Understanding your grounding is equally important as the physical use of grounding.
    - Removing the problem before you as the question.
- Single point grounding.

Minicomputers

Xetawave Radios

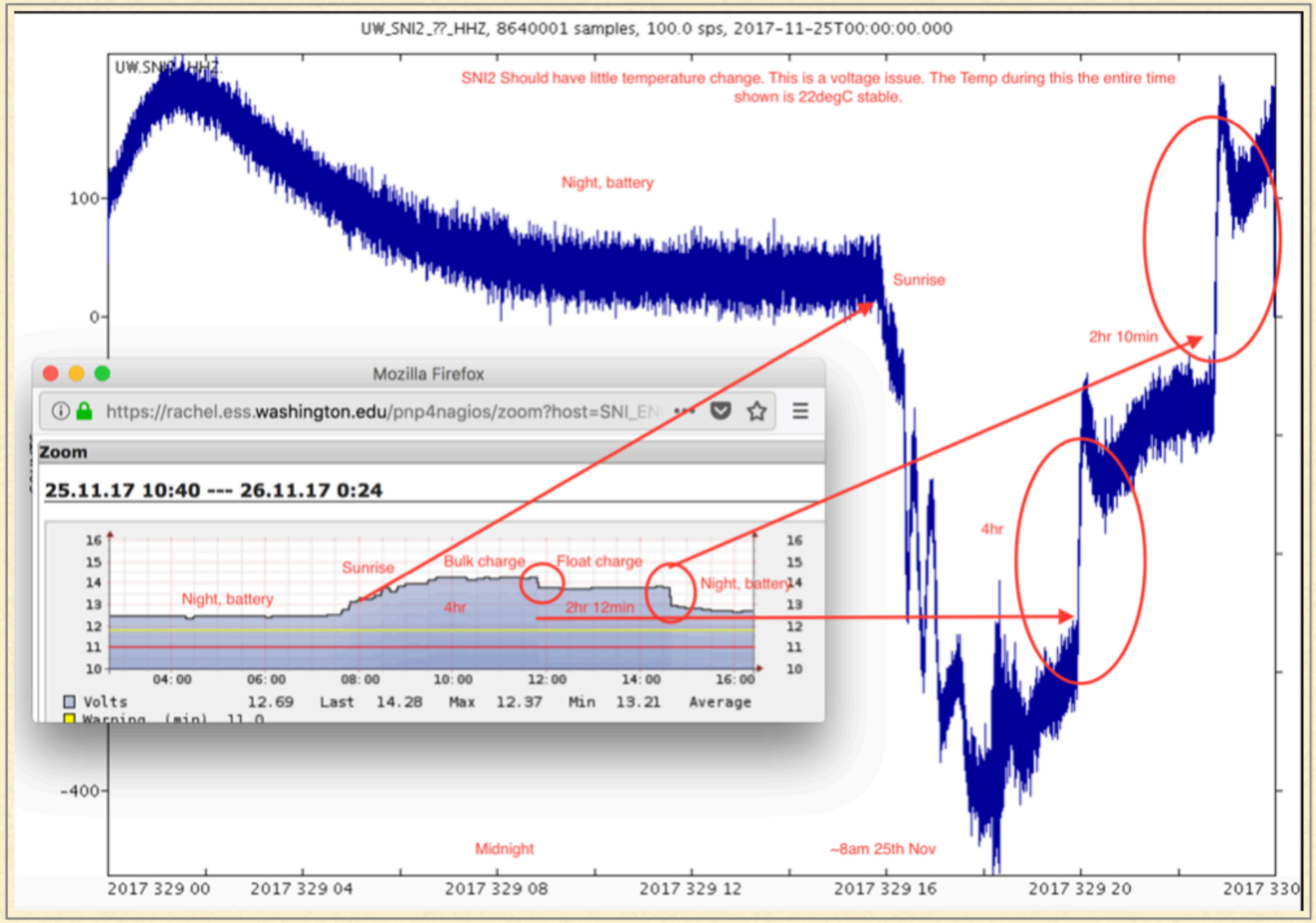
Moxa switches

What was needed in our power systems

- We had to standardize.
    - The sheer number of stations being installed left little doubt we needed a standardized approach.
        - We needed someone to fabricate the power boards for us.
- Power/solar/battery issues needed to be a thing of the past.
- High quality installations that resulted in Low maintenance was a must.

DESIGN QUESTIONS

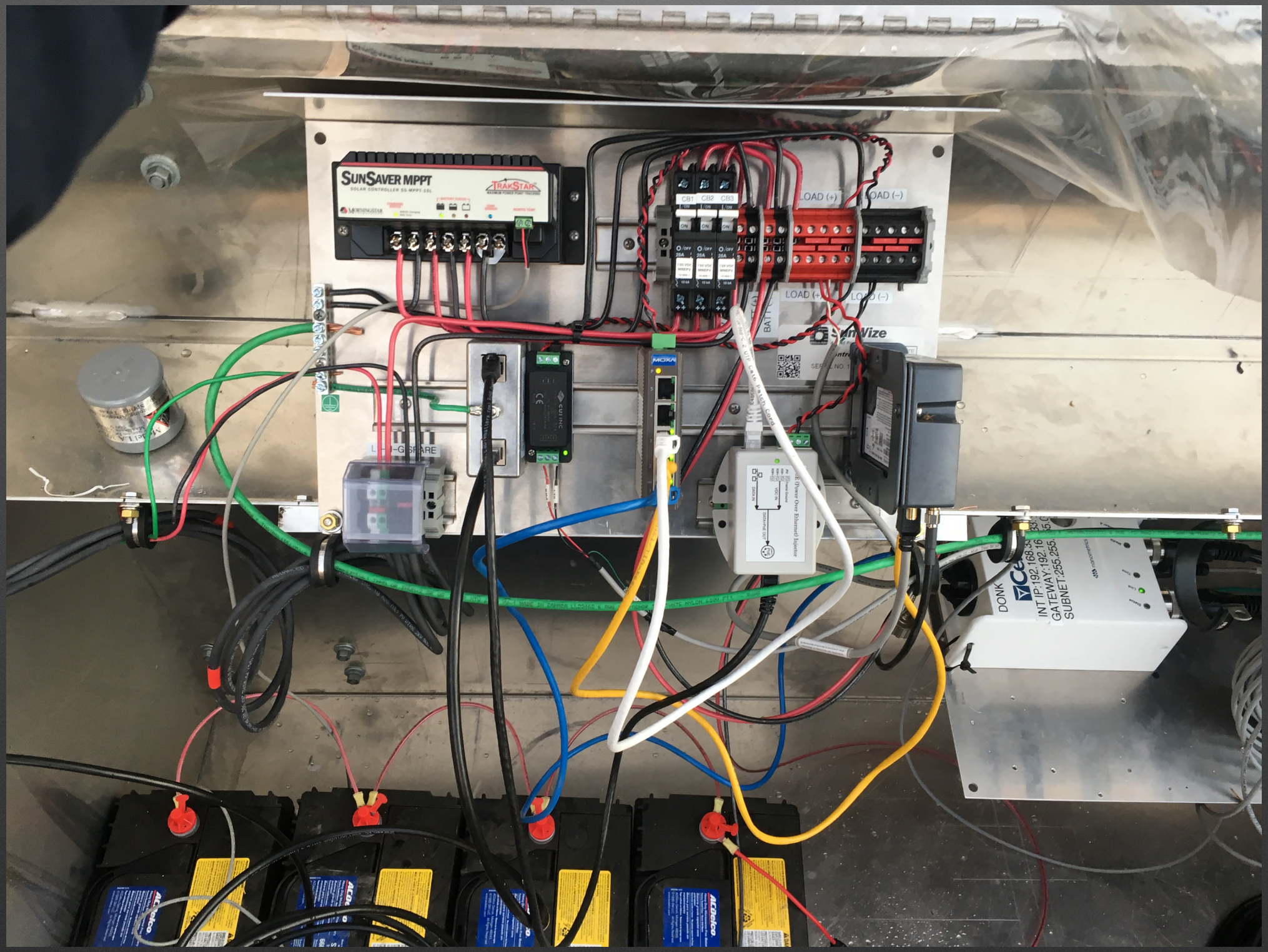
- To remove, "completely", the question in the first place.
- Reduce the problem enough so tha we can define the issue.
- If we randomize installation and var the constraints to which they are b trouble shooting issues becomes ineffective except on a station by station example.
- This means we may never resolve network wide issues.



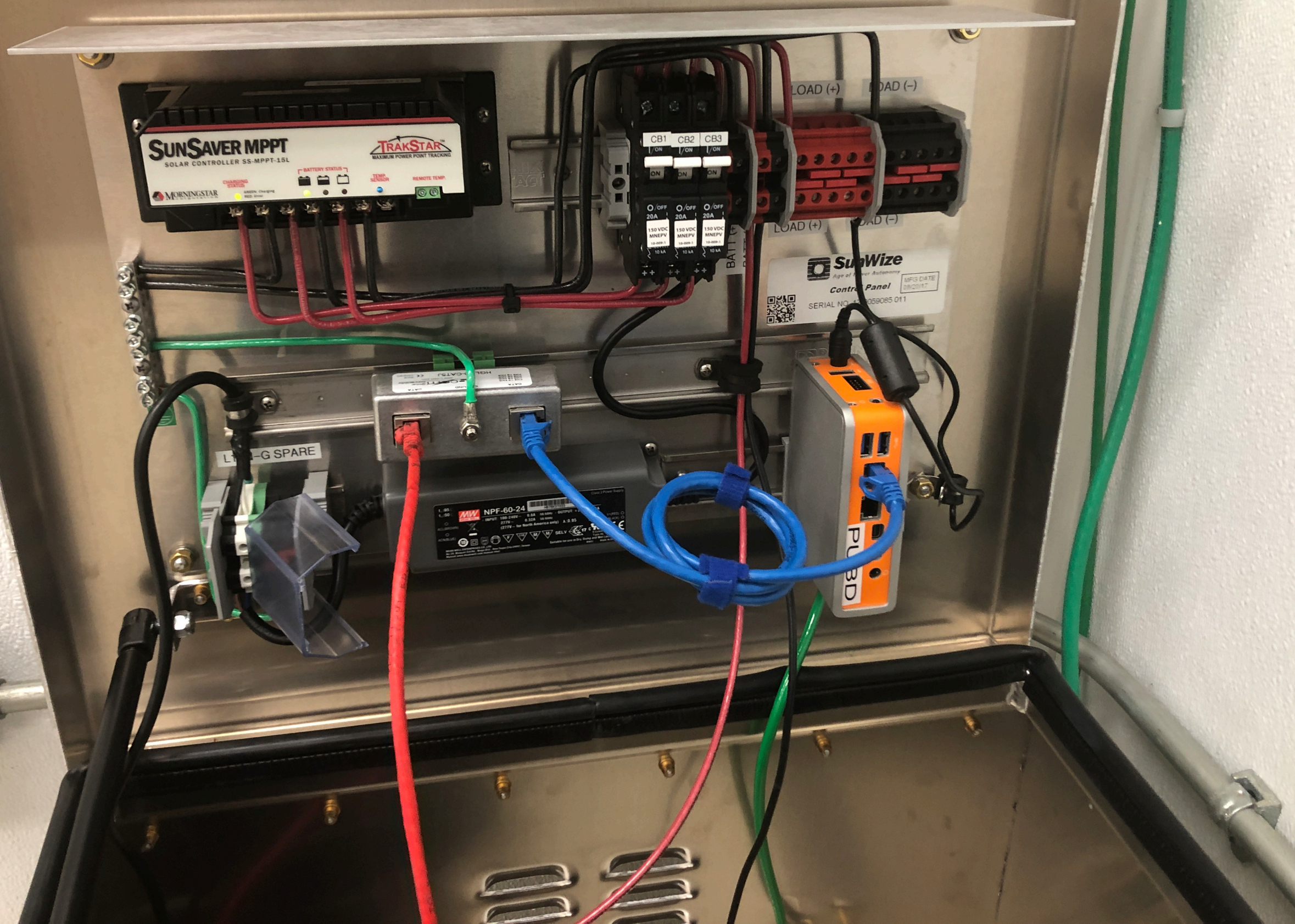
RV POWER SYSTEMS WITH 21ST CENTURY SCIENTIFIC INSTALLATIONS.

We found the Centaur/Cascadia system to be sensitive to voltage changes. We implemented a DC to DC regulator (9-36V —>24V) between the power system and the Centaur. This greatly reduced the shifts within the passbands of the Cascadia.


SUNSAVER MPPT
BAND

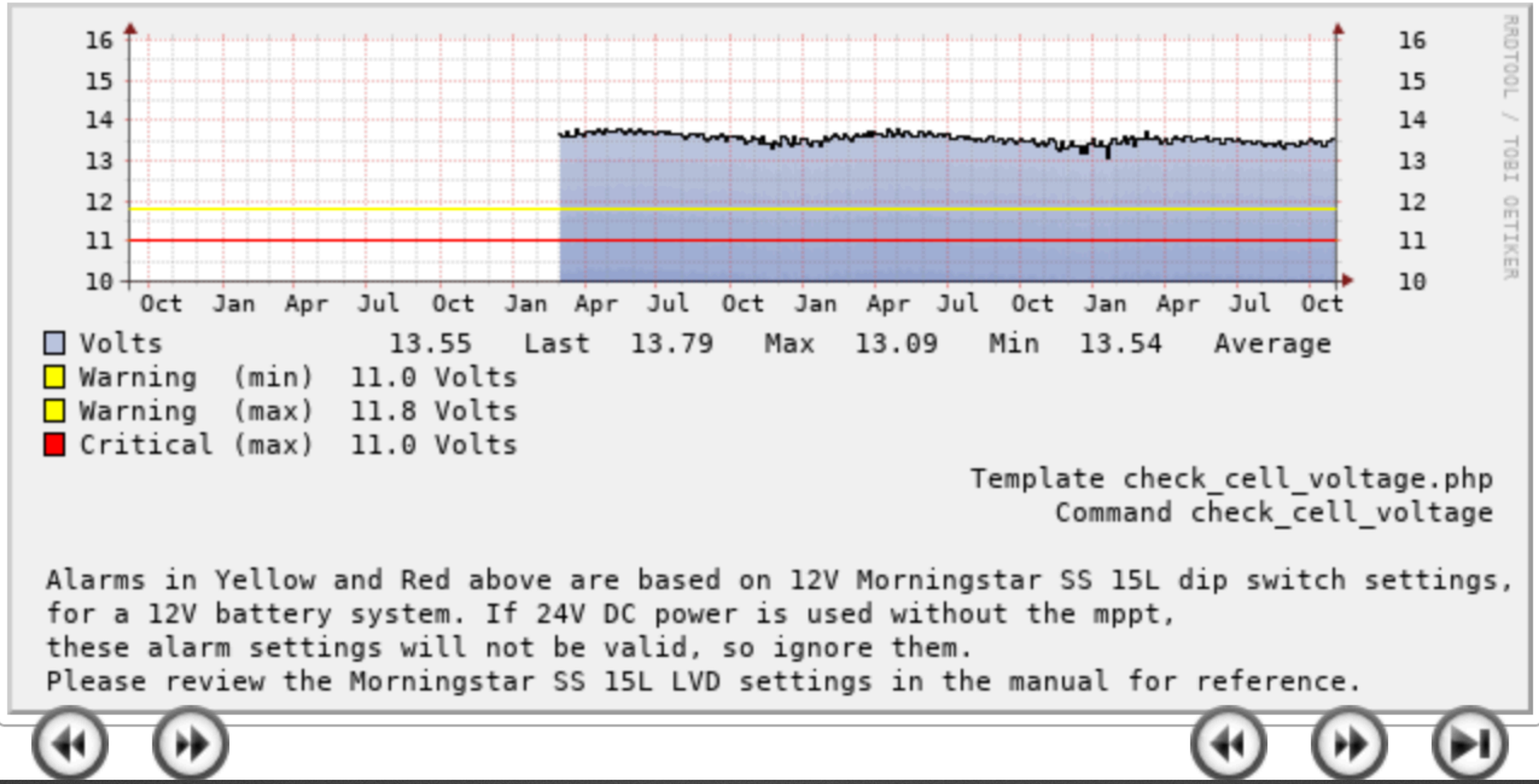

SUNSAVER MPPT
SOLAR CONTROLLER SS-MPPT-15L
TRAKSTAR
CB1 CB2 CB3
LOAD (+)
LOAD (–)
MOXA
CUI INC
SunWize
DONK
INT IP:192.168.
GATEWAY:192.16
SUBNET:255.255.


SunSaver MPPT
SunWize


SUNSAVER MPPT
SOLAR CONTROLLER SS-MPPT-15L
TRAKSTAR
MAXIMUM POWER POINT TRACKING
MORNINGSTAR
BATTERY STATUS
TEMP. SENSOR
REMOTE TEMP.
CB1
CB2
CB3
ON
OFF
20A
150 VDC
MNEPV
10 kA
LOAD (+)
LOAD (-)
SunWize
Control Panel
SERIAL NO.
NPF-60-24
PUBD

Zoom

04.09.15 8:13 --- 02.11.19 8:13

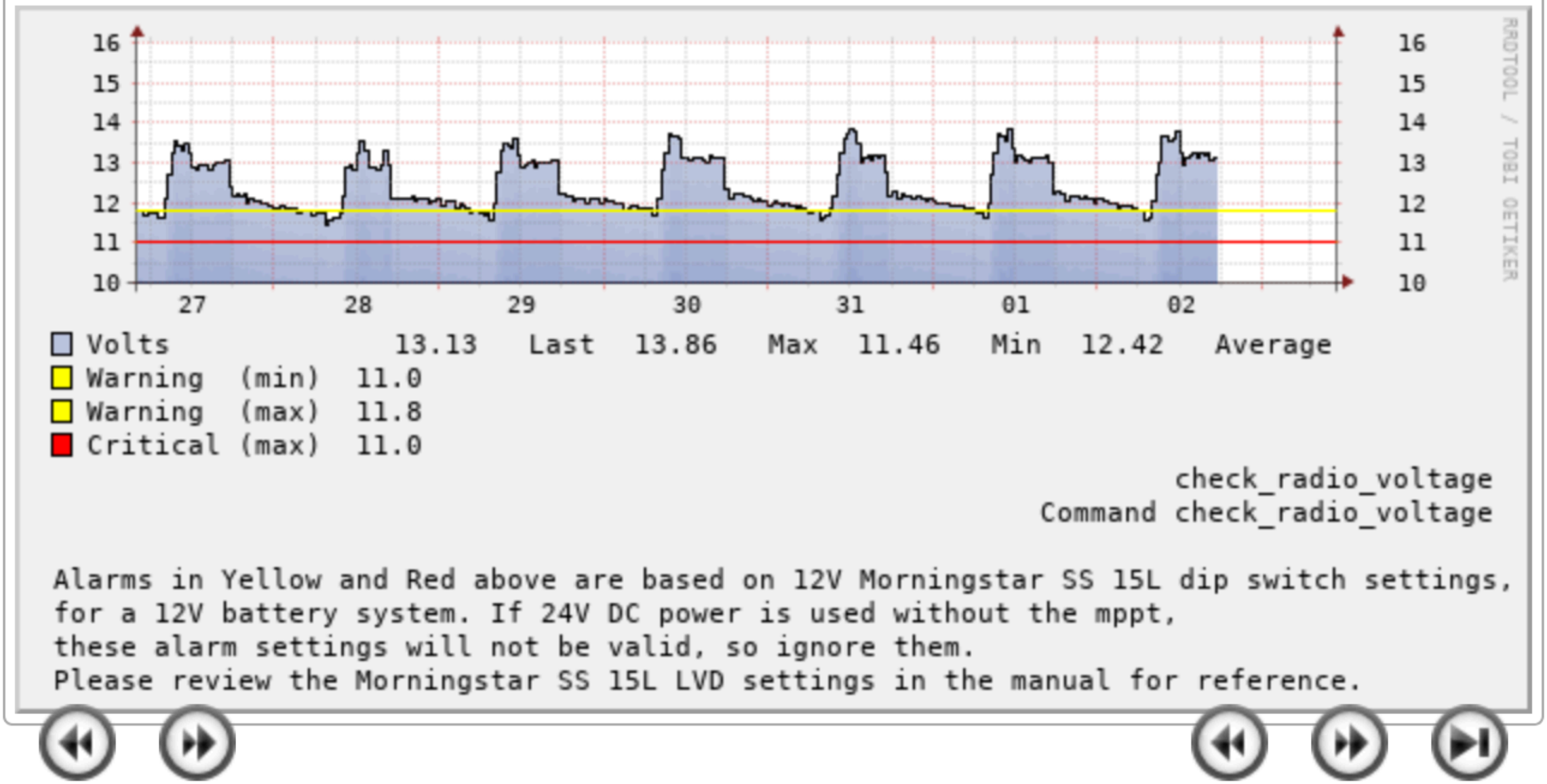


BAND Voltage, ~2.5yr

The point is to “NOT” get close to the yellow line.

Zoom

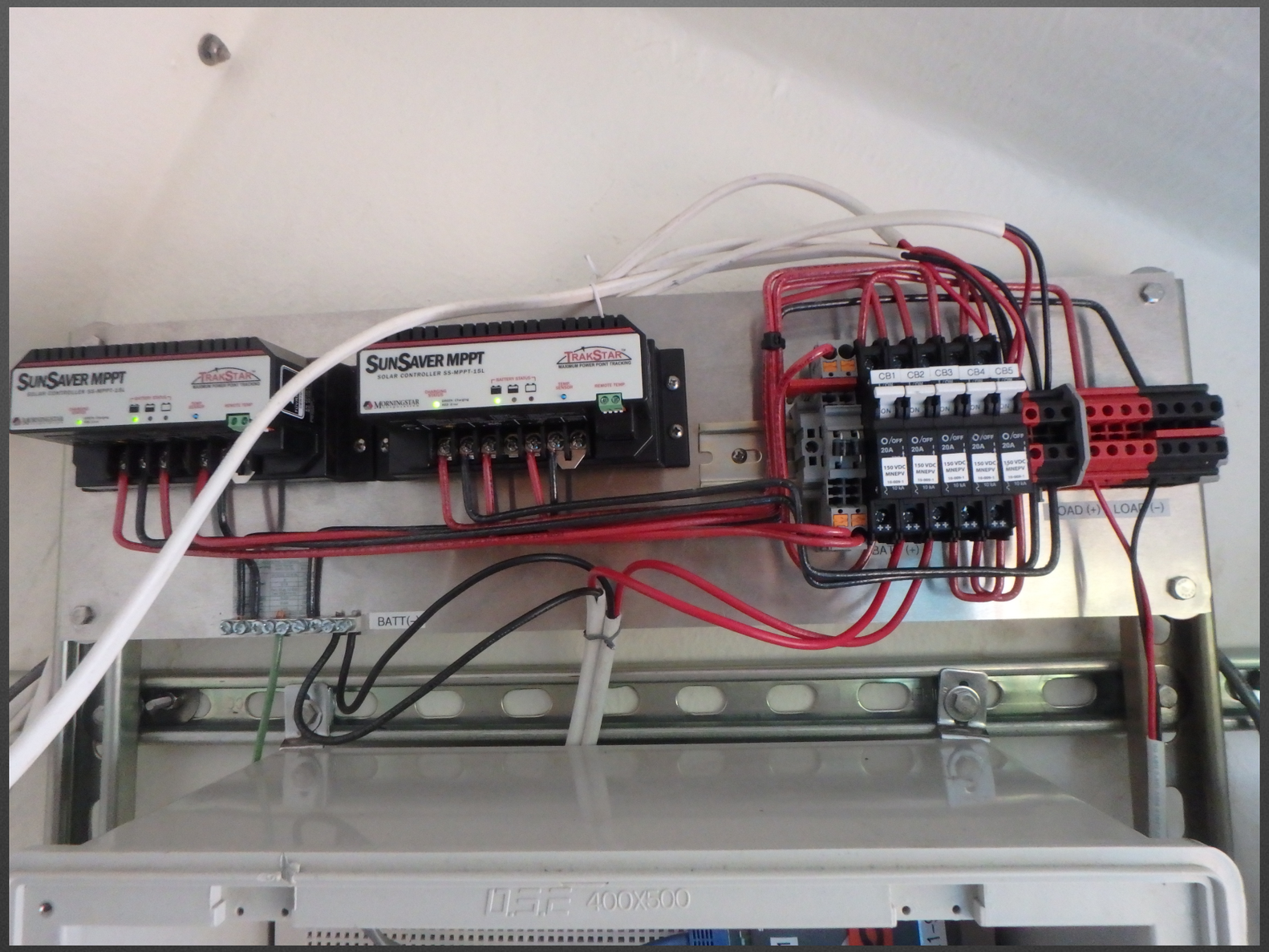
27.10.19 3:44 --- 03.11.19 9:44



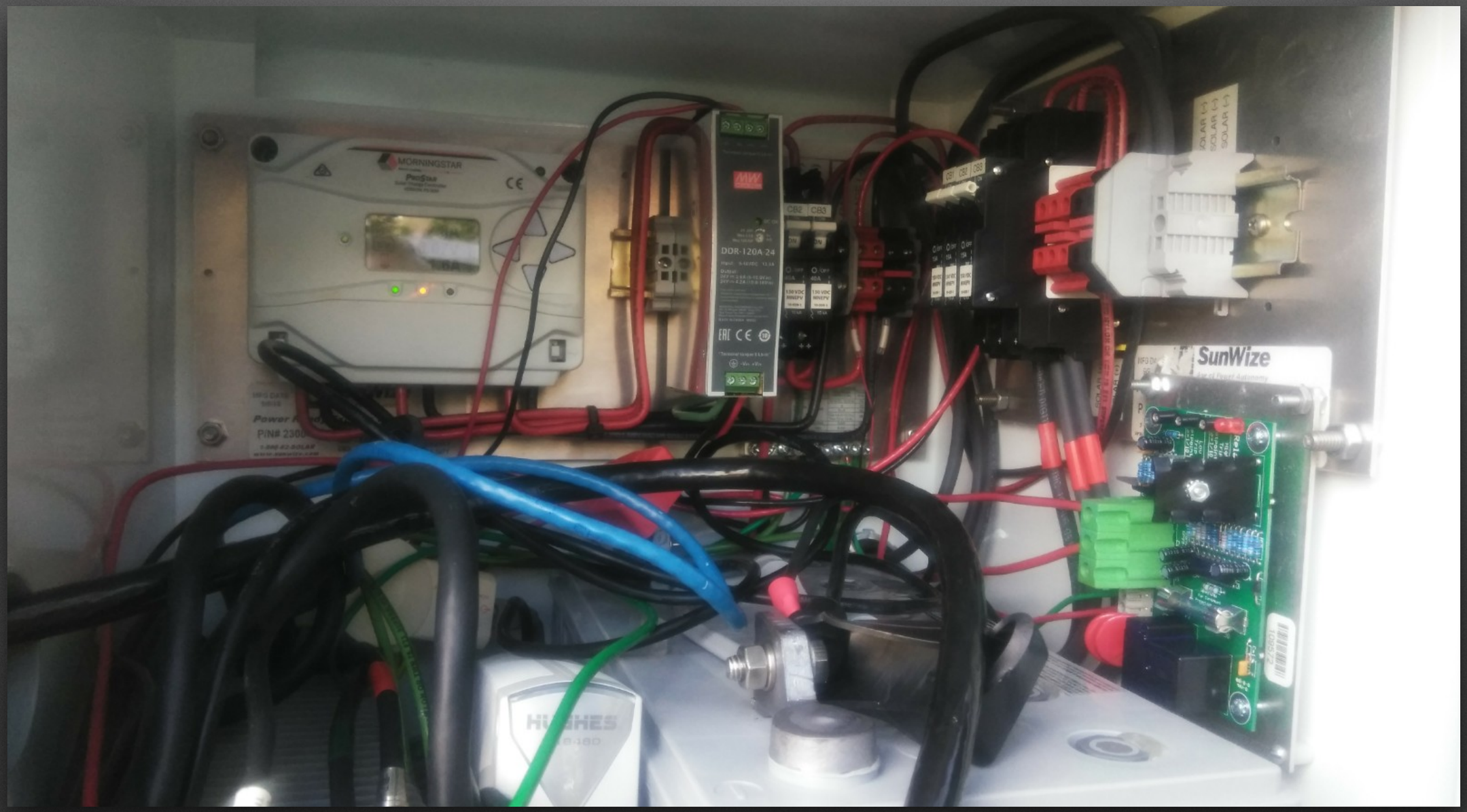
Volts 13.13 Last 13.86 Max 11.46 Min 12.42 Average
Warning (min) 11.0
Warning (max) 11.8
Critical (max) 11.0

check_radio_voltage
Command check_radio_voltage

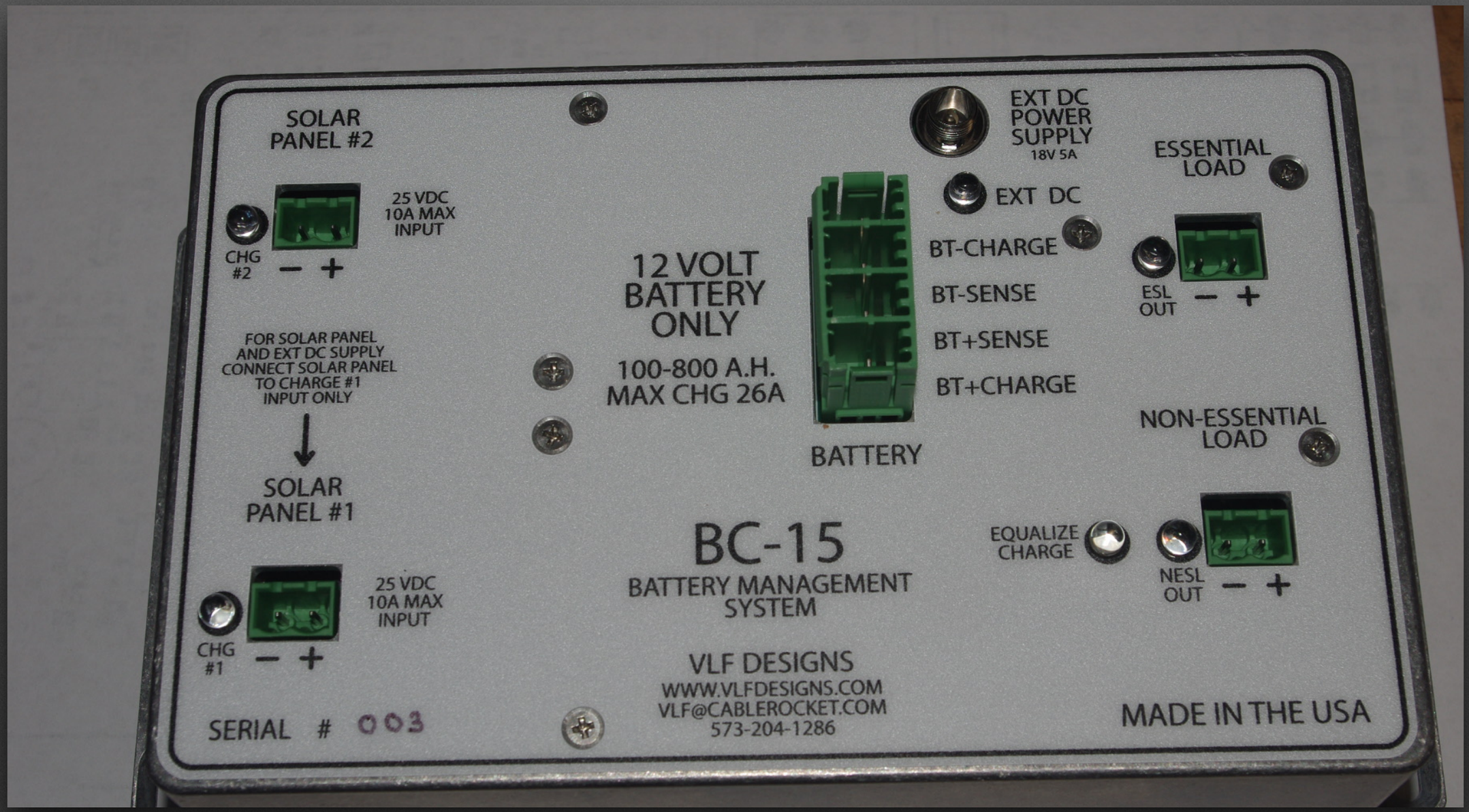
Alarms in Yellow and Red above are based on 12V Morningstar SS 15L dip switch settings,
for a 12V battery system. If 24V DC power is used without the mppt,
these alarm settings will not be valid, so ignore them.
Please review the Morningstar SS 15L LVD settings in the manual for reference.


SUNSAVER MPPT
TRAKSTAR
SUNSAVER MPPT
SOLAR CONTROLLER SS-MPPT-15L
TRAKSTAR
MAXIMUM POWER POINT TRACKING
CB1
CB2
CB3
CB4
CB5
BATT(-)
400X500

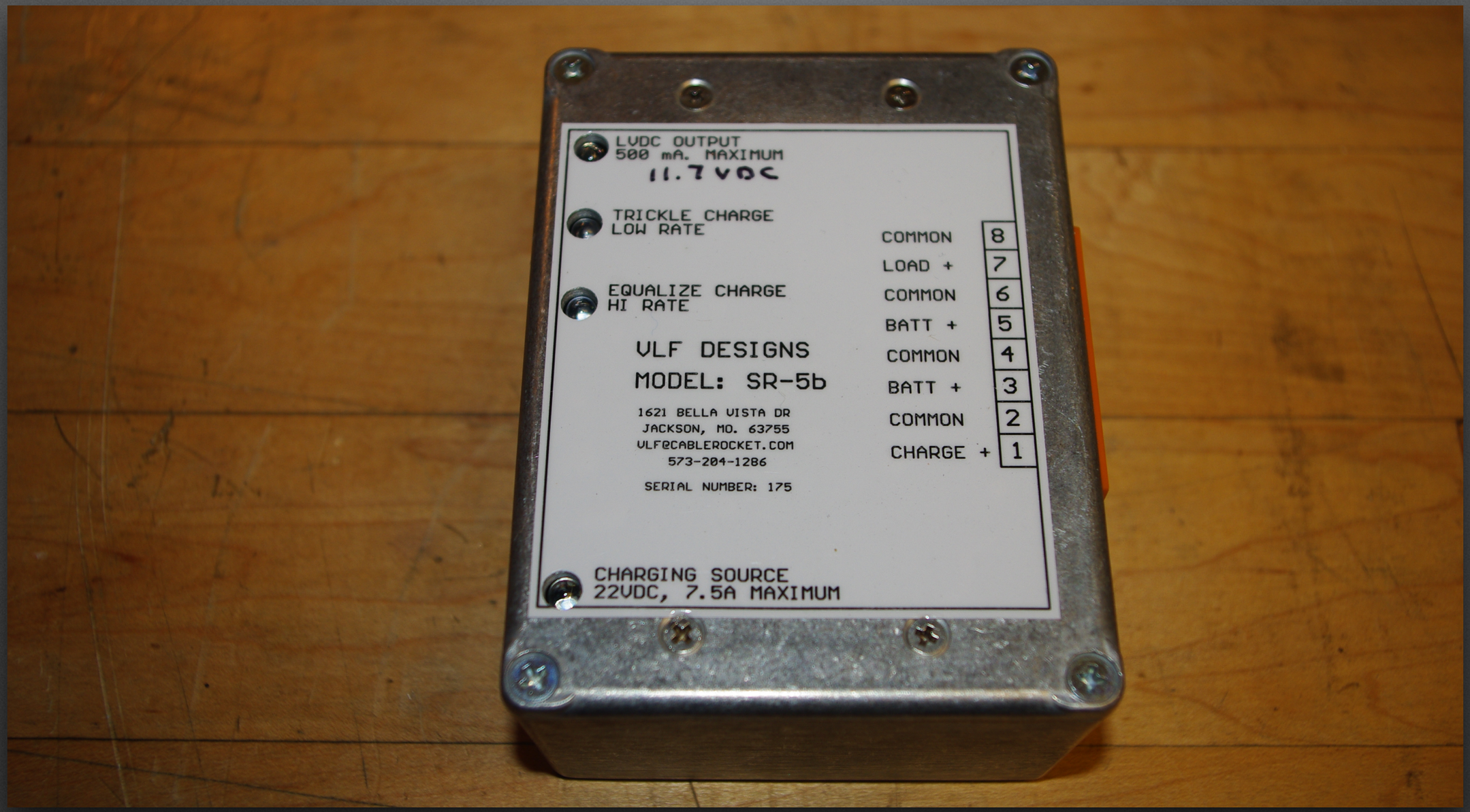
CVO



Puerto Rico



Greg Steiner



Greg Steiner

Conclusion

- The dull drums of labor have removed the issue of power from our problem list.

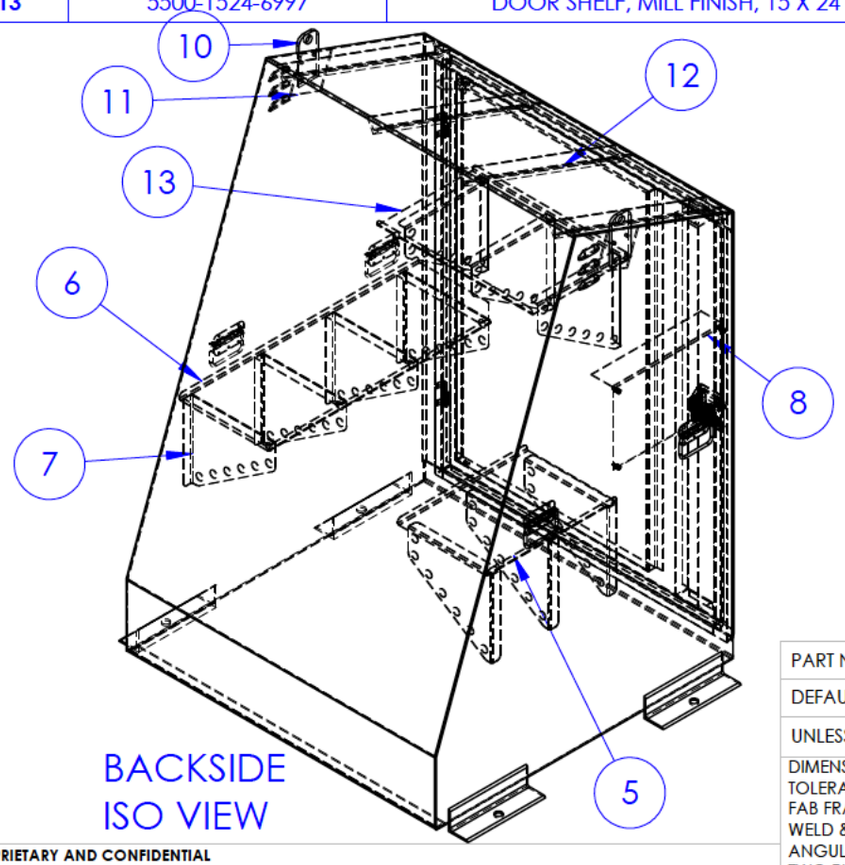
- The newer issue for the PNSN is Bandwidth, sample rate, seismic isolation, SOH monitoring, reaction to SOH monitoring data and its conclusions.

- How can we advance our power systems?

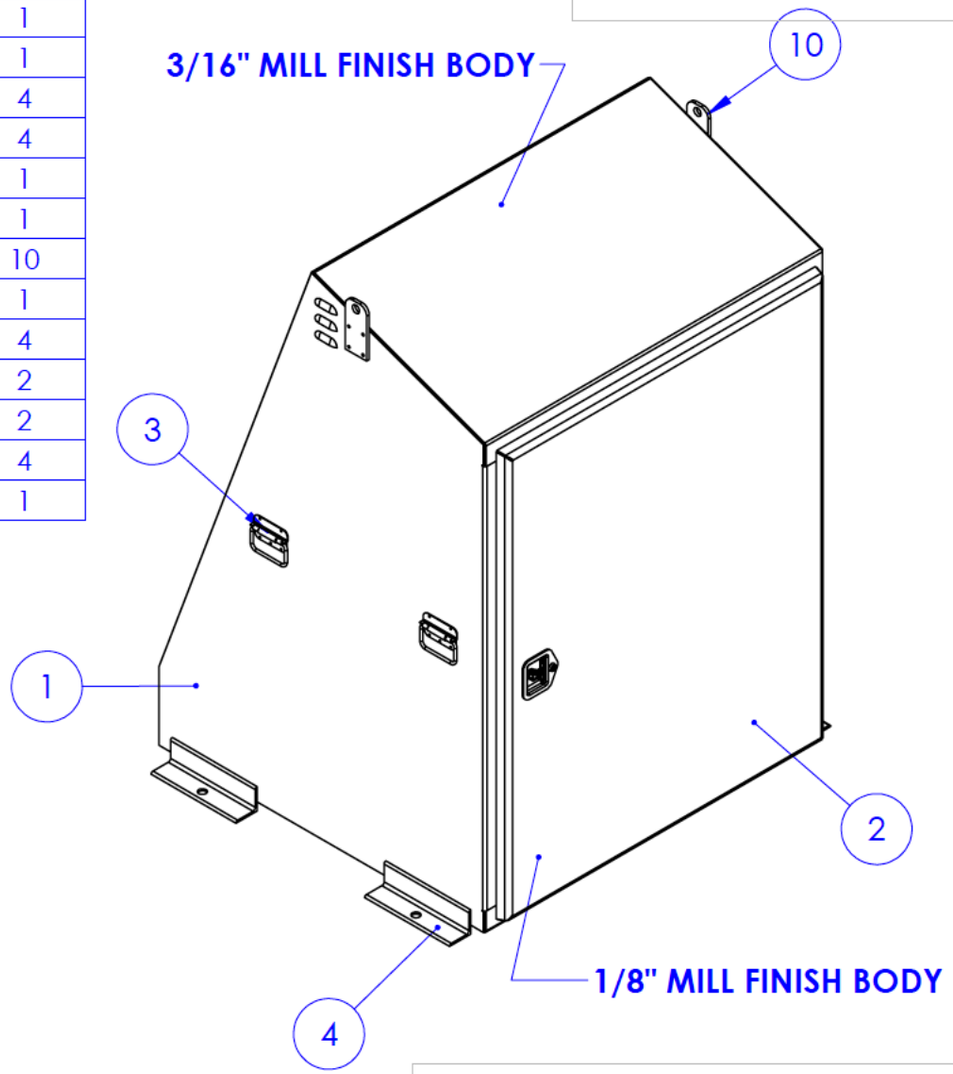
Engineering Shared Drive

- A shared drive that holds design work.
- Work drawings.
- Schmatics.
- Protocals.
- RFQ’s

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	294-250X-604846-6997	UW HUT, BODY ASSY, MILL FINISH	1
2	297-250X-6046-6997	UW HUT, DOOR ASSY, MILL FINISH	1
3	1856A63	SS PULL/LIFT HANDLE	4
4	277-25XX-12-6997	UW HUT, MOUNTING ANGLE, 3 X 3 X .25 ALUM	4
5	5500-1424-6997	DOOR SHELF, MILL FINISH, 15 X 24	1
6	5500-1448-6997	DOOR SHELF, MILL FINISH, 15 X 24	1
7	501-55XX-1213-6997	DOOR SHELF, BRACKET	10
8	POWER PANEL MOCK UP	POWER PANEL MOCK UP FOR FITMENT	1
9	93505A193	1/4-20 ALUM HEX STANDOFF - 1/2" TALL	4
10	210-2XXX-6030-6997		2
11	211-2XXX-4040-6997	UW HUT, PICK POINT - BACKER PLATE - 3/8"TH	2
12	278-2XXX-25-6997	UW HUT, ROOF SUPPORT ANGLE - 2 X 2 X .25	4
13	5500-1524-6997	DOOR SHELF, MILL FINISH, 15 X 24	1



BACKSIDE
ISO VIEW



Number

PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF Wickum Weld, Inc. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF Wickum Weld, Inc. IS PROHIBITED.

C:\Users\Jerome\WickumWeld\Design - Documents\WWCAD\UW HUT\2500-604846-6997

PART NUMBER: 2500-604846-6997
DEFAULT PART: 2500-604846-6997

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FAB FRACTIONAL ±1/16
WELD & ASM FRACTIONAL ±1/8
ANGULAR: MACH ±.1 BEND ±1
TWO PLACE DECIMAL ±.12
THREE PLACE DECIMAL ±.063
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5

DO NOT SCALE DRAWING

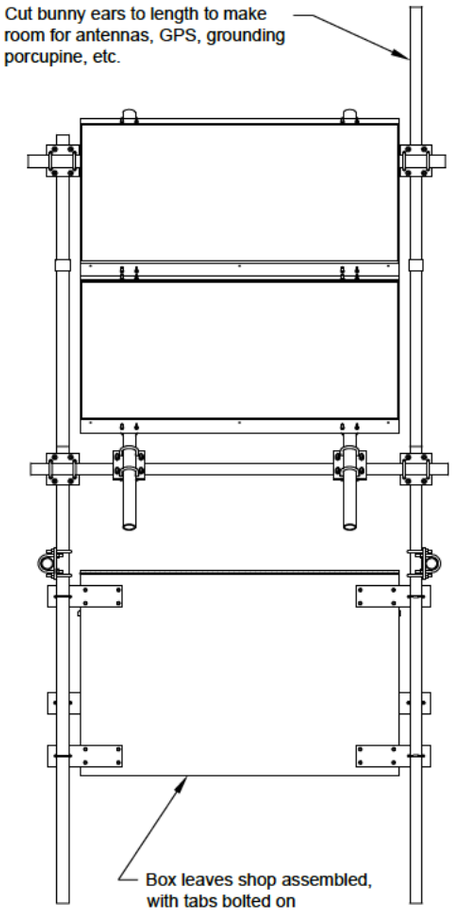
	NAME	DATE
ModelBy	JR	6/10/2019
DrawnBy	JR	6/11/2019
DoubleChk		
DXF By		
BOM By		

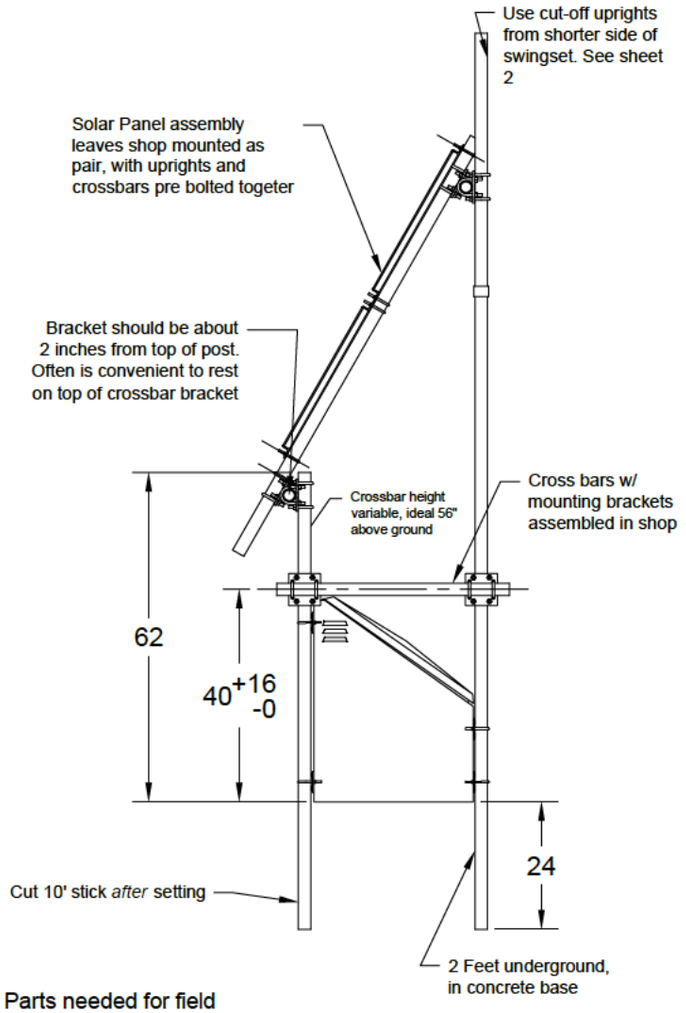
Wickum Weld, Inc.

DESCRIPTION
UW HUT, MAIN ASSY, MILL FINISH

SIZE	FILE NAME	REV
A	2500-604846-6997	0

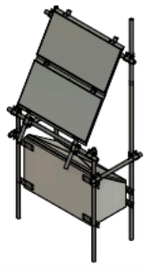
SCALE: 1.21 WEIGHT: 343.357 SHEET 1 OF 4





Parts needed for field
-Box Assembly
-Solar Set Assembly
-4x 10' sticks (to cut in-field)
-2x 42" lower crossbars
-4x Bracket Plate Sets

All units in inches

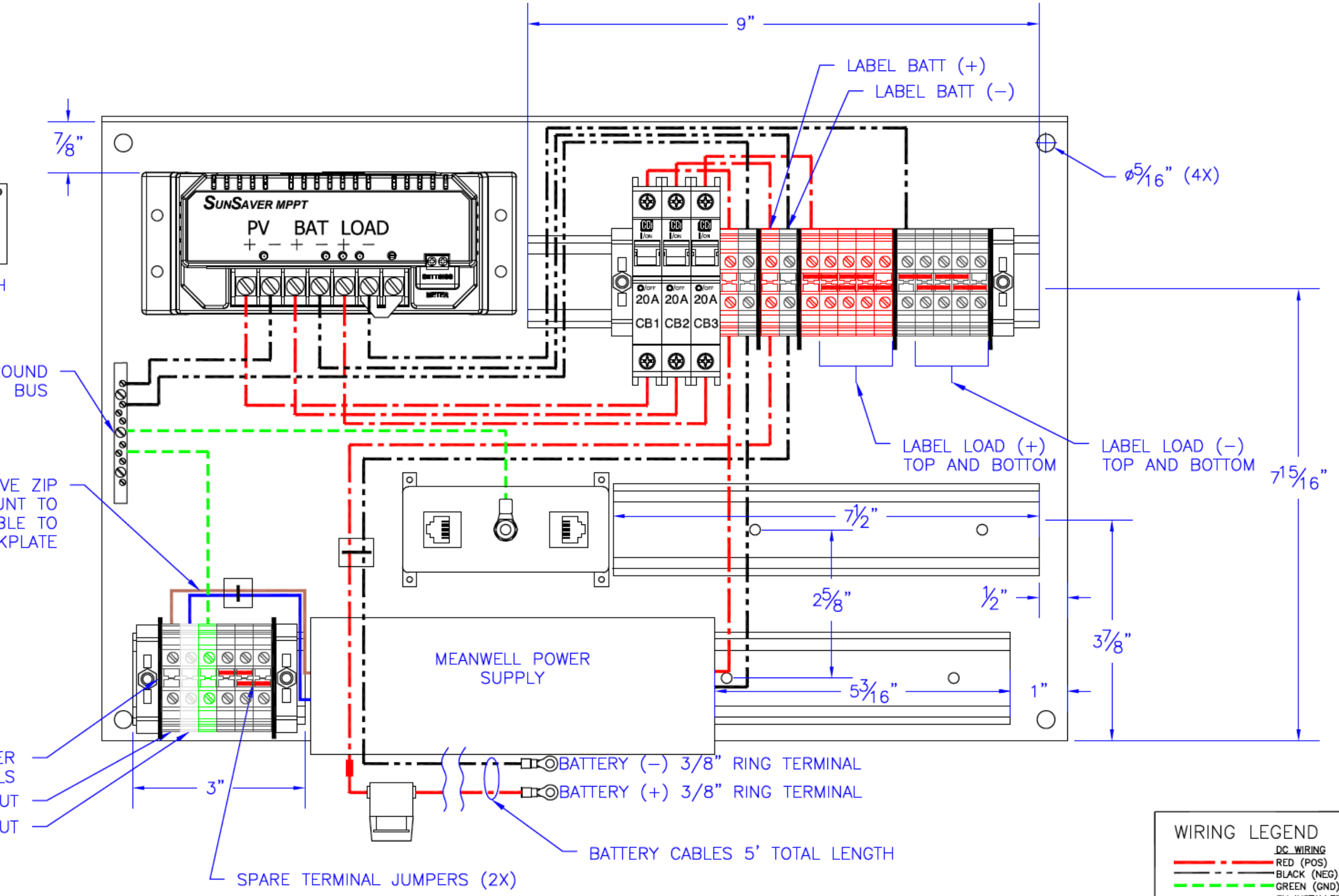


PROJECT
Swingset

TITLE
Swingset Assembly

APPROVED			SIZE	CODE	DWG NO	REV
CHECKED	Ben R. Pratt	03/28/2019	A			
DRAWN	Ben R. Pratt	10/17/2018	SCALE 1:30	WEIGHT	SHEET 1/6	

REV	ECR#	REVISION DESCRIPTION
–	–	RELEASED FOR CONSTRUC
B	–	GENERAL REVISION
F	–	MOVED BATT CABLES



WIRING LEGEND

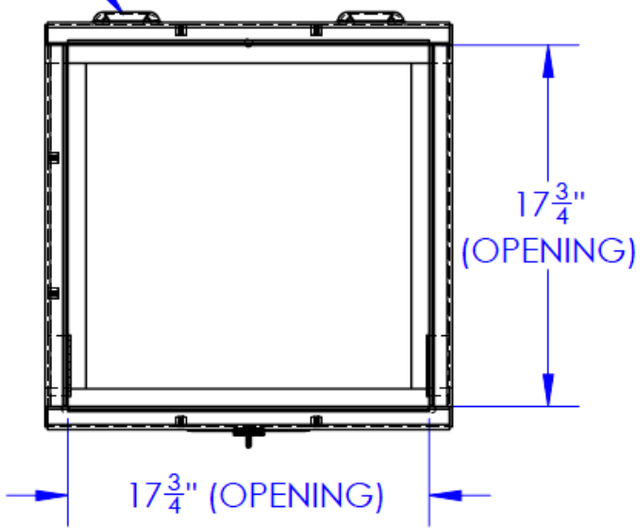
DC WIRING
- RED (POS)
- BLACK (NEG)
- GREEN (GND)
- BY INSTALLER

NTROLLER (–) CONNECTIONS ARE COMMON
S TO BE 41" LONG, RING CONNECTORS TO BE FOR 3/8" STUD
HARDWARE TO BE STAINLESS STEEL

THIS DOCUMENT CONTAINS CONFIDENTIAL AND PROPRIETARY INFORMATION THAT CANNOT BE REPRODUCED OR DIVULGED, IN WHOLE OR IN PART, WITHOUT WRITTEN AUTHORIZATION FROM SUNWIZE POWER & BATTERY

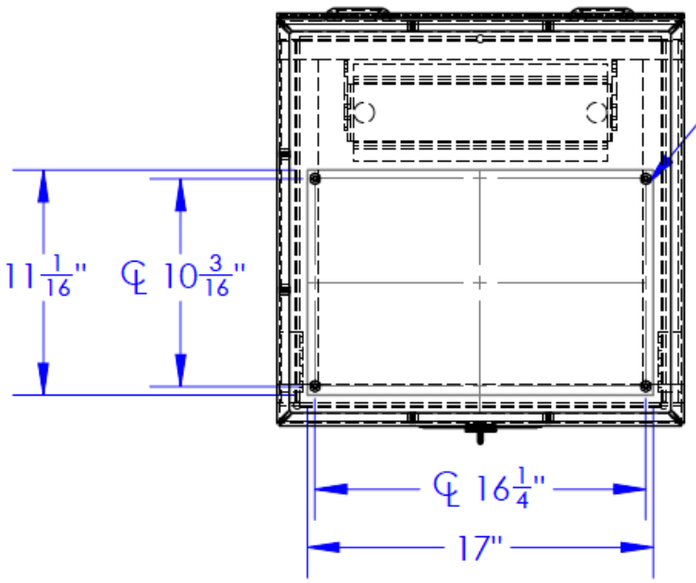
PART DESCRIPTION:

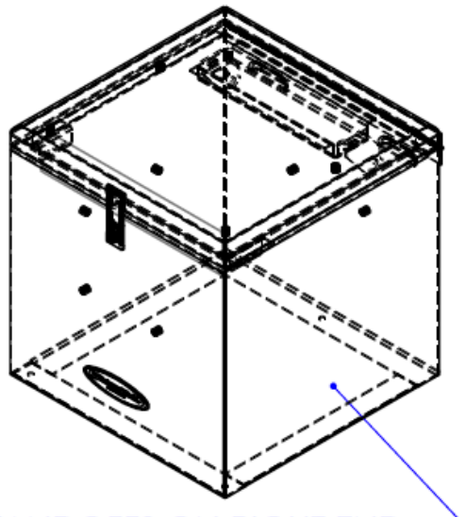
(X2) LOUVERS IN REAR OF BOX
AT THE TOP NEAR THE HINGE



VIEW WITH NO LID

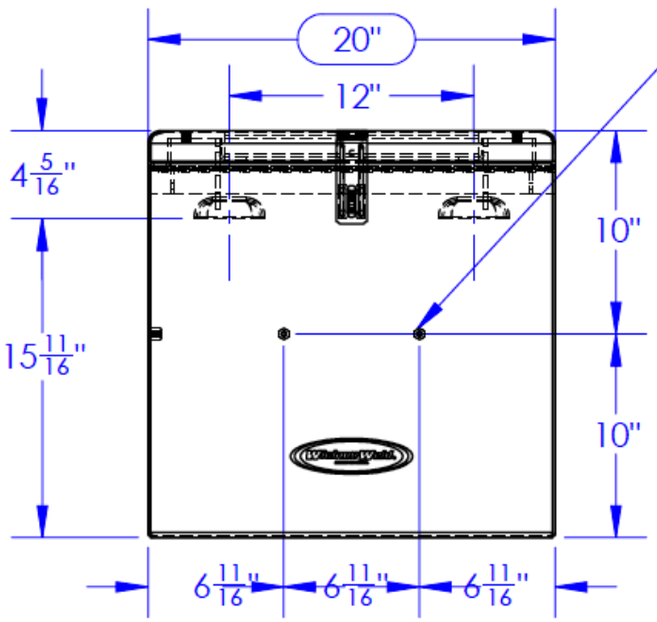
(X4EA) WELDED STANDOFFS IN LID FOR POWER PANEL
(1/4-20 THREADED X 1/2" LONG HEX STYLE)

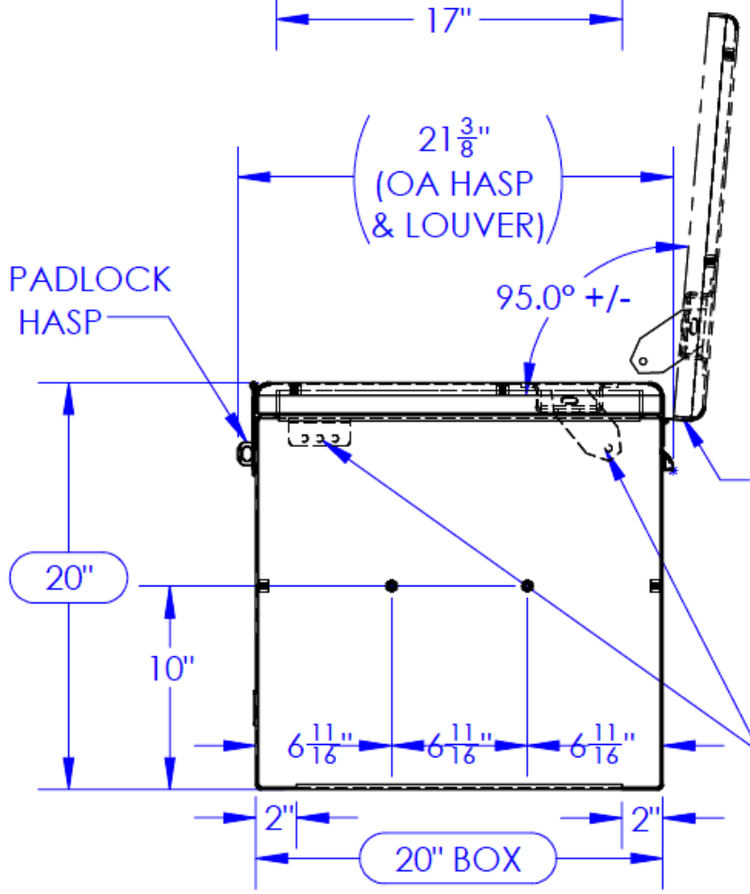


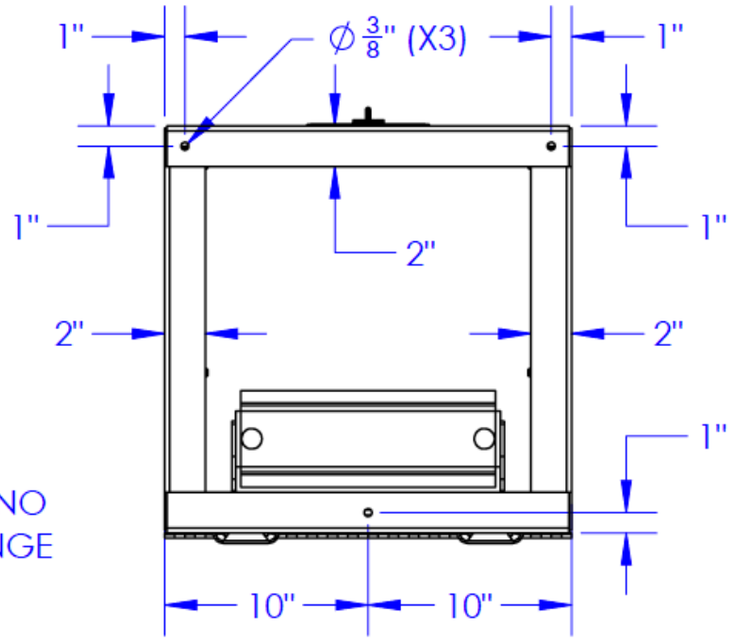


*NO STANDOFFS ON RIGHT END

(X2EA) WELDED STANDOFFS PER SIDE OF BOX
(EXCLUDES RIGHT SIDE OF BOX) - (X6 TOTAL)
(1/4-20 THREADED X 1/2" LONG HEX STYLE)





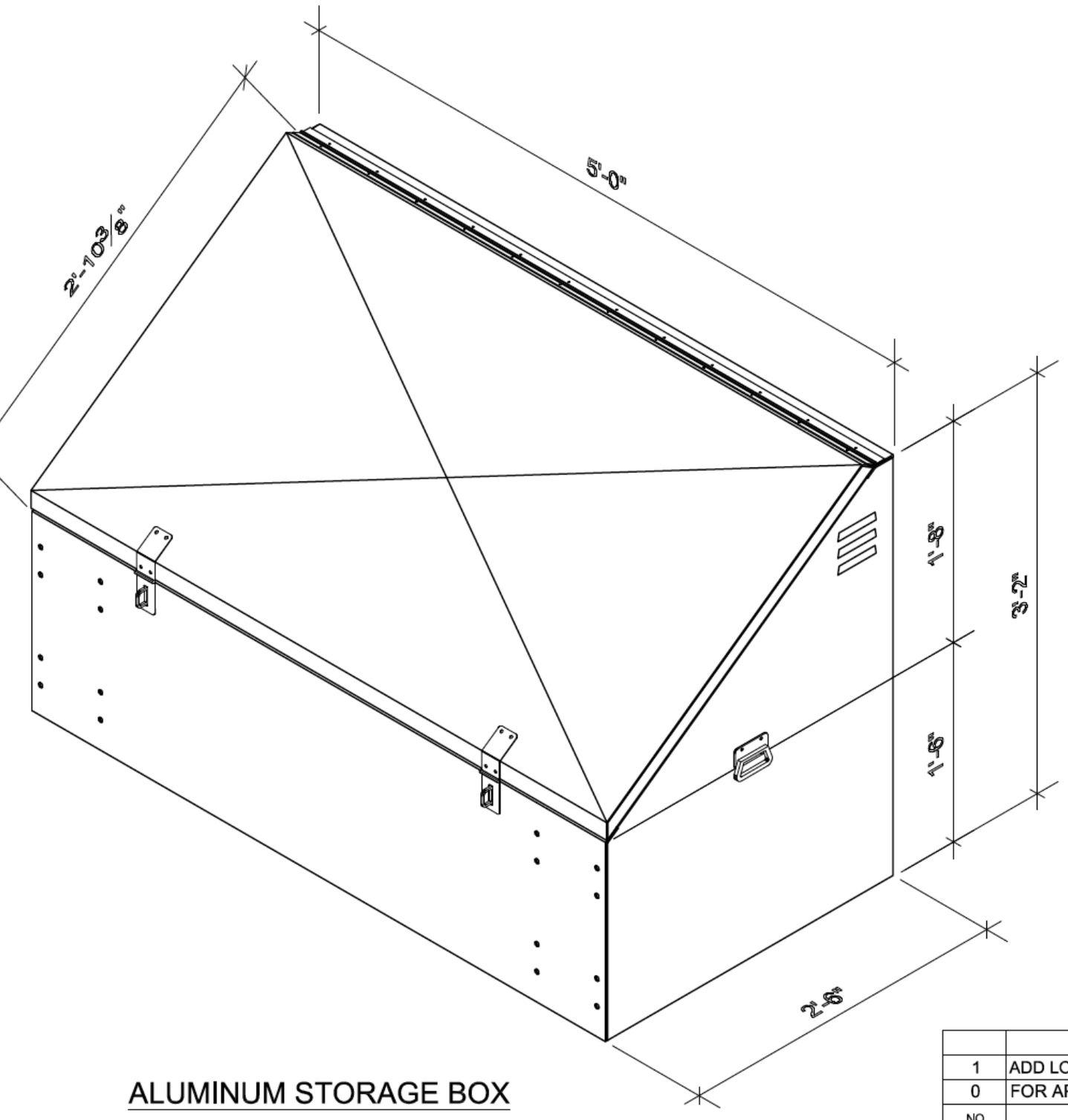


OPEN BOTTOM VIEW WITH NO LID

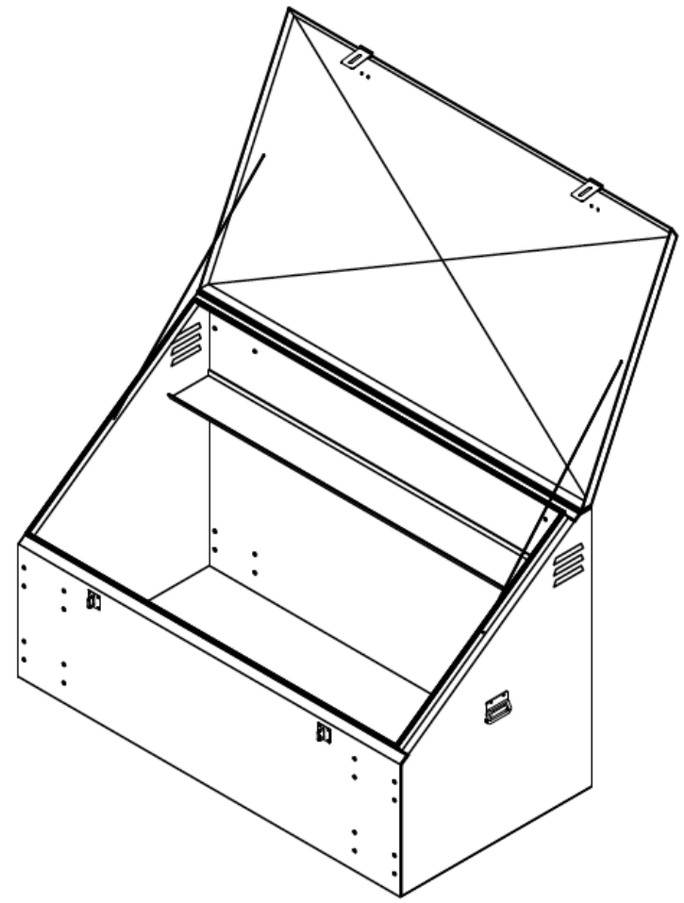
SHOCK MOUNT POINTS ARE
POSITIONED LOWER THAN
LID TO CLEAR POWER PANEL
(SHOCK NOT SHOWN)

DESCRIPTION:	TBOX, MILL FINISH BODY, MILL FINISH LID, 20 X 20 X 20	
P/N:	MODEL BY:	MODEL DATE:
2400-202020-6319	JR	
~~REVISION:~~	~~DRAWN BY:~~	~~DRAWN DATE:~~
0	JR	9/20/2018
~~FILE NAME:~~	~~CHECKED BY:~~	~~CHECKED DATE:~~
2400-202020-6319	-	

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF WICKUM WELD ANY REPRODUCTION IN PART OR WHOLE WITHOUT THE WRITTEN PERMISSION OF WICKUM WELD IS PROHIBITED.



ALUMINUM STORAGE BOX
60X30X38
ISOMETRIC VIEW



ALUMINUM STORAGE BOX OPEN
60X30X38
ISOMETRIC VIEW

SEE SHEETS 1.1 THRU 1.4 FOR ADDITIONAL PARTS AND DET

NO.	REVISION	DATE
1	ADD LOUVERS & HOLES FOR ATTACHMENTS	06-17-15
0	FOR APPROVAL ONLY	03-30-15

BOLTS Ø
OPEN HOLES Ø EDGE DIST. UNO
PAINT

ELECTRODES (UNO): AWS E70XX

MATERIALS (UNO):
Plate/Shapes: ASTM A36 Fy=36ksi
W-Shapes: ASTM A992 Fy=50ksi
Pipe: ASTM A53 GrB Fy=35ksi
Tube: ASTM A500 GrB Fy=46ksi

PETER DOUGLAS & ASSOC.
Structural Steel Detailing
6210 N. BOWDOIN ST.
PORTLAND, OR 97203-4210
(503) 477-4462 voice & fax
peterdoug@comcast.net

VERIFICATION OF DIMENSIONS, DETAILS AND QUANTITIES ARE REQUESTED, AS INDICATED. IF EACH VERIFICATION IS NOT NOTED OTHERWISE, IT WILL BE ASSUMED TO BE CORRECT AS SHOWN. ANY REFABRICATION DUE TO IMPROPER VERIFICATION WILL BE EXTRAWORK AND WILL REQUIRE A CHANGE ORDER.

Advance Welding Inc.
1509 NE 106th ST. • VANCOUVER, WA 98
(360) 573-1311 • Fax (360) 573-13

ITEM	ALUMINUM STORAGE BOX 60X30X38
JOB	UNIVERSITY OF WASHINGTON
LOCATION	
ARCH.	MARC BIUNDO
CONTR.	

PD&A JOB 1506 DRAWN BY PD CHK'D BY
REF. JOB NO. DWG. NO.

	Tool	Link	discription	Distributor	#per site	Orde
				McMaster Carr		
ngth, Fully Threaded		https://www.mcmaster.com/#95373A163	conn tabs to slope top box	95373A163	32	1
21/64" Height		https://www.mcmaster.com/#90371A031	conn tabs to slope top box	90371A031	32	1
9, .06"-.11" Thick		https://www.mcmaster.com/#98970A131	All 3/8ths bolts	98970A131	96	1
0.385" ID, 0.705" OD		https://www.mcmaster.com/95160a220	Lock Washers	95160A220	32	1
		https://www.mcmaster.com/8862t29	Tabs to pipe connection	8862T29	16	16
ntions.		https://www.mcmaster.com/#5663K12	Worm Drive Clamp	5663K12	8	2
x 1-1/4 NPSM Male		https://www.mcmaster.com/8180k14	Flex conduit adapters	8180K14	4	4
		https://www.mcmaster.com/#6923K36	Ground lug for top of stantion	6923K36	2	2
D		https://www.mcmaster.com/92141a029	1/4-20 washer	92141A029	38	1
		https://www.mcmaster.com/92676a029	1/4-20 nut Brass	92676A029	24	1
		Sheet break	Sheet break	Sheet break	Sheet break	Sheet
		https://www.mcmaster.com/91845a029	1/4-20 nut Stainless	91845A029	2	1
ng, Fully Threaded		https://www.mcmaster.com/92240a544	1/4-20 1.25" Stainless	92240A544	18	1
0.487" OD		https://www.mcmaster.com/92146a029	1/4-20 lock washers	92146A029	24	1
the brass rod.		https://www.mcmaster.com/93025a964	Single point ground rod, use SS nut	93025A964	1	1
g	x	https://www.mcmaster.com/5553a92	Deep well socket	5553A92	1	1
	x	https://www.mcmaster.com/85555a217	Torque Wrench for 7/8 3/8 bolts	85555A217	1	1
er Cushion, 1" ID		https://www.mcmaster.com/3225t28	Cable clamps 1"	3225T28	5	1
er Cushion, 2" ID		https://www.mcmaster.com/3225t31	Cable clamps 2"	3225T31	5	1
		https://www.mcmaster.com/1820k23	Anti seize 8 ounce can	1820K23	1	1
				Platt Electric		
s, 1 extra, you only need 13.		https://www.platt.com/platt-electric-supply/Con	Main structure for swingset	16275	13	13
		https://www.platt.com/platt-electric-supply/Grou	Ground clamp for top of swingset	487209	2	2
up to 10 stations		https://www.platt.com/platt-electric-supply/Bare	Primary blow surface ground	62913	15	15
		https://www.platt.com/platt-electric-supply/Grou	2 ground rods needed per site	50562	2	2
		https://www.platt.com/platt-electric-supply/THH	Mast ground cable	62711	20	1
		https://www.platt.com/platt-electric-supply/Com	Buried, ground lug	853496	1	1
Stud, Long Barrel		https://www.platt.com/platt-electric-supply/Com	Mast, gound lug	74053	1	1
		https://www.platt.com/platt-electric-supply/Flex	Flex 1 1/4" bulk head connector	9491	3	3
		https://www.platt.com/platt-electric-supply/Flex	Flex 1 1/4" aluminum flex 50'	65844	10	1

Swingset Enclosure Build Standards

Scope:

The scope of Sec1 SwingSet Build is to relay the PNSN's requirements for a pre installation fully constructed Swingset solar and power system.

The purpose of this system is to provide a rigid solar system that will function the same over 30 years.

The Swingset is a unibody approach. The overall structure is dependent on all the structural components tying into each other to create a rigid body. This minimizes the vibration. Vibration can contribute to a noisy seismic station.

Terms and Definitions:

1) Swingset: Aluminum structure containing solar panels, Grounding, Communication surge protection, Solar conditioning, and an enclosure containing batteries.
2) Stanchion: 2" ID aluminum pipe, either 2" sch40 or 2" conduit, typically used for mounting the solar panels, antenna, and enclosure.
3) Nominally: conduit, pipe, and sch40 all mean 2" ID, 2 3/8th" OD aluminum pipe. Two types of aluminum pipe can be used. Sch40 2" aluminum or 2" aluminum conduit.
4) SS means Stainless Steel. 18-8 or better.
5) x2 or x4 or x1pcs means the number of pieces involved with a task.

Materials:

1) All ¼-20 bolts Hex head screws will be 18-8 SS.
2) All ¼" washers will be SS.
3) All ¼" lock washers will be SS.
4) All Aluminum pipe threads will have Anti-Seize placed on their threads.
5) All ¼" Nuts will be brass.
6) All pipe will be 2" 2A aluminum conduit. Or 2" sch40 Aluminum pipe (pre-cut to length).
7) Any metal touching Aluminum is limited to SS, Bronze, Brass, or Galvanized metals.

Swingset framing materials:

1) 2A Rigid Aluminum Conduit. Or Sch40 pre-cut Aluminum 2" pipe. OD 2-⅜"
2) All Aluminum pipe threads will have Anti-seize generously brushed on the pipe coupling threads, 360deg around threads.