

Furuno X-band Radar Log for SPURS-2 2017

Dr. Elizabeth J. Thompson
Applied Physics Laboratory
University of Washington
206-543-9891
1013 NE 40th St, Seattle, WA, 98105
eliz@apl.uw.edu

1. Points of contact

Brent de Vries

Computing Resource Specialist
Scripps Institution of Oceanography (SIO)
tbdevries@ucsd.edu

Tom Cook

Programmer/Analyst, HF Radar Theory and Algorithm
Scripps Institution of Oceanography (SIO)
Coastal Observing Research and Development Center
La Jolla, Isaacs Hall, RM 333
858-534-9986
tmcook@ucsd.edu

Eric Terrill

Director, Coastal Observing Research and Development Center
Scripps Institution of Oceanography (SIO)
La Jolla, Isaacs Hall, RM 300
858-822-3101
eterrill@ucsd.edu

2. Background and Setup

The X-band Furuno radar in the computer lab of the R/V Revelle is typically used by Eric Terrel's group from SCRIPPS to monitor wave statistics in a program called WAMOS. The Furuno radar and the WAMOS system are not supported by Scripps Institution of Oceanography (SIO). The radar and WAMOS were funded and maintained by Eric's group. The radar operations console – basically a huge remote control that looks like a video game unit – usually sits on a lower shelf in the electronics and server wall. We cut the zip ties and brought the console over to a desk by the aft port hole.

A DVI connector was already routed from the back of the server room all the way to the computer lab main area. I plugged the DVI into a screen capture device, which connected via

USB to my Windows 7 laptop. Then I used ffmpeg to screen capture X-band radar images every minute using this command:

```
>> ffmpeg -f dshow -framerate 15 -video_size 1280x1024 -rtbufsize 10M -i video="AV.io  
HDMI Video" -vf fps=1/60 -strfime 1 -qscale:v 2  
"C:\DATA\Furuno_Radar\Images\Furuno_%Y_%m%d_%H%M.jpg"
```

This command worked for the ENTIRE cruise without interruptions or failures!

The screen capture device can also be used via VLC to play the radar stream live. However, you cannot save screen capture images via ffmpeg at the same time as live streaming.

I tried to split the DVI feed from the back of the X-band between my system and that of WAMOS. However, this resulted in an interrupted and lower quality signal feed to my laptop. Tom Cook agreed that WAMOS's system didn't even need the DVI input cable, since they still have their analog to digital converter being used somewhere else.

2. Parameters to monitor rain vs. waves

The main console has several knobs useful for changing settings between wave and rain:

BRILL -?

A/C RAIN – Rain filter. The bridge turns this rain filter on to suppress rain echoes in hopes of just seeing ships. The WAMOS system also turns this filter on to focus on waves.

A/C SEA – Sea clutter filter. Basically makes the surrounding 2 nm of persistent ship echo disappear, but there is almost no way to tell the sea clutter for rain at the ship, with or without this filter.

GAIN – You can make the rain echoes look as intense as you want, but try not to “fry” the magnetron by exceeding about 50-60% gain regularly (according to the captain).

VRM – range rings to two adjustable distances. Click on and use wheel to adjust on screen.

TRUE-G TRAIL (use scroll to select on radar display screen) – shows track of radar data. Doesn't show previous track if radar has been turned off recently.

Previous Settings for WAMOS:

RAIN – 32

BRILL - 76

SEA CLUTTER – 30

GAIN – 36

RANGE – 1.5

PULSE – S1

DISPLAY – Head up RM: keeps heading at top of screen and true north changes.

Settings used for “RAINMOS” – rain operating system:

RAIN – 0!

BRILL - 76

SEA CLUTTER – 45

GAIN –56

RANGE – 16 nm with range rings every 4 nm

PULSE – (adjusted itself automatically)

DISPLAY – north up RM: keeps north at top of screen and heading changes.

3. Limitations of radar

Vertical beam width – it’s huge! Always keep in mind that the radar beam width is 20° wide. The precipitation echoes and sea scatter are very vertically smeared. The width is wide to see all targets with a single elevation angle.

Attenuation – Isolated convective echoes, i.e. several nm wide and moderately intense backscatter, can be seen out to about 20 nm. When widespread stratiform rain surrounds the ship, the received rain signal does not normally extend beyond 4-8 nm due to signal attenuation. A considerable amount of rain surrounds the ship during these times, and fills the vertically wide beam even if the rain intensity is light. This causes signal attenuation.

Adjustable Gain – this means that your perception of rain intensity is also adjustable. The echoes may look as weak or as strong as you want them to appear depending on the Gain setting. Echo intensity changes as echoes approach the radar because the vertical beam width is narrower and the signal attenuation is weaker at closer range from the ship.

Ambiguous echo within 1 nm of the ship - Sea clutter filter make echoes near the ship ambiguous. It is difficult to determine when rain is actually at the ship during high waves (see pervious section). Even with the sea clutter filter on high levels, high waves will still show up in the radar. Very light echo around the ship can mean drizzle, sea spray, and/or waves. Go outside to double check!

Missing aft 70° of radar display – this Furuno is the lowest of the three Furunos aboard. The bridge and mast are blanked for safety.

4. Power outages

If someone is working on the flying bridge or for some other safety reason, the X-band will need to be “secured”. A labeled piece of tape points to the console button named “STBY TX” – which immediately turns the radar off. This happened periodically throughout the cruise. There were also two planned power outages to the computer lab due to power / generator issues.

7. Returning WAMOS and X-band back to original settings

Followed instructions on radar screen.

6. Future Work

The radar display does not include time. From the information we could discern in the manual, it appears that the time must be imported from a different data feed, which we could not secure. The bridge radars have set this set up, but this computer lab unit does not support it. The ffmpeg screen shot saving process saved each image with the date and time of the image. When I get back to shore, I will add watermarks of the time to each image using Image Magik.

7. Log of events:

10/16 set sail out of San Diego in WAMOS settings.

10/21 16:40 changed to RAINMOS settings from last year

10/21 21:36 Changing back to WAMOS

10/25 04:04 UTC Example of RAINMOS for a couple minutes

10/28/17 22:47 UTC Kyla approved change to do WAMOS during SSP and RAINMOS during USPS. Started using these operating procedures at this time.

NOTE: As of 10/28/17, the 2 TB external drive has only filled up 64 GB. Should be good for the rest of the cruise on this drive: 2 weeks down, 3 weeks to go.

10/29 08:41 UTC changed to WAMOS for SSP deployment

10/29 19:18 UTC changed to RAINMOS.

10/30 09-ish UTC changed to WAMOS for SSP.

10/30 19:55 UTC changed to RAINMOS after SSP recovery.

10/31 08:45 UTC changed to WAMOS for SSP.

10/31 16:26 UTC changed to RAINMOS after SSP.

11/01 08:38 UTC changed to WAMOS for SSP.

11/01 19:18 UTC changed to RAINMOS after SSP.

11/12 09:00 UTC DID NOT change to WAMOS because SSP deployment cancelled due to no rain and high winds. RAINMOS still going.

11/04 17:05 changed to WAMOS for SSP

11/05 03:10 UTC changed to RAINMOS

11/06 23ish UTC changed to WAMOS mid-SSP deployment.

11/07 06:41 UTC changed to RAINMOS. Lady amber in view a couple miles away. SSP has been in for 6.5 hours... I just forgot to change settings back. Oops!

11/08 04:15 UTC changed to WAMOS for SSP

11/08 15:30 changed to RAINMOS after SSP

11/09 05:38 changed to WAMOS for SSP

11/09 16:12 changed to RAINMOS right after gust front, no rain locally but all around us.

11/10 00:26 changed to WAMOS... late. SSP launch was about 30 min ago. Stratiform rain.

11/10 08:14 changed to RAINMOS after SSP

11/10 20:41 changed to WAMOS for SSP (last deployment)

11/12 08:00 changed to RAINMOS for rest of trip.

11/13 15:45 X-band was secured for something and then defaulted to WAMOS settings.

11/16 00:20 turned off screen capture system