

PavLab Radio Guidelines

Version 1.10
M. J. Sacarny
AUV Lab
MIT Sea Grant College

1. Introduction

The purpose of this document is to promote clear, professional, and legal use of two-way radios at PavLab. Although the radios available to PavLab personnel come in different styles, such as handheld and headset configurations, how we use the radios, that is, the **protocol**, will be much the same. An important part of this guide is an introduction to a standard radio protocol.

The government body that regulates radio use is the **FCC** (Federal Communications Commission.) This document highlights specific FCC rules that are dependent on the frequency of the radio, the **band**.

2. Radio bands

PavLab radios operate on the **FRS** or **Marine** radio bands.

- **FRS** (Family Radio Service)

An FRS radio is very straightforward to use. Without getting into the specifics of a particular model, the overall procedure will be similar to the following:

- Turn the radios on
- Set each radio to the same FRS channel (1 through 14, e.g. "FRS10")
- Set each radio to the same **Interference Eliminator Code**
- Push the **PTT** ("push-to-talk" button) to transmit and release to receive. Pushing the button is also known as "keying the mic."
- Adjust volume

You can talk on FRS radio channels as long as you want, like a land-line telephone with unlimited minutes. Unlike a land-line, however, when you are transmitting, you cannot hear what the other person is saying. Also, communication can become garbled by background noise, poor microphone position, radio interference, and other factors. For these reasons, it makes sense to use a radio protocol such as the one detailed later in this document.

Transmit power for FRS is .5 W, enough to almost reach the Southern shore of the Charles River, although this is highly dependent on antenna height.

- **Marine** band

The marine band is a specific set of channels allocated for maritime use. The overall procedure will be similar to the following:

- Turn the radios on

- Set each radio to the same Marine band channel. For PAVLAB, likely channels are 68, 69, and 71 (e.g. “SEA 69”).
- Adjust the **SQUELCH** control until background noise is limited
- Adjust the **transmitting power** to the minimum required. A handheld radio can transmit a maximum of 5 Watts.
- Push the **PTT** (“push-to-talk” button) to transmit and release to receive
- Adjust volume

Because Marine band channels are a shared and finite resource, their use is restricted to exchange of safety (e.g. “mayday”), operations, and commercial messages. Before you start using these channels, be sure to understand the following:

- False distress calls are a serious problem. A false distress call on channel 16, for example, is a Class D felony, with liability to \$5,000 plus costs to the Coast Guard. Although you may not make such a call, a guest to PavLab, perhaps a child, could make one. For this reason, keep good control of your radios. Also, be aware that in this part of the country, the Coast Guard knows your location within 1.5 seconds of keying the mic.
- Obscenity, indecency, and profanity on the air are criminal offences with a fine of up to \$10,000, imprisonment of up to 2 years, or both. Use of such language also reflects poorly on PavLab, which often operates in public spaces within earshot of recording devices. When on the radio, assume other people are listening.
- Do not use Channel 70 for voice communications.
- Stay off of Channels 09 and 16 unless you have very good reason, such as to make a distress (“mayday”) call.

Unlike FRS radio, communication on marine channels, especially channels 9 and 16, is required to be brief to keep the channel available to the highest number of users. Communicating on a channel for several minutes several times an hour, as an example, is probably not ‘brief’. That said, PavLab might be able to use the following Marine band channels for operational communications, as long as such use does not interfere with other stations:

- Non-commercial channels: Channels 68, 69, 71, 72 (ship-to-ship), and 78A. These are assigned to ‘non-commercial’ messages, such as from recreational boaters.
- Commercial: 7A, 10, 11, 18A, 19A, 79A, and 80A. These are assigned to ‘commercial’ traffic. PavLab operations are arguably commercial, as our profession is the development of marine systems.

3. Microphone and radio technique

When you are ready to use the radio, follow these practices:

- Listen for a second or two before transmitting to make sure no one else is using your selected channel. If they are using it, wait for them to finish. If there is steady traffic, inform your called station to switch to a different channel.
- Hold the microphone an inch or so from your mouth. “Eating the microphone” can result in unclear communication.

- Think about what you will say before you say it.
- Remember to breath and speak slowly and clearly.

4. Radio protocol

The following protocol is in wide use in law enforcement, military, and emergency response organizations. It includes the use of:

- A standard message format, which helps parties regulate their exchange of messages and improves interpretation.
- A standard set of **prowords** (procedure words), which improves message clarity and conciseness.

One phrase of a message looks like this:

<called station><calling station><message content><terminator>

Example conversation:

“RED1, **THIS IS** PCOM. What is the battery voltage? **OVER.**”

“PCOM, **THIS IS** RED1. Battery voltage is ‘one’ ‘two’ ‘decimal’ ‘5’ volts, **OVER.**”

“RED1, PCOM. **ROGER, OUT.**”

These two stations worked out their station names before conversing. Because they were using a standard format, they knew when each message started and ended. Consider if you heard the following partial phrase:

<garble> ... that all systems are fine ...

If the message was in standard format, you can infer the following:

- I did not hear the start of the message, so I do not know the intended called and calling stations
- I did not hear the terminator, so I did not receive the end of the message

The words in bold, such as **OVER** and **OUT**, are examples of prowords. Table 1 contains a list of common prowords, meanings, and examples.

Proword	Meaning	Example
BREAK, BREAK	Interruption to a transmission	
OUT	The entire conversation is complete – no need to answer	“Command, Mokai2. ROGER, OUT ”
OVER	The conversation is continuing – I expect a response	“Command, Mokai2. What is your position? OVER. ”
ROGER	I received your last phrase	“Command, Mokai2. ROGER, OUT ”
WILCO	I understand and will comply	“Command, Mokai2. WILCO, OUT ”
THIS IS	My station name follows	“Command, THIS IS Mokai2. OVER”
FIGURES	Numeric values follow	“Command, Mokai2. Voltage is FIGURES <i>wun, too, de cee mal, fi yiv</i> OVER”
SPEAK SLOWER		

SAY AGAIN	Repeat the message	“Mokai2, Command. <garble> your velocity, OVER” “Command, Mokai2. SAY AGAIN , OVER” “Mokai2, Command. I SAY AGAIN maintain your velocity, OVER”
I SPELL	Phonetic spelling follows	“Command, Mokai2. Vessel is a WAM-V. I SPELL Whiskey, Alpha, Mike, Victor, OVER.”
WAIT	I must pause for a few seconds	“Command, Mokai2. Vessel is avoiding traffic. WAIT All vessels clear OVER”
AFFIRMATIVE	Yes, that is correct	
NEGATIVE	No	

Table 1: List of PROWORDS

When you need to spell something, use the standard phonetic alphabet of Table 2. Emphasis is on the syllable in **bold**. Likewise, if you need to transmit a number, use the pronunciation in Table 3. You can practice using these by sounding out road signs and license plates.

Letter	Phonetic Equivalent	Pronunciation
A	Alfa	Al fah
B	Bravo	Brah voh
C	Charlie	Char lee
D	Delta	Dell tah
E	Echo	Eck oh
F	Foxtrot	Foks trot
G	Golf	Golf
H	Hotel	Ho tell
I	India	In dee ah
J	Juliet	Jew lee et
K	Kilo	Key loh
L	Lima	Lee mah
M	Mike	Mike
N	November	No vem ber
O	Oscar	Oss cah
P	Papa	Pah pah
Q	Quebec	Keh beck
R	Romeo	Row me oh
S	Sierra	See air rah
T	Tango	Tan go
U	Uniform	You nee form
V	Victor	Vik tah
W	Whiskey	Wiss key
X	X-ray	Ecks ray
Y	Yankee	Yang key
Z	Zulu	Zoo loo

Table 2: Phonetic alphabet

Number	Pronunciation
0 (Zero)	Ze ro
1 (One)	Wun
2 (Two)	Too
3 (Three)	Thuh ree
4 (Four)	Fo wer
5 (Five)	Fi yiv
6 (Six)	Six
7 (Seven)	Seven
8 (Eight)	Ate
9 (Nine)	Niner
. (Decimal)	De cee mal

Table 3: Pronunciation of numbers

Table 4 presents some examples:

Text	Pronunciation
XYZ 129	Ecks ray Yang key Zoo loo Wun Too Niner
44	Fow er Fow er
90	Niner zero
136	Wun thuh ree six
500	Fi yiv hun dred
1478	Wun fo wer seven ate
7000	Seven thow zand
16000	Wun six thow zand
164000	Wun six fo wer thow zand
10.4	Wun zero de cee mal fow er
812681	Ate wun too six ate wun

Table 4: Pronunciation examples

Here are a few additional notes on format and prowords:

- Do not use CB slang (e.g. “10-4, good buddy”) on marine radio bands
- Do not use OVER and OUT together, just one or the other.
- Do not use ROGER and WILCO together, just one or the other.
- Once you have connected with a station, you can drop “THIS IS”. Example:

“RED1, THIS IS PCOM. There is a kayak approaching from the Harvard Bridge, OVER”

“PCOM, RED1. ROGER. Going into station-keeping now, OUT”

5. How to describe relative vessel movement

Here are a few situations involving boats moving relative to each other, and language that could be used to describe them (Figure 1: Vessel movement):

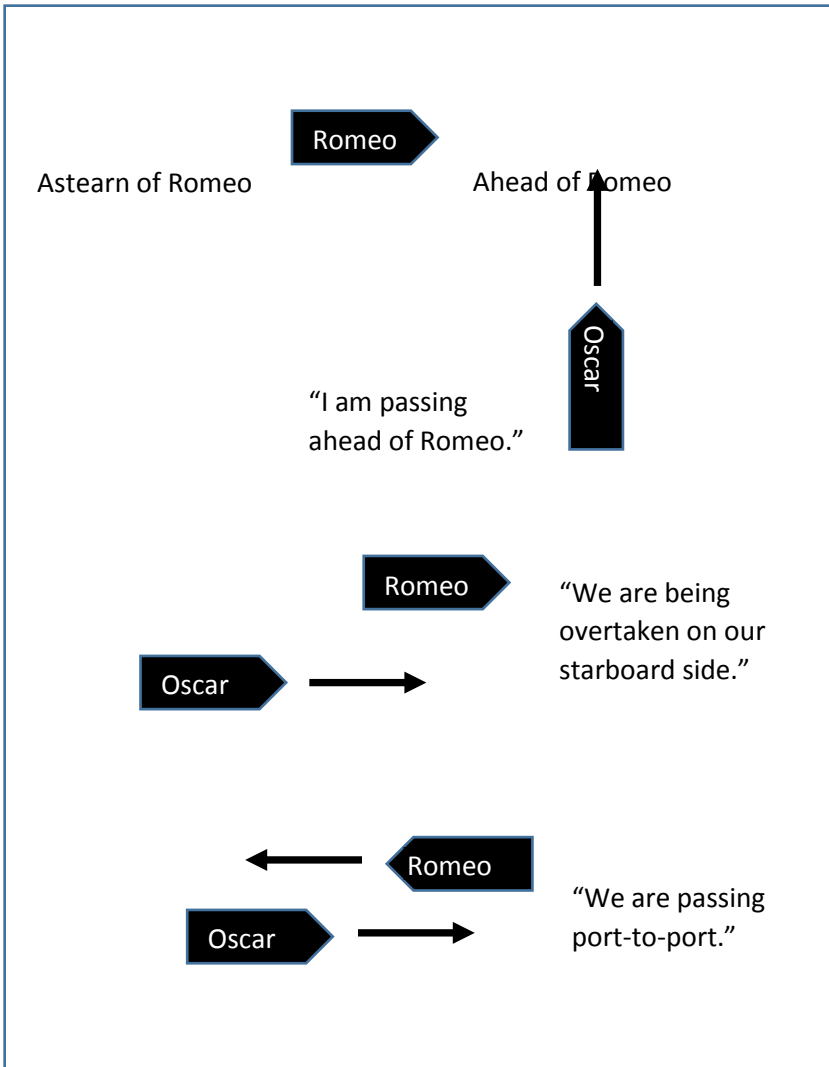


Figure 1: Vessel movement

6. Sample messages

Here are a few sample messages that could be used in the PavLab. PCOM ("pee-com") is the call sign for the PavLab Commander, RED1 is a vessel call sign, PLAB ("pee-lab") refers to all vessels.

Prelaunch phase:

"RED1, this is PCOM radio check on FRS 1, over"

"PCOM, this is RED1, loud and clear, over"

"Roger, RED1, Break, Break, BLUE1, this is PCOM radio check on FRS 1, over"

.....

Launching missions:

“All PLAB vessels, standby launching, PCOM out”

“All PLAB vessels, All PLAB vessels, good to go, proceed to home flag, PCOM out”

Start game phase:

“All PLAB vessels, this is PCOM, commence exercise (comex), out”

During game: (protocol relaxed)

“RED1, you have been tagged”

Stop game: (protocol returns)

“All PLAB vessels, this is PCOM, finish exercise (finex), out”

“All PLAB vessels, return to home flag, out”

Return to base:

“All PLAB vessels, this is PCOM, return to dock, out”

Change radio channel:

“RED1, this is PCOM, switch to FRS 2, I say again, FRS 2, over”

“PCOM this is RED1, switching to FRS 2, out”

New channel is selected:

“RED1, this is PCOM radio check on FRS 2, over”

“PCOM, this is RED1, loud and clear, over”

Battery voltage request:

“PCOM, this is RED1, what is RED2 battery voltage?, over”

“RED1, PCOM, RED2 voltage is One Two decimal Niner (12.9), over”

Battery recall:

“All PLAB vessels, this is PCOM, low battery return to dock, out”

Acknowledgements:

“RED1, do you have control of RED2?, over”

“Affirmative (Negative), I have (do not have) control of RED2, over”

Spelling:

“RED1, what is the registration of near collision vessel?, over “

“PCOM, registration is I SPELL Mike Sierra November Niner Niner over”

7. Alternative means to communicate

In addition to radios, it makes sense to have an alternative means of communication, such as cell phone. Make sure you have the cell phone numbers of other personnel ready on your phone before getting underway.

8. Concluding thoughts

The use of formats such as the radio protocol is intended to improve, not impede, communications. The more you use the format, the more relaxed and fluid it becomes. Conversely, when we deviate from the protocol, dropping the terminator, for example, we increase the likelihood of misunderstandings.

9. Acknowledgements

This document was developed substantially from materials of the U.S. Coast Guard Auxiliary, especially Boating Skills and Seamanship, © 2007, 2013 U.S. Coast Guard Auxiliary Asso., Inc. 14th Edition, pages 342-364.