ASCAC

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What in the world is an ASCAC?

The Anti-**S**ubmarine **Cl**assification and **A**nalysis **C**enter is often referred to as simply "the ASCAC room." The purpose of this room is to analyze data collected from various sources, and to transcribe the data into a format appropriate for locating, identifying, and targeting an enemy submarine.

How was data formatted before there were computers?

Formatting means that you translate raw data into a language that your file system understands, and without formatting it, your data is of little value. Formatting land masses, for example, was done over 2,000 years ago when Eratosthenes developed a map of Europe. On his map he drew a grid containing parallel vertical lines going north-south, and horizontal lines going east-west. The prime meridian was Alexandria, Egypt, and all mileages were measured in distances from that one point.

Today, this type of location coding is still used everywhere in the world when drawing maps.

The map coordinates of the USS Hornet today are: **37°46′21.15″N 122°18′10.23″W**

This code may look mysterious to some people, but with very little training, it is not so mysterious.

I understand how you can draw maps on a grid chart, but how do you put sound waves onto a grid?

About 1,000 years ago, the Benedictine monks of Italy started writing Gregorian chants on a simple 5-line staff using vertical bars to indicate pitch, and horizontal bars to indicate time. This was the first time that sound waves were formatted onto a sheet of paper for other people to read and understand later.

This type of coding is still used today for writing music.

Does this mean that the ASCAC Room is the place where submarine noise is digitized?

It would be more accurate to say that sound waves are formatted instead of digitized. If you format music, for example, you would take each note of a song, and print that note on a grid sheet that any musician could read and replicate at another time. If you digitized the music, you would assign a numerical code to every note, and put that information into a computer. You could then ask the computer to change music played on a piano to be played by a violin, like a synthesizer does. Or, you can ask the computer to have string instruments, wind instruments, and percussion instruments separated and played from different speakers, the way stereophonic music is played. This type of technology did not exist during the Hornet's lifetime.

When we enter the ASCAC Room, will we see sound waves formatted onto a grid chart?

Yes, in the ASCAC Room you can see an analog printer which formats sound waves onto a large roll of printout paper. The paper has no visible lines, but (using your imagination), visualize vertical lines which represent time, and horizontal lines which represent frequency. To an untrained eye, this information looks like an agglomeration of meaningless spots, similar to a giant QR code. From this readout, a skilled technician can determine accurate information about the enemy submarine.

What is the source of the information that ASCAC receives?

The information comes to this room comes from sonobuoys. There are two types of sonobuoys in our acoustic location system: **active sonobuoys**, and **passive sonobuoys**. A sonobuoy is an underwater listening device which can record submarine noises and relay the sound back to the ship. Active sonobuoys record sonar sounds, and passive sonobuoys record cavitation noise and other sounds made by the submarine.

What information can you get from sonar sounds?

Active sonobuoys emit a ***ping*** sound, and by watching the reflection of that sound, and doing a **Doppler shift** analysis, ASCAC can determine the submarine's range, speed, depth, and heading. The **Doppler shift** measures the change in frequency of sound waves as the submarine moves toward or away from you. Coming toward you, the sound waves compress making a higher-pitch sound, and away from you they stretch apart making a lower-pitch sound.

What information can you get from cavitation sounds?

When a ship or submarine moves through the water, the propeller creates reduced water pressure in front of the blades, and increased water pressure behind the blades. The lower pressure in the water in front of the blades causes small

bubbles of water vapor to form. These bubbles grow in size as they pass over the blade. The size of the bubbles is determined by the size of the propeller. As soon as these marble-size bubbles pass the blade edge, they enter the high-pressure zone, and they burst abruptly making a very loud roar in the water. This underwater rumble can be analyzed to determine what type of submarine it is, what country it is from, and what type of engine it has, where it is, where it is going, and how fast it is travelling.

Can we go to the ASCAC Room now to see how this works?

Not so fast! First we have to understand what we are looking at. Let's start with the **Anti-Submarine Warfare Room**. This room is usually called the **ASW Room.** It is located on Second Deck, near Ready Room 4, in Stateroom 243. Here you can see how the sonobuoys work. You can see what they look like before they are deployed, how they fall from the airplane and hit the water, and how they separate into three sections, (the hydrophone which may drop as far as 1,000 feet, the transmitter which floats on the surface, and the wire that connects the hydrophone with the transmitter).

Is the QR code on the storyboard next to the sonobuoy board something I can copy onto my smart phone?

That is not a Quick Response code. What you see on that storyboard is what the sonobuoy sound waves look like after they have been formatted by ASCAC. Notice that it has been formatted onto a grid pattern (even though you don't see gridlines), and the vertical bars represent time and the horizontal bars represent frequency.

So, after the analogue sound waves are picked up by the sonobuoys, how are they transmitted to the Hornet?

To see this, we need to go up to the **Airborne Early Warning Room**, also called the **AEW Room.** From the Security Desk, go up the ladder to the first landing. On the starboard bulkhead, look for AEW. If the door is closed, open it, (it's never locked). Inside this room you will find photographs of the type of planes used to relay radar signals. The Tracker you see in the photo has a large radar dome over the wings to transmit high-frequency signals hundreds of miles. The Tracker relaying low-frequency sonobuoys would not have such a large radar dome.

After the sound waves have been formatted, what does ASCAC do with that information?

ASCAC will use that information to make a plotting graph. A plotting graph is a map which uses triangles, (trigonometry), to find an unknown location by using two known angles.

Where can we see a plotting graph on this ship?

Let's go to Navigation. In this room you will find a **Deduced Reckoning Tracer**, also called a **DRT.**

If I use the horizon as a baseline, and a known star in the sky, and I know the exact time, and I measure the angle between myself and the star, I will know where I am because this is the only place I must be to see that particular star at that particular time.

Are there other DRTs on this ship?

Yes, let's go to the **Combat Information Center**, also called **CIC,** to see how this works. When you enter CIC, on your left side you will see a DRT, and over it you will see what is called the **Skunk Board.** Its real name is **Surface Contact Unknown,** but nobody ever calls it that because it is more fun to call it the Skunk Board. This DRT is used to track any ship which is not part of our fleet, and we need to treat it as a potential threat. By using this DRT in combination with the Navigation DRT, we will know exactly where the enemy ship is relative to the Hornet.

Does the data for this DRT get formatted by ASCAC?

Ship tracking is done by our surface radar units. The data is received through a radar antenna, and it is sent immediately to that unit's specific radar processing room. Early radar units showed only a wavy line on an oscilloscope screen, but by the 1960s, the radar antennas rotated for a 360-degree sweep, and when it located a ship, a dot would appear on the repeater screen, and a sweep line would show the position of the ship relative to the Hornet. The dot would fade away after a couple of seconds until the antenna found the ship again on its next rotation. This was very sophisticated technology for its time, and the formatting for this was done in the Radar Room, not in ASCAC.

What formatting was done in the ASCAC Room?

ASCAC was dedicated only to data related to underwater surveillance. Right here in the Combat Information Center, very near the entrance door, we can find another DRT. It looks very similar to the Skunk DRT and to the Navigation DRT. This one creates a plotting graph to trace the movement of an enemy submarine that was detected by sonar.

Where is the ASCAC Room from here?

Follow me. We exit CIC through the back door, (opposite the entrance door). You enter a dark, mysterious passageway. You will find the light-switch panel to your left, on the starboard wall.

Directly across the hall from the CIC door, you will find the room marked ASCAC. The key for ASCAC is the same as for CIC.

Are there different types of sonobuoys?

There are many different types of sonobuoys. The most common ones are the ones displayed on the table to your right:

The **Command Active Sonobuoy System**, (called CASS), is a long-range sonobuoy used to localize a target detected by the Sonar Room. **"Active"** means that the sonobuoy emits a **ping,** and records the position, heading, and speed of the submarine, and gives no other data about the submarine. **Active sonobuoys** were usually avoided because their "pings" can be picked up by the enemy.

The **Sonobuoy Model 57** is used to localize a target previously detected by a CASS Sonobuoy. The **Model 57** is a passive sonobuoy, and it gives off no noise to alert the target.

The **Passive LOFAR Sonobuoy** records sounds emanating from the cavitation bubbles produced by the submarine's propellers. **LOFAR** stands for "Location Finding And Ranging," but this sonobuoy records much more than location and range. It also records engine noises which will identify the type of engine, and the model of the submarine.

The **Bathythermograph Transmitter Sonobuoy** is usually called the BT Transmitter. This sonobuoy measures the water temperature from the surface to a depth of about 1,000 feet. Sound waves travel faster in warm water than in cold water, because the warmer the water is, the faster the water molecules will move, thereby allowing sound waves to transfer energy more freely. By knowing the temperature surrounding the submarine, the sound waves coming from it can be analyzed more efficiently.

Okay, now that ASCAC has received the sonobuoy data, what will they do with it?

Just to the left of the sonobuoy models, you will see the **Vernier printer.** This machine is an analog data processer. It prints out a hard copy of the sonobuoy data. Keep in mind that there was no electronic formatting during the 1960s, so this analog printout had to be read and analyzed by a highly trained technician.

What are those boxes under the printer used for?

Those boxes are frequency amplifiers for the printer. Sonar units use lower frequency than radar units because lower frequencies penetrate the water better, and they are less detectable by the enemy. These frequency amplifiers can boost the signal for printing to get better resolution.

Way in the back of the room, it looks pretty dark. What's back there?

In the back of the room are the radio receivers and tape recorders. There is an annex room on the left that housed the LOFAR repeater.

Now that the submarine information has been recorded, how does it get to CIC?

Right in the center of this room, you will find a large plotting table. The submarine's coordinates are entered into this device, and this becomes the master DRT for the repeater you saw in CIC. ASCAC is responsible for keeping track of the submarine's progress, and must make position updates at regular intervals.

I think that I understand ASCAC now, so why do I read all kinds of mysterious powers that they had?

Do you remember *The War of the Worlds'* **heat-ray** from 1898, or Buck Roger's **ray-gun** of the 1930s, or Captain Kirk's **pocket-phaser** of the 1960s, or Obi-Wan Kenobi's **lightsaber** from the 1990s? Science fiction novelists have long been entertaining readers with the image of the good-guys being able to thwart the bad-guys by using ultra-sophisticated weaponry. It is not unknown that our Navy sometimes "leaks" security misinformation to mislead enemy powers. If you want to research online what goes on behind ASCAC's closed doors, be aware that some of what you read may be the product of modern-day fiction novelists.