NATIONAL TRANSPORTATION SAFETY BOARD

IN RE:	
THE EL FARO INCIDENT OFF THE COAST OF THE BAHAMAS ON OCTOBER 1, 2015	NTSB Accident No. DCA16MM001

Interview of: MICHAEL FITZMAURICE JR.

Friday,
March 4, 2016

NOAA Satellite Operations Facility
Suitland, Maryland

BEFORE:

JON FURUKAWA, NTSB
DOUGLAS MANSELL, NTSB*
PAUL WEBB, U.S. Coast Guard
PATTY FINSTERBUSCH, TOTE Services*
JESSE REICH, NOAA SARSAT
LISA HESSLER, ERT*
CHRISTOPHER O'CONNER, NOAA*

* present via telephone

This transcript was produced from audio provided by the National Transportation Safety Board.

Furukawa Robert

From: Mickey Fitzmaurice <[redacted]>
Sent: Wednesday, May 11, 2016 2:09 PM
To: Furukawa Robert
Subject: Re: Fitzmaurice Interview Transcripts: for review and comment to ensure its accuracy

Yes, the represent my words accurately.

Thanks
Mickey

On May 11, 2016, at 1:49 PM, Furukawa Robert <[redacted]> wrote:

> Mickey,
>
> Are you good with the transcripts?
>
> Best regards,
>
> R. Jon Furukawa
> Investigator + NTSB-OMS + c: [redacted] + [redacted]
>
> **From:** Furukawa Robert
> **Sent:** Friday, April 08, 2016 3:25 PM
> **To:** Mickey Fitzmaurice <[redacted]>
> **Subject:** FW: Fitzmaurice Interview Transcripts: for review and comment to ensure its accuracy
> **Importance:** High
>
> Mickey,
>
> I just want to make sure you got this last week and are working on it.
>
> Best regards,
>
> R. Jon Furukawa
> Investigator + NTSB-OMS + c: [redacted] + [redacted]
>
> **From:** Furukawa Robert
> **Sent:** Thursday, March 31, 2016 5:43 PM
> **To:** 'Mickey Fitzmaurice' <[redacted]>
> **Subject:** Fitzmaurice Interview Transcripts: for review and comment to ensure its accuracy
>
> Mickey,
>
> Attached are interview transcripts and an errata sheet.
>
> Please review transcripts email me the signed errata by COB 14-Apr-2016.
>
> Best regards,

P-R-O-C-E-E-D-I-N-G-S

11:17 a.m.

MR. FURUKAWA: The time is 11:17. It is Friday, the 4th of March, 2016, and we're here at NOAA's --

PARTICIPANT: Satellite Operations Facility.

MR. FURUKAWA: -- Satellite Operations Facility in Suitland, Maryland. We're here to interview Michael Fitzmaurice, Jr., the NOAA SARSAT senior space systems engineer. Mr. Fitzmaurice goes by Mickey, so we just call him Mickey.

MR. FITZMAURICE: Perfect.

MR. FURUKAWA: This is Jon Furukawa with the NTSB. I'm the group chairman for the survival factors group. We'll go around first in the room over here and introduce our names and affiliations for the transcriber.

MR. WEBB: I'm Paul Webb. I'm U.S. Coast Guard. I'm on the survival factors group.

MR. REICH: Jesse Reich with the NOAA SARSAT program. I'm the ground systems engineer.

MR. FITZMAURICE: Mickey Fitzmaurice, the satellite systems engineer for the NOAA SARSAT program.

MR. FURUKAWA: For the other NOAA people, Chris and Lisa, can you state your names, first name,

last name, and your positions?

MR. O'CONNER: Sure. My name's Christopher O'Conner. I'm the director to the branch chief, and I'm the program manager for the search and rescue satellite-aided tracking system. I represent the U.S. (Inaudible) program as the lead, which helps provide the international satellite-aided search and rescue system.

MR. FURUKAWA: Thank you.

MS. HESSLER: I'm Lisa Hessler, ERT program support to NOAA SARSAT.

MR. FURUKAWA: Patty.

MS. FINSTERBUSCH: Patty Finsterbusch. I'm a member of the survival factors group, and I work with TOTE Services.

MR. FURUKAWA: Doug.

MR. MANSELL: Doug Mansell, NTSB Vehicle Recorders division. I'm the electronic data specialist group chairman for this investigation.

MR. FURUKAWA: Did we miss anybody online? Mickey, do you acknowledge that this interview is being recorded?

MR. FITZMAURICE: Yes, I do.

MR. FURUKAWA: Do you acknowledge that we've discussed the NTSB mandatory briefing items?

MR. FITZMAURICE: I have.

MR. FURUKAWA: Let's go into the interview. Just some general background. How old are you?

MR. FITZMAURICE: Fifty-two years old.

PARTICIPANT: This is on record, Mickey.

MR. FITZMAURICE: I'm 52 and a half.

MR. FURUKAWA: Still younger than me.

MR. FITZMAURICE: I feel older.

MR. FURUKAWA: Can you give us your professional background?

MR. FITZMAURICE: Professional background. I'm an electrical engineer. Did my undergraduate University of Maryland, College Park, 1986, and my graduate school, Johns Hopkins University, applied physics lab, 1990. I worked at NASA in the Space Systems division over there until 1997, and then I came over to NOAA in 1997 to run the polar satellites, the low Earth orbiting environmental satellites. Did that until 2006. I came over to the SARSAT program with the goal to bring MEOSAR (Phonetic), which was a NASA Goddard Space Flight Center research and development program, into NOAA and get a couple of these mid-Earth orbiting search and rescue satellite ground stations built. Of course, we staffed up. We hired Jesse Reich, and he's been a part of this program since, I

think, 2008.

MR. REICH: Nine.

MR. FITZMAURICE: 2009. That's been my job is working with the search and rescue satellite-aided tracking program since 2006 in the satellite systems area, whether it's the satellites -- getting new ones launched into service, evaluating for Chris, at the international level, foreign satellites that are in use, and getting ground stations built with Jesse, obviously. Is that enough detail, or do you want more detail?

MR. FURUKAWA: University of Maryland, that was --

MR. FITZMAURICE: Electrical engineering (Simultaneous speaking).

MR. FURUKAWA: And Hopkins?

MR. FITZMAURICE: At Hopkins, electrical engineering also.

MR. FURUKAWA: Master's, PhD?

MR. FITZMAURICE: Master's.

MR. FURUKAWA: Your professional experience is since 1990, so --

MR. FITZMAURICE: Twenty-six years, and I was a co-op before that. That was at NASA. Since 1984, I've been in the aerospace field with NASA and

NOAA.

MR. FURUKAWA: With that, I'll turn the interview over to Paul.

MR. WEBB: I think I'm going to approach this as I want to start out and get a general explanation of the SARSAT system, and then we'll go from there (Simultaneous speaking).

MR. FITZMAURICE: As the name implies, search and rescue satellite-aided tracking, NOAA has a series of environmental satellites, low-Earth orbiting, which we call LEOs, and geosynchronous Earth orbiting. Those are meteorological satellites that have various instruments on them.

One series of instruments are the search and rescue repeater and search and rescue processors on the LEOs. Then on the geosynchronous satellites, we have search and rescue repeaters. Those have been -- the LEO search and rescue program we call LEOSAR, low-Earth orbiting search and rescue. That's been in operation since 1982. The Russians have been a partner. They had some LEO satellites also.

The geos, we started instrumenting them in the early '90s, with the three axis-stabilized satellites came on board, not the spinners. We did put them on spinners as an experiment, but operationally,

they've been on the -- I think we started with GOES 8 as the first operational geosynchronous Earth orbiting. Those satellites, because they don't have the relative motion to their surface, they just are looking down at the Earth. There's no way to get independent position. You just get detection with the geosynchronous. The key to this system is the low-Earth orbiting satellites. They orbit in a slightly inclined polar orbit, such that when they pass over a distress beacon, just from time tagging or relaying the distress beacon to a ground system if it's in view -- so there's two ways. It can be (Inaudible) to a ground station.

If a ground station's not in view, it gets time tagged and put into a SAR processor in a continuous store and buffer mode, and it constantly transmits on a two or two and a half minute cycle. That program works efficiently, but over the years, I think we now have operational satellites. Those satellites, they orbit the Earth every 100 minutes. They're instantaneous field of view is about 6 percent of the Earth's surface at any one time.

As I said, they orbit on a 100-minute polar orbit, so as the Earth rotates in 100 minutes, you get Earth coverage over the course of the day. Every satellite will cover a spot on the Earth probably four

times a day, each satellite. With five satellites, theoretically, you'll get a hit about 20 times a day. With that said, orbit planes have precessed. We have three distinct orbit planes right now. So we have two satellites in what's called the 9:30 a.m. orbit, and they're out of phase exactly by 50 minutes, but they are tracing out almost the same path. It's slightly off. We have two in an early-morning orbit. We call it the terminator orbit. Those two satellites go in and out of conflict with each other on about an eight-day duty cycle. For about four days, they're flying on top of each other, and four days they're exactly out of phase, out of 15 minutes apart.

Then we have the last NOAA satellite, which is in an afternoon orbit. We use these LEOs, they're our operational system, those LEOs and geos. The report that we produced today -- well, we didn't produce it today -- that we're showing you today, we produced back in mid to late-October, after the El Faro incident -- is on the MEOSAR system, which is a development system that the U.S. Air Force, the U.S. Coast Guard, as our partner, NASA and NOAA have collaboratively said we are going to bring online operationally.

We've been testing, doing a demonstration

and evaluation project. We did a proof of concept from 2006 to just recently, and we went into a demonstration evaluation phase. Probably by the end of this summer, we are going to be, as we presented the other day at the Coast Guard controller's conference -- we'll be comfortable distributing the data that we get through the MEOSAR. That's medium-Earth orbiting search and rescue. Those satellites, as their names imply, are different altitude orbits. The medium-Earth orbiting are about 20,000 kilometers out. The geosynchs are about 34,000 kilometers out. The LEOs are about 850 kilometers up. The advantage of MEOSAR is that you have relative motion to the Earth, so you can use processing. There is a slight Doppler curve.

It's not as distinct as LEO, but it's not as small as geo. There's also the possibility that -- there's the fact that there are more MEO satellites than there are the geos and LEOs, combined. We presently have 18 experimental satellites with an experimental search and rescue payload. I say experimental because we didn't produce the payload. We're using a payload that was supplied for other reasons, but it happens to detect our search and rescue band.

The bandwidth for search and rescue is 406

to 406.1 megahertz. The bandwidth on this particular instrument for us extends out about 80 kilohertz on each side. It's about 270 kilohertz of bandwidth, so there's a noise floor that's a little bit higher with this experimental payload. Chris, you're going to have to correct me if I'm wrong, but I think our first MEOSAR payload will be on GPS, the dedicated one with the 100 kilohertz, the proper bandwidth, will be -- is it GPS Block 3, Spacecraft 11?

MR. O'CONNER: Right, but they don't use the block term anymore, but it's part of the GPS (Inaudible) deployment, and the first spacecraft would be Space Vehicle 11. That's where they do the design turn to add search and rescue and other capabilities.

MR. FITZMAURICE: Right, and that's in 2021 at the earliest?

MR. O'CONNER: No, that's 2022, but stay tuned. Schedule's change.

MR. FITZMAURICE: Yes, that's true. But I just want to emphasize that the MEOSAR satellites and packages we're using now, they weren't designed explicitly for search and rescue, but we have proven them to be able to do search and rescue to some degree, with the higher noise floor, and we've built ground stations to be able to handle both the current

experimental payload and the future SAR payload. That's about as quick as I can go through a program description.

MR. REICH: Can I give a few more things?

PARTICIPANT: Introduce yourself on the --

MR. REICH: I'm sorry; this is Jesse Reich, the ground system engineer -- just a few things that I'm not sure you mentioned, Mickey. The beacons, themselves, some beacons do have the capability of detecting GPS or GNSS signals and locating themselves, in which case they then relay that position through the GEOSAR system or the LEOSAR system. In this case, we didn't have that. We didn't have any code (Phonetic) location, but that is another possibility --

MR. FITZMAURICE: That's a good point.

MR. REICH: -- possible way of detecting the location of a beacon.

MR. WEBB: This is Paul Webb. Can you explain, with the three different satellite systems, how position -- we've got the one for the geos that has to be GPS, but how the signals are turned into positions?

MR. FITZMAURICE: Okay. As Jesse pointed out, the instantaneous field of view from the geosynchronous orbit is approximately 40 percent of the

Earth, but that just tells you that a beacon was detected in the 406 to 406.1 band. If it had encoded information in it, the digital information, of course it would relay that, but that's the only means for position determination through the geo. The LEO satellites have the capability to pick up that same signal, but because of the movement of the satellite, 18,000 miles an hour, approximately, you get a Doppler curve, and you can figure, when you get multiple hits from a beacon -- they're 50 seconds apart, randomized slightly -- you draw out a Doppler curve, and you can figure out your time of closest approach. So you'll get a real position, and you'll get a mirror position on both sides, equidistant, from the time of closest approach. It's a little mathematical formula. We have a presentation we can give you to show you that, that outlines that. We've given it at the UN controller's training, and it shows you that.

That's called Doppler processing. That's independent of any encoded location. We've found, over the years, that getting within a five-kilometer box, that seems to work very well. We've had a lot of success. The problems you have is if you don't have a LEO in view when the beacon's going off, if you only had three or four bursts from a beacon -- like I said,

you have five satellites.

Each one of these LEOs sees 6 percent of the world. You're only looking instantaneously at about 30 percent of the world with these five satellites. If a beacon's going off for a short period, there's a chance you're not going to see it. That's a key point, as you'll see when we go through this report. If LEOs are in view, the system works intrinsically very well. We've seen that. What happens is we draw out that Doppler curve. We get an A and a B position. When another satellite comes in, or if there's encoded position in, we can pick, between the image and the mirror image, which one is the most reliable. We do a percentage whenever we do one because the Earth's rotation gives us another feel. The Earth's rotation, relative speed at the equator's 1,000 miles an hour, and up at 45 degrees, it's only 700 miles an hour, so the Doppler curve of the beacon, you can imagine relative speeds, they're going two different physical speeds. Angular speeds are the same. You can draw a probability to the A and the B solution, but we usually need two LEO passes to definitively resolve where the location is from Doppler processing.

MR. WEBB: What's the average time for LEO passes in a certain area?

MR. FITZMAURICE: Well, at the equator, I think what we've done -- the very worst case is at the equator because you have the maximum separation. I think our wait times at the equator were a little over two hours, if I remember right.

MR. REICH: Maximum, yes.

MR. FITZMAURICE: Yes, maximum.

MR. REICH: If you're lucky, it's a couple minutes (Simultaneous speaking).

MR. FITZMAURICE: Right, yes.

MR. REICH: Maximum, the current constellation (Phonetic) is, I think, a little over two hours.

MR. FITZMAURICE: And it fluctuates, depending on, of course, the orbital precession. Like I told you, we have two satellites that are literally in the same orbit plane, but one orbit plane's drifting. When those two separate sufficiently, we will have a fourth orbit plane. That time will go down. Right now, the worst case is two hours at the equator. At the poles, because everything overlaps at the poles, it's a lot shorter. If it's 40 minutes or 30 minutes on average, like Jesse said, it could be ten minutes. We have multiple ground stations in Alaska. We've had conflicts, where you've had two satellites

flying over Alaska at the same time, so you run into that.

MR. WEBB: How about down in the Caribbean (Simultaneous speaking)?

MR. FITZMAURICE: In the Caribbean, the mid-latitudes, of course, you're going to see -- it's going to be less than that maximum. As you'll see in this report, we actually outlined when we had LEO passes over the incident area. Jesse was able to go in and we plotted the four MEO satellites. We know from geo -- and I'll enunciate better -- when the detections went off. We know when the LEO satellites were in view of that area. This report will walk you through the three constellations. MEO -- it was the last one described in position -- uses multiple satellites receiving a beacon burst from different locations using time of arrival and frequency of arrival because the satellites, of course, are moving in different directions relative to the beacon. So if you use the time of arrival and frequency of arrival of three or more satellites, essentially, you have six knowns, and you're solving for four unknowns, lat, long, altitude and time. So that's what we do. The MEOSAR system relies on multiple satellites in an area. Is that right?

MR. REICH: Yes.

MR. FITZMAURICE: If I say something wrong, correct me. I'm not above it.

MR. REICH: In this report, this is, I guess, a typical possible wait time that you could see? In this case, we saw -- I think Mickey was talking about there was a wait between the different LEOSAR passes. There was actually two. I think you had mentioned before that some of the LEOSAR satellites are in conflict at certain periods. I'm not sure if they were directly in conflict at this time or not, but we had two in a 25-minute period go right overhead, and then not again for another hour and almost 20 minutes.

MR. FITZMAURICE: So they were slightly leading or lagging each other, but they're in the same orbit plane. A typical pass is about 15 minutes. The fact that we see those for 25 and 20 minutes means on those two particular revs, they were flying one right in front of the other. We probably have that somewhere in there. But if you --

MR. REICH: (Inaudible.)

MR. FITZMAURICE: You have the LEO coverage there?

MR. REICH: Should.

MR. FITZMAURICE: That's MEO, right?

MR. REICH: It's LEO coverage. Right here, you can see (Inaudible) for some reason.

MR. FITZMAURICE: The green boxes, those are MEO satellites, right?

MR. REICH: (Inaudible) sorry, you're right, those are.

MR. FITZMAURICE: Yes. The circles, the red circles that you see, that's a LEO footprint.

MR. REICH: The times that we just gave you before there, the 10 --

MR. FITZMAURICE: 10:22 to 10:47, you're at 10:31 here.

MR. REICH: (Inaudible) so you can see the time up here. That's where we got the 10:22. As Mickey said, there's a NOAA 18 just went directly overhead, a NOAA 15 directly overhead.

MR. FITZMAURICE: Now, that's important, too. Because when they go directly overhead, the image and the mirror image are very close to each other. So now it gets a little bit tougher because you can't use the separation -- the eight degrees inclination. You can't use the rotation of the Earth to give you a waiting factor. You would really need a second satellite, from a different orbit plane, to confirm which one of those two positions were derived. Because

those two are going to come up with almost identical A and B solutions, so you're going to be kind of stuck.

MR. WEBB: (Simultaneous speaking) between the A and B (Simultaneous speaking)?

MR. FITZMAURICE: In this particular case, I don't know. We'll have to look at the date. I didn't memorize it.

MR. WEBB: (Simultaneous speaking) they only had the unlocated (Simultaneous speaking)?

MR. FITZMAURICE: Right. The burst --

MR. REICH: Based on our detections, the beacon was not going off at this time.

MR. FITZMAURICE: Right.

MR. REICH: So we weren't able to --

(Simultaneous speaking.)

MR. FITZMAURICE: So there wouldn't have been anything during this period.

MR. WEBB: Right. So the beacon went over about 1000 to 1030?

MR. FITZMAURICE: No, the satellites flew over from 1022 to 1047, and that's what you're seeing there, and then they don't come around again. He can run the simulation and show you when the next time it came over. Then --

MR. O'CONNER: Mickey, guys, this is Chris

O'Conner. If you look at the document -- just look at Table 3. I think that explains it well. You can see the period of time that we believe the beacon was transmitting, and then on either side of that, you can see the periods of time that satellites were in view of that area. I think that's probably the best way to show it.

PARTICIPANT: One went to the right, one went (Simultaneous speaking) we missed it, but as Chris was saying here, in the document, Table --

MR. FITZMAURICE: Table 3. There you go. You see the satellites were in view there, and then the next orbit.

PARTICIPANT: That's what we just looked --

MR. FITZMAURICE: From the GOES satellite, when we got detections, that's in the green. That's really the best chart.

MR. REICH: The data that we actually did detect is in here (Simultaneous speaking).

MR. FITZMAURICE: This is from two different satellites. This was from the GOES E satellite at 75 degrees west longitude, and the GOES west satellite at 135 west longitude. We had two different satellites that picked up distress beacons at that time. We're highly confident -- you see the one picked it up,

started at 11:35, and it looks like the next one picked theirs up at 11:36, about a minute later. One of them got a burst in. The geometry was better. As the ship's moving around and the antenna pattern moves around, if you think of a donut, I'm guessing just the radiation pattern -- you're trying to look from zero to about 60 degrees.

MR. REICH: They both got 13 bursts that they received and decoded properly over the course of approximately 22 to 24 minutes.

MR. FITZMAURICE: We empirically look at this and say this is the transmit time. If this is what GOES saw, now we can work our way back. We say was there a LEO in view, a LEO satellite, low-Earth orbiter? The answer, as you saw from the chart and Jesse's simulation was there was no LEO. That gets us through the first part of our synopsis of the operational system. Then we said let's go to the demonstration evaluation system that's on the test, which is the MEOSAR.

PARTICIPANT: I'm not sure (Simultaneous speaking).

MR. O'CONNER: Hey, Mickey?

MR. FITZMAURICE: Yes, sir.

MR. O'CONNER: This is Chris O'Conner again.

As we go into and start looking at the experimental MEOSAR data, I just want to make sure we're clear that this is experimental. This data is not going out operationally.

MR. FITZMAURICE: It's not being monitored.

MR. O'CONNER: This data is completely separate from our operational system, so it requires some type of manual intervention to actually go and do this. This is a post analysis.

PARTICIPANT: Yes, thanks.

MR. WEBB: Before we go into that, can you explain, for the record, how this information gets to the Coast Guard?

MR. FITZMAURICE: How it would get to the Coast Guard?

MR. WEBB: Right, how did the unlocated report -- how does that get pumped out to the Coast Guard?

MR. O'CONNER: The two stationary unlocated alerts (Simultaneous speaking).

MR. FITZMAURICE: Oh, the operational system, how does that get --

(Simultaneous speaking.)

MR. FITZMAURICE: The LEO and geo, that gets routed out to -- especially unlocated goes out to the

RCCs, the Coast Guard RCC and the Air Force RCC (Simultaneous speaking).

MR. O'CONNER: Mickey, this is Chris again. I think we should take a step back. The geostationary, the data gets received by GOES East and GOES West, and then the data comes down to Suitland, Maryland, where we have our two stationary antennas. Then that data goes directly into the U.S. Mission Control Center. The data is then processed. They pull out the beacon ID. They check for registration. If there's registration information that's dependent to the beacon ID, since it's geostationary and there was no encoded location from GPS or GNSS chip, then the beacon ID, along with any registration information, would then be sent to the Air Force and the Coast Guard. Because we don't have any location --

MR. FITZMAURICE: Automatically.

MR. O'CONNER: -- so it would send it to both rescue centers because we don't really know where in the western hemisphere it's going off. Now, I think they could identify some information by registration, based on it's an (Inaudible), so there's a home port. That sometimes would help direct the location of where it goes. If we need more information specifically on MCC processing and how this was actually distributed,

who got this alert first, we should probably go back and engage the contractor that manages the MCC because they would have more specifics.

MR. WEBB: I just wanted to clearly say how does it get from the satellite to the Coast Guard (Simultaneous speaking).

MR. FITZMAURICE: Right. It's an automated process once the detection occurs.

MR. WEBB: What's the length of time it takes from detection to arrival at an RCC?

MR. REICH: Two minutes.

MR. FITZMAURICE: Yes, it's less than five.

MR. REICH: In this case, it was two minutes. We can track when we sent the messages out, and it was two minutes.

MR. WEBB: Okay.

PARTICIPANT: RCC is?

MR. FITZMAURICE: Rescue coordination center. We're sorry.

MR. REICH: Sorry, the two minutes was actually the incorrect one.

MR. FITZMAURICE: I thought it was less than five.

MR. REICH: It's less than five (Simultaneous speaking).

MR. FITZMAURICE: It's always less than five. It's automated. But like Chris alluded to, the MCC does a lot of automated processes. When you get this unlocated alert, it looks into the registration database and says, "Do I have something? Oh, that's the El Faro. You know what? When we send it to the Coast Guard and the Air Force, the Air Force will look at it and say it's a cargo ship." "Coast Guard, what do you do?"

They start calling and say, "Oh, yes, that sailed three days ago from Jacksonville," or whatever. I don't remember the details. But that would get handled at the RCC level as hey, we got an unlocated alert, and someone will say, "It left Jacksonville this day or that day." "Well, we got the rescue beacon through the system." As you can see on this timeline, Table 5, which is on Page 7, and it's up on the screen -- forgot we're on WebEx -- that blue is the operational system.

MR. REICH: That's, I believe, all that was (Simultaneous speaking).

MR. FITZMAURICE: It was sent to Coast Guard District 7, and that's probably because the home port was Jacksonville, right? I'm guessing. I don't know the particulars. I would get the MCC staff in here to

answer the logic. It's a highly automated process. The work that you see here is, for post-forensic work, done (Inaudible) look and mesh it in with what would have happened operationally if we were distributing data from the MEO system. That's really what this report does.

MR. REICH: We do have some of the output messages of what exactly was sent to the Coast Guard at the time. You can see here -- and we can help you decode this if you want to, but as Mickey said, it was sent to District 7, the satellite that we detected it from, the time that it was detected.

MR. FITZMAURICE: The detection frequency, frequency of arrival.

MR. REICH: To answer your question from earlier, it was 11:36 was when we see the first alert at the MCC, which is almost exactly when it was sent by the beacon receiving (Inaudible) level, and then it was sent out within -- I thought I saw three minutes here, and 11:39 was when the message was sent.

MR. FITZMAURICE: But you see down below, "Beacon registration database information," if you slide down just a little, Jesse, a few lines. It tells you SeaStar line, limited liability corporation (Inaudible). There's an email contact to tell you who

they are, the phone numbers. That all comes out automated in the message, just out of the registration database.

MR. REICH: (Simultaneous speaking) beacon registration, it's appended to the message that's sent to the rescue coordination center.

MR. FITZMAURICE: This all happens at the MCC level. Once we detect it through the satellite, down to the ground, this is what comes out of the MCC to the Coast Guard or to the Air Force. That distinction is mostly based on is it an unlocated alert, it goes to both, if it's a maritime, it goes to the Coast Guard. If it's terrestrial, it goes to the Air Force.

MR. REICH: You can see the home port (Simultaneous speaking).

MR. WEBB: (Simultaneous speaking) satellite to mission control to RCC?

MR. FITZMAURICE: Yes. I have --

MR. REICH: There's one other hop in there. It's the local user terminals, the LEO LUTs, the geo LUTs, the MEO LUTs. Eventually, they are the ones that actually receive it from the satellite, and then send the data to the mission control center here at (Inaudible).

MR. FITZMAURICE: These ground stations that we have, these low-Earth orbiting local user terminals, we call them LUTs, L-U-T-S, so LEO L-U-T-S. That's low-Earth orbiting local user terminals. We have two -- an antenna on the roof -- two small ones, but one of them's a LEO LUT.

We have three larger antennas. Those are geo LUTs, geosynchronous Earth orbiting local user terminals. We have three geo LUTs here, one LEO LUT. But in Guam we have two LEO LUTs. In Hawaii we have two LEO LUTs, in Alaska two LEO LUTs, in California two LEO LUTs, and in Miami, Florida, two LEO LUTs. We have them spread out throughout the U.S. area of responsibility for search and rescue.

That's been the historical operational assets of the program. As Jesse said, they track the satellites, and they get the relay of the distress signal down to the ground. In the case of the LEOs, if a LEO is not in view of a ground station, it has that instrument I was telling you called the SARP (Phonetic) instrument. If you're flying over the South Pacific and there's no ground stations in view, it's like a TiVo. It's recording. It records a time of arrival and a frequency of arrival, and it puts it in a buffer, a continuously dumping buffer. Then when the satellite

comes into view of the Hawaii ground station, the LEO LUT, it dumps down that digital stream and says, "Hey, since the last time I saw you, here's two -- I'm dumping the whole memory in about two and a half minutes."

The LEO LUT says, "I've got all that data from before, but hey, this is all new," and it goes and processes Doppler locations, sends them to the MCC, and says, "Hey, I've got some new stuff." So you get real time -- anything that happens in real time supersedes anything stored. So the stored data stream's coming down, if a real-time event goes off, it'll pause, send down the real-time event, and then it continues dumping the stored data, we call it.

That's how the LEO -- you can ensure if a beacon's going off for more than an hour-hour and a half, pretty much, it's in a couple satellites, easily. If it's in view of GOES, it's not blocked, because the position of a GOES satellite, a geosynchronous -- if you're in a maritime environment and you're going up and down waves and your antenna pattern's moving, there's a chance you might not hit the GOES West satellite, but you might hit the GOES East satellite, and vice versa. Same thing when we're terrestrial, inside the Grand Canyon, down low, or in the Rockies,

you could be on one side. Whereas, a LEO comes over, it changes position.

MR. REICH: It might be worth noting there, when you mentioned that, I said they both had 13 bursts. They weren't the same exact burst. To me, speculating, that indicates heavy rocking because it'll get to one, and then it'll get to the other one; it'll get to one. So the fact that they're not receiving all of the exact identical burst, to me, implies some kind of a motion like that.

MR. FITZMAURICE: No, I agree. I saw that.

PARTICIPANT: You mentioned something earlier about that.

MR. FITZMAURICE: I knew they weren't the same exact because the start times on the two weren't the same. I'm imagining the radiation pattern from the antenna being like a donut going out, a big donut. Then I imagine the waves tilting that donut. You say, "All right, did I hit the two satellites?" If you turn on your side, now you might not even get a LEO. A LEO could be down low on the horizon, but because your radiation pattern's straight up and down, you're looking at 60 degrees in the keyhole because you're sideways. We've seen that on terrestrial crashes, not so much in the maritime environment, but I'm not saying

it couldn't happen. In general, that's how a distress case gets up to the satellite, down to a local user terminal, either a LEO or geo, get shipped from those remotely to the USMCC, where it gets processed against the registration database. It gets processed against a set of rules, if it's quality, if it's been validated.

You can imagine if you got a beacon down here and it had enough errors in it, doesn't meet in the registration, and it doesn't have a location, you're like is that just noise? What is that? It's not a valid beacon. It doesn't have a location. Is it an interferer? We have a separate process that we look for interferers, anybody that's radiating. There's a lot of quality checks. We have error correction. The beacons have a concatenated code, a BCH code that they use for error correction.

I think we can detect and correct up to three errors, so that's another advantage of the system. We can have three errors, they get corrected by the LUT on the ground. It says, "You had an error here, here and here. That's Jon's EPIRB, or that's Paul's ELT. You'll be able to correct those errors. That's how the system gets the detection to the rescue coordination center, the RCCs.

MR. WEBB: Let's talk about the MEOSAR and

the project in general and where it's at today, and then we'll go into what you guys found in the --

MR. FITZMAURICE: I'll try and bring you up to speed. In 2004, NASA, working with the Air Force research lab, said, "We have these instruments on our satellites that if you looked at them properly, there's a way to process location for search and rescue worldwide," because of the coverage of the GPS satellites.

There's 24 satellites in a constellation. You're sitting here now; there's probably seven to nine satellites in view. Your GPS receiver in your phone is looking at those, picking the best three or four, telling you exactly where you are right now. That research and development project, they built a four-antenna system over at NASA Goddard Space Flight Center. It's called the SAR lab, search and rescue laboratory.

I came on board in 2006. The joint program, which NOAA manages -- Chris is the manager -- they said, "We would like to build a couple of these and get those tested out, demonstrated, and then consider them working towards operational." Because the number of satellites is highly advantageous, in view of the low-Earth orbiters we have in orbit now are aged. So

we built these two ground stations, one in Hawaii, on the island of Oahu, just north of the town of Wahiawa, and it's on the NCTAMS, the Naval Communications Telecommunications Area Master Station. I think I said that right. Good luck to the stenographer -- NCTAMS. The other one was built on the U.S. Coast Guard COMSTA, communication station, Miami. It's about 10 or 12 miles due west of (Simultaneous speaking) southwest of South Beach.

It's right next to the Miami zoo, if you're looking for it on Google Maps. You'll see the com station. It's well defined. Those are two six-antenna systems. Those LEO systems I told you about, those are two LEO antennas per site. They're individual channels. A MEO LUT, a medium-Earth orbiting local user terminal, it has six independent channels tracking six different satellites simultaneously.

For operational purposes, we need four of those six to be operating to be considered a MEO LUT, to be able to get accurate positions. If you get down less than that, you're relying on the geometry of the satellites and everything else. Operationally, we say four antennas working, you have an operational MEO LUT, and it can stand alone and work by itself. With that said, we have these two systems, they have six

antennas. That's built for operational reliability, to ensure that at least four are always working over the course of the year, but our goal, of course, is to have maximum up time of six antennas working as much as possible.

MR. REICH: It's important to mention that it's not operational yet. We've mentioned that. It was also, I think, around the testing that we've been doing. Mickey said some of the antennas were down (Simultaneous speaking).

MR. FITZMAURICE: Yes, for maintenance and for other cross checks. At the time, since we're not an operational system, we're just testing it out, we're calibrating different things. We're looking at test beacons. We have a series of test beacons we're turning on and off around the country. We say, "All right, we know exactly where that is. Tell us how we're doing. All right, let's analyze. We got this position. We were off by seven kilometers. How come we were off by seven? Oh, it's because our scheduling algorithm picked these satellites."

You have something called dilution of precision. You would like all six antennas to be working, but if you don't, what's the impacts of five antennas working, four antennas working, three? We're

doing tests to do that. That's the demonstration evaluation part because we want to know what is our coverage area? I'm sitting here in Miami, Florida, and then 5,000 miles away, in Hawaii, I've got another system. What is my coverage area? They overlap. I've seen cases off the coast of Florida and the Hawaii MEO LUT got just as accurate a position as the Florida MEO LUT. I want to know why that is. I could drive to the Florida site, and Hawaii's 5,000 miles away, yet they were using similar satellites, and they calculated the position the same.

Like has been pointed out, this experimental system went through proof of concept with the NASA Goddard. We built two stations here. We've watched as the satellite population with the experimental SAR payload has increased, to now it's 18, soon to be 19. We launched one a few weeks ago, I think February 6, and it's still under test, but we'll be up to 19 MEOSAR satellites.

With 19 satellites with this capability, we can track 12 of them in the United States, our two systems. We have partners in other countries that we're working with. They have these MEO LUTs. Brazil was just in here. They have six or eight antennas. I don't remember. They're in the process of building.

Argentina, New Zealand just built a six-antenna system. The goal is we demonstrate on a standalone basis how well we do, and then we start networking. So now, with enough networking, if we can track every satellite in the sky, we pretty much have instantaneous global coverage with MEOSAR. That's the goal of the program is to get to that point. The Russians, the French, the Canadians, and the U.S. are the four charter members of the international CASPUS (Phonetic) SARSAT program. CASPUS is the Russian acronym for SARSAT.

MR. REICH: Do you want to mention how we're working towards getting to the initial operating capability now because of a (Inaudible) (Simultaneous speaking).

MR. FITZMAURICE: Chris O'Conner has been the lead for this. We're doing something called early operational capability. What normally happens is when you get a new system up, you go to IOC, initial operating capability. But there's an inherent risk because our LEOSAR satellites are aging so fast. The last LEOSAR that we launched with a SAR capability was NOAA 19, which we call SARSAT 12, S12. That was in 2009. That satellite is already seven years old. These satellites, when we bought them, the U.S. government -- NOAA asked NASA to build them, buy them,

launch them. They built them under spec for three years, with the expectation of five years, and we've seen inherently, nine years is easy. We get nine years. With that said, the five satellites we have on orbit now, SARSAT 7, which is NOAA 15 -- it has two monikers. The meteorological number is NOAA 15. The SARSAT number is 7. That was launched in May of 1998. Then the next working satellite asset is SARSAT 10, which is known by NOAA 18. That was launched in 2004. The next one was launched by our partners in the European Union, European Commission.

It's called METOP A. We call that SARSAT 11. That was launched in 2006. It took them a while to calibrate it. Then we launched our last NOAA satellite in 2009. That was NOAA 19. That's SARSAT 12. Then the Europeans came back and launched METOP B. They launched that in 2012. That's the last LEO satellite that was launched. Because that satellite is coming up on its -- I think it was built for a five to seven-year operational lifetime, the Europeans did, but you need three to four orbits to have a successful LEO constellation.

Because of the risk, the aging of these satellites, the U.S., led by Chris, has gone to the international community and said, "We need to bring

MEOSAR up, even the experimental, and our European partners are launching Galileo satellites with a dedicated" -- Galileo is the European GPS constellation. They're launching satellites with a dedicated search and rescue package on them. I think they're up to -- they have four satellites on orbit, but they're about to launch four this year, Chris?

MR. O'CONNER: Yes, this is Chris O'Conner. I think they have five satellites on orbit, and I think they're going to put up four this year.

MR. FITZMAURICE: The issue is to come online and start trying to use the MEOSAR data now, to mitigate the risk of the LEOs aging out and having to be decommissioned. We're already having trouble with SARSAT 10, not from a SARSAT perspective, but from an operational perspective, the satellite, in terms of maintaining pointing and power balance and control, so as a risk mitigation, bringing MEOSAR online. Did you want to say something, Chris?

MR. O'CONNER: Yes, I just wanted to talk a bit about (Inaudible). This is Chris O'Conner again. What we've learned so far from the testing is that there are some advantages to the experiment (Inaudible) system, in terms of if you use latency to detect a beacon, the location is as good, in many cases, as the

LEO and geo, the operational systems, so the international community decided to move forward with the early operational use of the experimental system, what they're calling early operational capability, EOC. From a national perspective, NOAA will put in all the possible -- all the ground segment capabilities to make the MEOSAR data available. Probably by the end of the summer, we'll have the right (Inaudible) equipment, but it will be up to the Coast Guard and Air Force to develop the proper policies and procedures for using the EOC data, MEOSAR data. I don't know yet how they plan to use the data, whether they're going to use it in conjunction with operational LEO/geo data, whether they want to keep that data slightly separate and look at it as an alternative. We have to wait and let our customers decide how they're going to put their policies in place.

MR. FITZMAURICE: That's all factual. Did that get you to where we are in MEOSAR and why we're trying to get to using it operationally?

MR. WEBB: Yes, I think so. Let's go into what you guys found on the El Faro.

MR. FITZMAURICE: The best part is the executive summary, we have everything else that we've kind of danced around. This outlines the fact that we

did receive transmissions from the El Faro. The time period, on October 1st, that we received them, from between 11:35 and 11:59 Z. That's outlined in the table that we showed you a little later in the document. Jesse mentioned that the EPIRB, the emergency position radio indicating beacon -- EPIRB is spelled wrong. We've got to change that acronym to EPIRB, so position indicating radio beacon. How did we not catch that after five months, four months? I don't know. It did not have a GNSS encoded location, as we mentioned, but we did get the reception through the GEOSAR system. We also pointed out that due to probably the radiation pattern of the antenna, we didn't get the same transmissions through the GOES East and West satellites.

Some of them did line up, but we got the same number through both. During this particular time period, where we saw through the geo, we did look, and there were no LEO satellites in view, even close in view, at that time, of that area. So that LEO system would've given us a Doppler -- an independent location just on radio transmission, alone.

Because we didn't have that geometry at that time, or just the luck of being in the area, we weren't able to get a location from the LEO system. So then we

point out that the developmental MEOSAR system, we did detect the EPIRB within four minutes. So we have a timeline that we'll allude to, and we'll show you all the hits that the MEO system received, whether it was the Hawaii MEO LUT, or the Florida MEO LUT. But we want to point out, again, it's a developmental system. It wasn't operational. We took antennas offline. We didn't have the two MEO LUTs networked. We were doing other things. But this is the data we got through that system.

MR. REICH: It's also worth noting that we didn't -- in fact, we still don't really have, at the time, a MEO LUT MTC (Phonetic) that's capable of automating (Simultaneous speaking).

MR. FITZMAURICE: Shipping them out to somebody. It would require -- yes, in the operational environment, we would have an automated MEOSAR taking in and shipping them out, but we didn't even have a person monitoring. We have an 8:00 to 5:00, come in here, work. We're in the developmental phase, Monday through Friday. We're doing tests this weekend, but it's not something --

MR. WEBB: When the data -- no matter what --

MR. FITZMAURICE: Came through the system.

MR. WEBB: -- came through, and to this day, it just gets put into a file or a buffer --

MR. FITZMAURICE: That's right.

MR. WEBB: -- and then when you guys come in, you analyze it --

MR. FITZMAURICE: We analyze it.

MR. WEBB: -- check that against the LEOs and the (Simultaneous speaking).

MR. FITZMAURICE: I did that just this morning. We had a case in Nome, Alaska. I asked our engineering staff (Inaudible) I want to see what Hawaii got and Florida got for that particular site. We do that every day.

PARTICIPANT: (Simultaneous speaking.)

MR. FITZMAURICE: We have it, but it's just not distributed anywhere. We just look. I'll say, "All right, I know all six antennas were up yesterday when that occurred, so let's go and look at performance." Nome, Alaska's a certain distance from Hawaii, certain distance from Florida. I've got the report. I know exactly where it was. I can check my accuracy of the system. I'm building that case so that when we get to this EOC, early operational capability, when it's automated, it sends it out, it applies something called a quality factor that gives a

confidence that when you receive this alert, you're like, "Oh, they're very confident. They know exactly where that is." That's the stage we were. We were just doing that.

MR. REICH: I would say bottom line is we didn't, at the time, and we still don't really have the ability to use this data operationally. It's not hooked up. It's not designed (Simultaneous speaking).

MR. FITZMAURICE: Yes, we don't expect to have that capability until probably late July or August of this year.

MR. FURUKAWA: This is Jon Furukawa. You're building that MCC (Simultaneous speaking)?

MR. FITZMAURICE: Yes, the MEO Mission Control Center, yes. Then we go through and we talk about how we analyze this. We danced around all this, but we had other ancillary data provided to us -- of course, the automatic identification system, the AIS, and then you had the ship security alert system.

We call it the SSAS, even though it's S-S-A-S. We got positions from those from ancillary data from the Coast Guard, our partners. The Coast Guard and the Air Force, as I mentioned, are one-third operational and financial support of the program. This is a joint program. Even though NOAA manages it, the

Air Force and Coast Guard provide essentially a third of the operating cost.

NASA is the research and development arm. They don't put money into the program, but they get money from the program to go off and do research and development. That's more of the -- that's up at Chris's level. The Coast Guard gives us this data as part of an incident history database. Now we go through in the summary of the data. This was well put together. We've seen this. We talk about the various mission control centers that you would deliver this to in the western hemisphere.

MR. REICH: In fact, they actually provide us the same data (Inaudible) international system. If you see something that's of relevance to another mission control center, you send it to them.

MR. FITZMAURICE: Right. It's unlocated alert, but it was a U.S. beacon, so anybody that gets it around the world says, "Hey, do you all know this is going on? We don't know where it is, either, but it's one of yours."

MR. REICH: Likewise, if there was a location that was in U.S. waters, they would send it to us, just as we would for them if it was something in their waters.

MR. FITZMAURICE: That's part of the rules of the SARSAT program.

MR. WEBB: Did they?

MR. FITZMAURICE: Yes.

MR. REICH: They sent us the same -- essentially the same alert that we had (Simultaneous speaking).

MR. FITZMAURICE: The unlocated alert. Nobody got a location, but everybody said, "Hey, there's an alert of one of your beacons going off. Do you know about it?" essentially.

MR. WEBB: Argentina, Brazil, Spain, Chile, Canada (Simultaneous speaking).

MR. REICH: Yes, they were all looking at the same GOES West and GOES East satellites.

MR. FITZMAURICE: Yes, same data.

MR. REICH: And saw the same things.

MR. FITZMAURICE: We saw it, so it was a, "Yes, thank you, we saw it, too." But there are times maybe they do see something we don't, or if they get a beacon in their area, if they know it's in our area, but it's registered somewhere else and we didn't get it, they'll ship it. They'll say, "Hey, we saw something in your area of responsibility. Did you see this?" I like to think we always yes, but I'm sure

there's cases where they've shipped (Inaudible). The first table you're looking at here is the GOES East data.

MR. O'CONNER: Hold on, Mickey. This is Chris O'Conner. (Inaudible) about speculating on that. It's all automated, the process you're talking about of alerts coming from within the (Inaudible) Brazil is detecting something from a geostationary satellite, and there has not been something already alerted in the system, they send that to the U.S. MCC, and we process it, and we send it off to the Coast Guard or the Air Force. There's no decision making. There's no discussion (Simultaneous speaking) on that, just to be clear.

MR. FITZMAURICE: Yes. No, thanks, you're right. That's a valid point. All the decision making's built into the logic. If we got it, that's fine. It's probably already been sent. If we didn't get it, it processes it, it sends it out to the RCC. Thanks, Chris, yes, sorry about that.

MR. REICH: You'll probably hear us talk about, over the next little bit here, that we put it all together -- all the data that we receive on one beacon ID (Inaudible) what we call a site, just to compile data (Inaudible) we know to look up or process

data is all built in that one site that's created.

MR. FITZMAURICE: If you look at those times, you'll see some of them line up, some of them don't.

MR. REICH: Actually, I think, in looking through this, one of the clocks was off a little bit, so after this, I raised the ticket that they needed to adjust the clocks. Doesn't really affect too much of the data, except that you have to -- if you wanted to see exactly which ones lined up, you'd have to put an offset in there. I looked through it previously, and they don't exactly line up. The bursts, like I said earlier, are kind of alternating in some ways.

MR. FITZMAURICE: The key point is this is two different satellites and two different ground stations. That's the data they received.

MR. WEBB: We don't receive -- and this is an actual question because I don't know the answer. The Coast Guard, we don't receive, actually, the number of bursts for unlocated? We don't see that?

MR. FITZMAURICE: No, I don't think you do.

MR. REICH: No, not the number of bursts. We'll provide certain updates for unlocated if it remains unlocated for a long enough time. We'll notify it's still going off. We'll provide things like the

location. Obviously, if we got a location, we'd say, "Here's the location." (Simultaneous speaking.)

MR. FITZMAURICE: If the Doppler came into view, right.

MR. REICH: If the location was confirmed, like Mickey said, the ambiguity resolution -- we have a whole document of what type of messages we would provide.

MR. FITZMAURICE: You wouldn't be bombarded. The RCCs wouldn't be bombarded with all 13 bursts. "Hey, we got a burst. We got another burst." You wouldn't get that.

PARTICIPANT: (Simultaneous speaking.)

MR. FITZMAURICE: Yes.

MR. REICH: The messages that we provide are more (Simultaneous speaking).

MR. FITZMAURICE: We're going to get to that. You're going to see the messages that we're going to send out.

MR. FURUKAWA: FYI, we've got 45 more minutes for the conference call.

MR. FITZMAURICE: Then we talked about the LEOSAR system. During the time period that the GOES satellites were detecting distress signals, the LEOs, we told you, were in view of that area from 10:22 to

10:47. It was two satellites almost flying in formation. Then they didn't come around again until approximately 100 minutes later, at 12:04 to 12:24. Those two satellites I've identified. We've spelled them out. We used their meteorological moniker of NOAA 15 and NOAA 18, that would be SARSAT 7 and SARSAT 10.

Then we summarized, on a bar graph here, when the LEOs were in view, when we think everything was transmitting. I think the bottom one, to the bottom right, that's METOP A. That was another satellite. Just the fact that they're in different orbit planes, so they cover the area at different times of the day. I'm sure if you expanded that chart out, there'd be another line right over where Jesse's got his mouse cursor. So then we get to these developmental MEO LUTs. I've told you about those, Hawaii and Florida. The Florida MEO LUT, obviously these -- we're doing testing, but the Florida MEO LUT, we had three of the six antennas offline for maintenance and correction. We had offset some tracking issues. We were getting them checked out. That's not a normal configuration, and that would not be considered operational.

If -- and that's a big if -- if we were operational, it would be a major event that we would

have three antennas offline. But in the case of this, it wasn't a big deal for us. We're doing experimental testing. Hawaii, at the time, was working. We went -- after the fact, of course, went back and looked on the LUTs and said, "What did you get for this beacon ID that we saw through the GOES system?"

We noticed that from 11:36, through two of the three antennas in Florida, and then at two of the six antennas in Hawaii, they were tracking different satellites, and they all got bursts. There is essentially four satellites that received the burst. If -- and this is a big if, again -- if we were in an operational scenario and we had the MCC up and running, and we had four antennas tracking satellites that had co-visibility, we'll call it, of the beacon event and a ground station, we would've probably produced an accurate location within five kilometers. That's probably the most effective thing I'll say, probably. We didn't go back and push the data together.

MR. REICH: That's the performance goal that we're aiming towards. All this developmental testing is trying to prove out that we can meet that (Simultaneous speaking).

MR. FITZMAURICE: Instantaneous single burst within five kilometers.

MR. FURUKAWA: Five kilometers is the accuracy --

MR. FITZMAURICE: With one burst, one single burst, we want to be able to get to that.

MR. REICH: That's a lot of what the testing, the (Inaudible) testing is trying to prove out.

MR. FITZMAURICE: Because now, the LEO system requires at least three just to get a curve. You need three bursts. Sometimes you might not get three bursts. You may only get one. So the goal is global coverage, single burst, within five kilometers. Then we go on and we say all right, we had some partners out there. We talk about we were in standalone mode. It turns out that the EC had a MEO LUT in Cyprus -- Chris, you were in Cyprus. Is that a four channel or a six channel? I think it's a four-channel MEO LUT in Cyprus.

MR. O'CONNER: Yes, Chris O'Conner. Yes, it's a four-antenna site, so all the (Inaudible).

MR. FITZMAURICE: That's right, they're all four. Thank you. I'm just making sure. We go and look in our developmental MEO MCC, and we notice we got some hits, not enough to make a location from Florida, not enough to make a location from Hawaii, by

themselves, but the Cyprus MEO LUT had all four channels up, and it produced a location.

I go on to note that the El Faro incident appeared to be 900 miles from the Florida MEO LUT, and that the position -- we don't know the position to use as a reference, but the position that we were provided by the NMARSAT (Phonetic) SSAS beacon, we were 17 nautical miles away. The dilution of precision for the satellites that were used was nine.

You can reasonably estimate that if either the Florida or Hawaii antennas had been networked together, we would've got probably a better dilution of precision. The higher that number, the worse -- the error bar increases. If you get a Doppler of two or one, it's considered a very good location, and your confidence factor goes way up in quality. There's a statement. Now, on a map -- Jesse was nice enough to go and take all that and put it on a map.

MR. REICH: We've produced multiple solutions from the MEO LUTs, so these are all the different solutions. I guess there's the first one. I don't see the second one. Oh, the second one was from Hawaii. You can see how we're all kind of around this area.

MR. WEBB: What's the area between all of

those positions?

(Simultaneous speaking.)

MR. FITZMAURICE: From one side to the other?

MR. REICH: This is 17 miles (Simultaneous speaking).

MR. FITZMAURICE: Seventeen nautical miles.

MR. REICH: (Simultaneous speaking) Position 1 to the far right there.

PARTICIPANT: (Inaudible.)

MR. REICH: I think I noted here (Simultaneous speaking).

MR. FITZMAURICE: There was a life raft. But that position we put in there, we don't know how accurate that is. That's the problem with this analysis -- with any analysis. Unless you have real ground truth, you don't really know. I think if we went back now -- I don't know how, when a boat goes underwater, how far the glide path is. It doesn't sink straight down, I wouldn't think. I don't know. I'm not an expert by any means. To know exactly where the El Faro is, in relation to these positions, at that time, I don't know.

MR. REICH: I've looked at the news reports since, obviously, they located the wreckage, to try to

put it on this, but I haven't been able to find the exact location. If you'd like, we can go and refine and say (Simultaneous speaking).

MR. FITZMAURICE: If you all, in your study, have a report, we can put in the report you found the ship, and if you have some expert expertise that tells you what -- maybe the glide and the sinking pattern -- because once it goes underwater, you're just at the mercy of the currents and the glide pattern, right? I don't know. I'm not an expert. But again, this is the positions provided by the various --

PARTICIPANT: These are some of the international positions (Inaudible).

MR. FITZMAURICE: Right. You look up there in yellow is the Florida MEO LUT. In red, you had the --

MR. REICH: Cyprus -- oh, I'm sorry, the red (Inaudible).

MR. FITZMAURICE: Red is Hawaii. The two green were the Larnaca, which is in Cyprus.

MR. REICH: These are the Cyprus MEO LUTs that they provided.

MR. FITZMAURICE: And the time. You see the times, 11:39, 11:43. If 11:36 is agreed that was the first transmission, within three minutes, we had a

location. How good was it? That's still up for debate, and it's still up for the geometry of satellites.

MR. O'CONNER: Hey, Mickey, this is Chris O'Conner. Yesterday, we (Inaudible) presentation, and they were talking about some of the MEOSAR activities that they're working on. One of the things they're looking at is making correction of biases, like group delay. I think there was time delay on the ground side. We don't do any of those bias corrections right now, right (Simultaneous speaking)?

MR. FITZMAURICE: That's correct. The only thing that gets corrected that we do at the LUTs are reference beacons, co-located reference beacons. We will calibrate on the ground, but that's a distinct effort that we periodically check to see how long the delays are if it comes through Antenna 6 versus Antenna 1.

You take all your antennas, you put them up on one satellite, and then you measure the same signal coming down. There's six antennas in a hexagonal array. You calibrate. You say, "All right, I'm fine. I'm within a couple microseconds or a couple nanoseconds," whatever it is. You get a bias. The group delay on the satellite is different for every

satellite, and that has to be calibrated.

MR. O'CONNER: Then there's also a delay on the ground, right, depending on where the antenna is, the length of the fiber cable that takes it back to the rack. Isn't there some time (Inaudible)? I'm just going, again, by the (Inaudible) study, which I'm looking at. We haven't been able to implement any of those (Inaudible).

PARTICIPANT: This is just raw data without the corrections.

MR. FITZMAURICE: Well, yes.

MR. FURUKAWA: Eventually, you want to get down to five kilometers in accuracy, and right now, it doesn't.

MR. FITZMAURICE: That's right. Because we haven't calibrated -- if we took data in from Cyprus, we don't know what the delays are on their side. We just know you gave us a couple measurements. All right, those measurements, unless we calibrate your data -- if you send data to us -- I know my Florida MEO LUT by itself. I know my Hawaiian MEO LUT by itself. If I try to share data between the two -- and we're working on that, also -- you want to be able to calibrate. You want to know what the group delay is of each satellite -- because there's an intrinsic delay,

when the distress beacon gets to the satellite, how long it takes to get out of the satellite and back down, depending on frequency. If it's at the 025 channel, the 028 channel, the 031, the 034, whatever channel it is, is the delay the same through the instrument? That's the whole group delay. You measure it; you characterize it; you hope it's small; and you hope there's some spec, but it's not a SARSAT designed instrument, so we don't have those numbers.

We have to empirically figure that out, and that all factors in to our error bar. But again, I iterate we don't know, at these times -- obviously, they're in a line. Somewhere on that line was the actual El Faro transmission. This next picture, this shows you the coverage area of the MEO satellites. Where you see green means that those areas were covered by three satellites, and I have them labeled here. I gave the PRN number, the pseudo random number that's generated from each satellite. We put a three in front of them to designate that they are MEO satellites.

MR. REICH: You should mention these are only the satellites that we were actually able to track at the time, due to the fact that three of the antennas were down, and the Florida -- there were actually more satellites in view, but (Simultaneous speaking).

MR. FITZMAURICE: But these are the four that are mentioned in this report. Jesse, I asked him if he would go and show me of those four, what was their coverage area? What would you expect? You would expect if you had four satellites and you were computing a location -- you had four satellites over the El Faro at this particular time. This is at 11:30 on October 1st. Now, look how it changes. This is at 11:45.

You still have the same kind of coverage area, and you can see the areas where you only had three of these four satellites, but the El Faro's still on there. Then a little bit later, you see here's at 12:00, noon. You only had three satellites in view. One of them's gone. It shows you how over time, there is other issues here. Like Jesse alluded to, if we had more antennas up and we were tracking more satellites, this would be a non-issue for the MEO system, also.

Here's the hits we got. If we calculated the latitude and the longitude, you see that listed, and then you see, in the last column, a quality factor. Those quality factors in green, we've seen experimentally those are pretty good. The yellows, I've seen them good and bad. I've seen an 850 come in and it's not very good, and I've seen an 850 come in

and be within a kilometer. But it's all based on the DOP, the dilution of precision column, and some other factors.

MR. REICH: It's important to note here that as Mickey said earlier about the networking, we didn't have networking on, so these are only -- in this case here, Hawaii generated a solution probably on the same -- sorry, different (Inaudible). But had networking been on, these three-point solutions could be six-point solutions, in which case your DOP goes down, your quality factor goes up, and your location is --

MR. FITZMAURICE: It's more refined.

MR. REICH: Yes. Those are the type of cases where you're definitely getting (Inaudible) you're getting much better solutions.

MR. FITZMAURICE: As the title of the table alludes to, this is what would've come into the MCC automated, and then been shipped out.

MR. REICH: This is actually what did come in.

MR. FITZMAURICE: That's what I said. This came -- I'm saying if we were operational, this came in to the experimental MCC. This is what would've got shipped out to some level to the RCCs, right?

MR. REICH: Yes.

(Simultaneous speaking.)

MR. FITZMAURICE: Actually, that -- I'm sorry. This is Table 5. This is what would've been shipped out. That came into the experimental. This is when you put the filter in. He put in when the geo came in, in relation to -- but I don't see the time. Did we drop -- oh, there it is. The MEO actually was essentially a minute ahead of the geo. The Florida MEO detected a minute before the geo system, or at least it sent out the message, I should say. I shouldn't say it like that. I need to correct that.

This is the messages that would've gone out -- if we were an operational entity, this is how they would've gone out. The MEO would've been first by about a minute, then the geo, and then you see these MEO solutions. Now, we got a calculated position. You see the quality factor. Then you see a second one go out. It says it's a blown no compare. That means the first one, when I compared it to the second one, they weren't close enough to each other at that latitude and longitude.

So then the Cyprus comes in. It has a location. You say, "Well, I'm comparing it to the other ones." This is all happening automated. It says, "It doesn't compare. It doesn't compare." Then

you come down to 11:50, the second to last one, and the Florida MEO LUT generates first computed DOA, Florida MEO, quality factor of 847. There you go. You've got a location. Then the next line, Hawaii comes up and gives you one. It's not very good, either that or we dropped a decimal or something because the latitude's way off. Even though the quality factor's 911, that's a bad position. That's why it's still experimental. Until we have answers on that kind of stuff, we don't want to ship stuff out like that. In conclusion, we summarize it here. This is an experimental system.

There's a lot of intrinsic value in the data that we get through it. There are some questions that we think would cause problems in an operational environment that we need to resolve before we go operational, but to date, we're seeing very positive signs on this system going forward. We think with enough MEO satellites and enough MEO ground systems, we will be able to achieve our goal in the future of getting a single burst solution within five kilometers. We're not there yet. As you saw in the data, we still have some questions to be answered. Chris has alluded to them. Jesse's alluded to them.

MR. REICH: But operationally, we did -- sorry, we detected the beacon. We were not able to

locate it, just based on all the things we talked about with the timing of the LEOs going overhead.

MR. FITZMAURICE: And the operational system.

PARTICIPANT: That's on the LEO and the geo?

MR. FITZMAURICE: Yes, but the MEO was able to get eight locations. Now, the accuracy of that location is still up in the air because we don't know what we're comparing our location to. Our best locations that we got, we don't know what we're comparing them to. We plotted them. That's all we can do. I don't think Chris (Inaudible) I don't think there was any issues. This is all just what we got.

MR. REICH: I would just say that this report was put together, I believe, for the Coast Guard, for our Coast Guard --

MR. FITZMAURICE: Partners.

MR. REICH: -- yes. We basically were trying to, at the time, make the case that we can go to early operational capability, and here's some of the data that you could expect (Inaudible).

PARTICIPANT: Who did you send the report to?

MR. FITZMAURICE: [redacted] (Phonetic) and Captain [redacted]

(Simultaneous speaking.)

PARTICIPANT: So CGSAR got --

MR. FITZMAURICE: Yes. They're our operational partners, Captain [redacted] and Lieutenant Commander [redacted] (Phonetic).

MR. REICH: That's why you see a little bit of the MEOSAR system being put in there, as a comparison to what was in the operational (Inaudible). Everything else is more of a supplement, just to put it all there. (Simultaneous speaking) messages to the MTC, the output messages, which we looked at earlier, to the RCCs, and we don't need to go through all of them because it's a lot of data that (Simultaneous speaking) decoder ring to --

MR. FITZMAURICE: But this is all automated stuff, general operation stuff.

PARTICIPANT: (Inaudible.)

MR. FURUKAWA: Doug, you have any questions for Mickey? Thank you for being patient.

MR. MANSELL: Yes, Doug Mansell with NTSB. I think I have some (Inaudible), but I just want to confirm real quickly. With the current operational system, do the automated messages sent to the rescue coordination centers only indicate the first alert or burst?

MR. FITZMAURICE: The word only scares me. We get an alert in, and the first alert will get sent out. Then if there's any information that adds to that first alert, that would get sent out, too. It's all automated by a decision tree. An unlocated alert comes in, if some ancillary information comes in that's better -- if location -- I'm trying to think of what else --

MR. REICH: Updates to location, if we have a second source -- if we had a --

MR. FITZMAURICE: A LEO did come into view.

MR. REICH: Yes. If we had a GPS location, we would've sent that, and then we got a LEO coming into view that confirms that position, we would send a position confirmation.

MR. FITZMAURICE: But if you keep getting the same unlocated alert, the answer's no, I think it would be filtered here. It'll be kept in a buffer; it doesn't get eliminated, but it just says, "I'm not going to pound you with 13 straight bursts over a half hour."

MR. MANSELL: Okay. So unlocated alerts, no additional information is pushed automatically to the rescue coordination centers (Simultaneous speaking) so long as it remains unlocated?

MR. REICH: No, if it's still going off, I believe we will provide --

MR. FITZMAURICE: Every 20 minutes.

MR. REICH: (Simultaneous speaking) 20 minutes, I believe.

MR. O'CONNER: Can I clarify something?

MR. FITZMAURICE: Yes, go ahead, Chris.

MR. O'CONNER: This is Chris O'Conner here. Once we have an unlocated alert, and we don't have any registration information or any actionable information, we do not send that message. That message does not go out.

MR. FITZMAURICE: That's right.

MR. O'CONNER: That's not because NOAA doesn't want to send it. It's because the Coast Guard and Air Force have told us they do not want to receive alert messages --

PARTICIPANT: There's nothing they can do with that.

MR. O'CONNER: -- unless there's some type of actionable information on there. In this case, we had an unlocated alert, but we had registration information, so it did get sent.

MR. FITZMAURICE: Okay, but then to get back to his question, when he said only, the answer to your

question is if we keep getting the same unlocated alert from a registered beacon, I think the answer is we will send you the first one. We keep getting alerts, 20 minutes later -- as long as that beacon's going off, we'll send you another alert to let you know it's still going off, but it doesn't give you any added information, other than it's still going off. Wherever it's going off, it's still active. Every 20 minutes, you'll get an update automatically, but unless something changes -- unless a LEO comes into view, or unless the encoded location gets put in there, you won't get any more updates. You'll just get the standard, "It's still going off."

(Simultaneous speaking.)

MR. MANSELL: So in this incident, approximately 20 minutes later, was a follow-on automated notification provided to the RCC?

MR. FITZMAURICE: I'd have to go and look at the appendix here.

MR. REICH: I don't believe so. I think the timing -- I can't remember if it's 20 or 30 minutes. I think it might be 30 minutes that it would actually be updated.

MR. FITZMAURICE: I think if the LEO -- because the LEO pass, at the most, is 15 minutes. I

might be getting the two mixed up.

MR. REICH: I believe there's also a site -- after we don't receive data for, I think it's four hours, we provide a site closure message, as well, which I don't believe is in here, but we would've provided that, as well. (Simultaneous speaking.)

MR. FITZMAURICE: I'll look for that, Doug. If this thing went off, if it didn't send out a message in 20 -- if the line in the sand's 30 minutes, we did not have 30 minutes' worth of transmissions on the GOES, so --

PARTICIPANT: (Simultaneous speaking) 24.

MR. FITZMAURICE: It was 24. I'm tending to agree with Jesse. I think on the geo, it might be 30 minutes, not 20. I have no problems being corrected on that.

MR. O'CONNER: This is Chris again. Like we said earlier, we don't have (Inaudible), so we're really just prepared to just talk about the experimental data we have and the LUT data. We could find out more information if you want to have a complete (Simultaneous speaking).

MR. FITZMAURICE: Yes, but it's well documented. We can pull out the document. Before you leave, I can go over here, pull out the document that

shows --

MR. O'CONNER: So Chris again. You'll just have to tell us, though, if you really want us to take that extra data mining step there to pull out a complete list of what messages were sent. Right now, this information here just provides you that first information, as well as the registration information that's in there.

(Simultaneous speaking.)

MR. MANSELL: Doug Mansell, still. For unlocated alerts, say it had exceeded the threshold to send a follow up, 30 minutes or whatever that time duration is, in that follow-up message, is the (Inaudible) of the bursts included in that communication to the RCC (Simultaneous speaking) count?

MR. REICH: I don't believe we provide the number of bursts at all. We boiled it down to -- in the geo, we don't provide any indication of the quality of the alerts. As Mickey said earlier, we have the error detection and correction, so we know that we trust that beacon ID. On the LEO side, we do a similar thing to the quality factor that we provided them of an (Inaudible) ellipse of where we think the beacon's located.

MR. MANSELL: Perhaps my last question here

today, thank you, is in your report, I see that you cite some AIS and MRSAT (Phonetic) timing position data that you're comparing. How do you receive the AIS and MRSAT data?

MR. FITZMAURICE: That was in a post-test analysis from the Coast Guard incident history database. That was given to us in -- I guess it's the IHDB. Is that what we call it?

MR. REICH: Yes, but I thought that was -- was that the IHDB? I thought that was just provided to us by [redacted]

MR. FITZMAURICE: I think [redacted] but I think they appended it. I think if we go in the IHDB you'll see it, because I think that's where we got it from.

MR. O'CONNER: So the key there is we don't normally get that data operationally.

MR. FITZMAURICE: We're shipping data out (Simultaneous speaking).

MR. O'CONNER: In this case we got it for the post analysis (Inaudible) Coast Guard provided us the location from the SAT beacon. I don't know if they provided us anything else.

MR. FITZMAURICE: If you can understand, Doug, what we're trying to do is find a location to see how good our MEOs were doing. Even though they were at

limited capacity and they're not operational, we're trying to do a comparison for a confidence factor of our own. We wanted any locations we could get for where the El Faro actually was.

MR. MANSELL: Right. That's understood and appreciated. The reason I ask is I see, perhaps, some discrepancies between the positions and time stamps that you're citing, compared to the sources that I have received from the Coast Guard nav center and other sources. I'm just trying to see what the source of the information provided for you to compare is, compared to what (Simultaneous speaking).

MR. FITZMAURICE: We try and use UTC time on everything.

MR. MANSELL: Understood.

MR. FITZMAURICE: One thing I have noticed, whenever we do forensics, a lot of times I look at -- when people append times, you make sure they're using the same time and they have accounted. If it's local time and they put it down as military time, and it's local, you're saying, "Is that UTC? Is it local? Did they account for Daylight Savings Time or Standard Time?" I don't know what you see, but I know when we went and scoured this pretty good, we were trying to line up where the LEOs were in relation to transmit

times.

MR. O'CONNER: Mickey?

MR. FITZMAURICE: Yes.

MR. O'CONNER: I'm sorry to interrupt you (Inaudible) Doug's point, since we didn't originate the data, if there's any discrepancy between the data that Doug's been looking at and what the Coast Guard provided us, it's probably best for now if the Coast Guard SAR (Inaudible) discrepancy was.

MR. FITZMAURICE: That's where I was going. I was going to say I was pretty confident in our correlation of times.

MR. O'CONNER: Oh, right. I was just thinking seeing an entire list of all of the KIS data that was reported and provided to us during this investigation, the actual point that's referenced in this report that we're reviewing isn't actually one of the points that was provided by U.S. Coast Guard Center.

MR. REICH: Honestly, I think the AIS I might have pulled right off of live -- there's an AIS tracking website that I might have just looked up the El Faro and gotten that last position and a time from it.

MR. MANSELL: That would be good to know.

MR. O'CONNER: Jesse, can you double check that, please?

MR. REICH: I definitely did that. I'm not sure -- you said it was the AIS one that there was a discrepancy?

MR. MANSELL: Yes, let me -- sorry -- go back to this. Yes, in the scope of analysis there on Page 1, I believe, the AIS reported, at 0401 Zulu --

MR. FITZMAURICE: 0401 Zulu?

MR. MANSELL: Yes, right there in that second paragraph, scope of analysis, the report cites at 24.275 --

MR. FITZMAURICE: Yes, I see it.

MR. MANSELL: That point, I don't believe, is a point that was actually recorded in the raw AIS data, according to historical AIS data recorded from Coast Guard NAVCEN. I'm not sure where the source of that (Simultaneous speaking).

MR. FITZMAURICE: Yes. No, let's go look at that. I thought it was out of the IHDB provided to us from the Coast Guard.

MR. MANSELL: Then similarly, from the records that I've obtained, I think there's a discrepancy with that MRSAT position, as well.

MR. REICH: This might be where I got it

from. I basically just looked it up on one of these vessel finders or AIS tracking.

MR. FITZMAURICE: Okay, so it wasn't --

MR. REICH: (Inaudible.) That was not a piece of information that was provided from the Coast Guard, itself.

MR. MANSELL: Okay. Thank you.

MR. REICH: (Inaudible.) I can look (Simultaneous speaking).

MR. MANSELL: I have no further questions. Thank you very much.

MR. O'CONNER: I'm sorry; this is Chris O'Conner. Jesse, if we're going to use this document at all going forward, we need to update it, make sure it reflects precisely where the data came from.

MR. FITZMAURICE: Right.

MR. REICH: Okay.

MR. O'CONNER: We probably want to recheck, then, what you pulled (Simultaneous speaking).

MR. FITZMAURICE: Would you highlight that?

MR. O'CONNER: I don't know if it's practical, if the NTSB's interested, if we're updating this sheet, if we want to use something that's more official, in terms of locations, you could substitute -- just work with what's been reported.

PARTICIPANT: (Inaudible.)

MR. O'CONNER: That's up to the NTSB. I don't know how they want to proceed.

PARTICIPANT: If we had better positions, we could certainly put them in the analysis (Inaudible).

MR. FITZMAURICE: If we just cite the source of that in that statement, according to the last reported position. That time, that's way outside the window of detection (Inaudible).

MR. FURUKAWA: I think Doug has our most accurate positions and times, right, Doug?

MR. MANSELL: I'm sorry; what was that?

MR. FURUKAWA: You have the most accurate positions and times for the NTSB, correct?

MR. MANSELL: I'm accumulating them, yes.

MR. FITZMAURICE: Would it be possible to send them to us?

MR. FURUKAWA: Doug?

MR. MANSELL: It can be provided at some point. Right now, I'm still encountering additional reports and some discrepancies, so I don't have a final tally. I still have what I'm calling a preliminary collection of all the sources of position and timing data. But certainly, it will become public. Hopefully even before then, I should be able to share that with

certain entities.

MR. O'CONNER: This is Chris O'Conner. I'm thinking if we're going to provide data, then, to the NTSB, we should probably just stick to the data that we own, and not speculate on the AIS position or anything else, just provide the geostationary located information and the experimental MEOSAR locations we have. Then they can do the comparison once they have a finalized track. I don't want to provide any data that's not been validated. I don't want to do that.

MR. REICH: The only reason I think we used that previously was just to try to get an idea for where it was, so we could gauge our own accuracy.

MR. O'CONNER: I understand completely, Jesse (Simultaneous speaking) doing a little self-analysis and trying to share that with our customers, the Coast Guard. But for the NTSB investigation, I wouldn't want to provide any locations that we don't have -- that we can validate and know. The other thing we really control is the geo and the MEOSAR data.

MR. REICH: Understood, okay.

MR. FITZMAURICE: Is that good for you, Doug?

MR. MANSELL: Yes, that sounds great. I

look forward to it. I'll be able to provide that data at some point for your internal comparison analyses to help improve your product.

MR. FURUKAWA: Any more questions for them, Doug?

MR. MANSELL: No more questions for me.

MR. FURUKAWA: Okay, Patty.

MR. O'CONNER: Before you move on, this is Chris again. I have to drop off. I have another call at this time. I wasn't sure how long this would go. Just for your reporting and the record, I'll drop off now. I guess if Mickey and Jesse want to answer a few more questions, that should be fine, just let me know when you guys are done, okay?

MR. FITZMAURICE: Okay. Thanks, Chris.

(Simultaneous speaking.)

MR. O'CONNER: Bye.

MR. REICH: I think I found the marine traffic where I got that data from, the AIS.

MR. FURUKAWA: Patty, do you have any questions for Mickey?

MS. FINSTERBUSCH: I do have one or two questions, I guess. When the whole incident was happening, we were notified at some point that they had gotten an EPIRB hit. It sounded like it was just a

single hit, which made us think, at the time, that maybe they just pushed the test button on the EPIRB, but they hadn't set it off completely. How do you guys -- if someone's testing the EPIRB, what happens -- what do you know?

MR. FITZMAURICE: The self-test mode comes out with an inverted frame sync. The geo LUTs will -- in the raw data, the geo LUTs, it will keep it, but it will not send it --

MR. REICH: No, it won't keep it.

MR. FITZMAURICE: It won't keep it?

MR. REICH: We can configure it to keep it. Our test system does keep that. But if it's a self-test, we essentially ignore it.

MR. FITZMAURICE: So in the raw data -- so there you go. The answer is when you send self-tests, the frame sync is inverted. That's how we know it's a self-test, and not an actual beacon.

MR. REICH: It will never get relayed to the rescue (Simultaneous speaking).

MR. FITZMAURICE: It doesn't get sent out, "Uh-oh, Paul Webb turned on his -- he self-tested his beacon."

MR. REICH: At the LUT level, it basically ignores it.

MR. FITZMAURICE: But I know in the MEO system, we keep those. We have that raw data. I will now go look. If you think that they turn it on in that mode, I'll go back and look. We'll look for the -- because we do keep that on the MEO.

(Simultaneous speaking.)

MR. REICH: The rescue coordination center would have been trained that they aren't getting any test data in that respect.

MR. FITZMAURICE: Right, they know (Simultaneous speaking).

MR. REICH: If they're getting the data from us, it's not a test. It's an operational burst.

MR. FITZMAURICE: Is that speculative, or is that fact that there is --

(Simultaneous speaking.)

MR. FITZMAURICE: I will go look. I was under the impression that our -- I'll have to go check with Goddard because Goddard Space Flight Center, up the road, they have a geo LUT. I think they keep all the self-tests. I think they're configured to keep raw data, if we're not operationally. We don't do anything with it. We just get it in, and we look at them and say -- because you're looking at 40 percent of the world instantaneously, so you can imagine how many

people in that 40 percent footprint --

MR. REICH: From the dataset you had there, you know that (Simultaneous speaking).

MR. FITZMAURICE: Those are all legit --

MR. REICH: -- that beacon was sending data bursts for 24 minutes.

MR. FITZMAURICE: Actual data bursts.

MR. REICH: So it was outside, in view of the satellites, not inside the pilot house, for 24 minutes.

MR. FITZMAURICE: Right. During those 24 minutes, we were getting transmissions that were validated, went through all the cross checks, passed all the validation checks, and said this is a real beacon. This is really going off. There's no errors. We know -- go look up the registration. Obviously, it was a registered beacon. A self-test comes in. It goes through the same processing, but it's a self-test beacon. If you configure the LUTs, you said, "Do I really care? Do I want to send this to the MCC?" Sometimes, you keep them at the LUTs. We're doing that in the MEO systems. I can go check. I can go look at -- after today, I will take that beacon ID and I will go and I'll look for the self-test burst to see if that's indeed a fact.

MR. REICH: (Simultaneous speaking.)

MR. FITZMAURICE: I thought that actually what she was asking. She said she speculated that there was a possible single self-test --

MR. REICH: I think she said they were notified a single burst, and they thought it might have been a self-test.

MS. FINSTERBUSCH: We were led to believe that it was possibly a self-test, and that it was just a single burst that was all that was ever -- that they told us about. We kept trying to figure out if it was just a single burst, what did they do? Did they take this EPIRB off the outside of the ship, bring it inside? Is that why we didn't get any more EPIRBs? I'm finding the fact that there were all these other bursts as really new information. It tells me more than I knew before (Simultaneous speaking).

PARTICIPANT: The Coast Guard only receives the unlocated report. They don't receive a report saying that there were 13 bursts within that one unlocated. The Coast Guard Command Center is only receiving that unlocated report during that period of time that it was active. Then it receives a report that it was no longer an active beacon.

MR. FITZMAURICE: Right, which is four or

five hours later. I can't remember what the --

PARTICIPANT: That's all they know. The watch standers in the Command Center, they get the unlocated. Then normally what happens is you get the LEO hits within the next hour.

MR. REICH: We set up our rescue coordination centers. What they've asked for is that essentially, they want actionable type of information. If it's still unlocated, nothing's changed, don't really provide (Inaudible).

MR. FURUKAWA: This is Jon Furukawa, NTSB. Like Patty was saying, if it was unlocated for 30 minutes, then a second message would following saying (Simultaneous speaking).

MR. FITZMAURICE: Saying it's still going off.

MR. FURUKAWA: But since it stopped at 24 minutes, there was no follow up (Simultaneous speaking).

MR. FITZMAURICE: We'll verify that (Inaudible). When we walk out of this room, I will walk over and I will get the person to answer the question.

MR. REICH: But I do see here, we did actually send messages (Simultaneous speaking). We

have what's called a missed pass. When we look back at that LEO timeline here, we know, based on -- how would we have known that? I guess we know it's a missed pass -- oh, on the geo level, that we haven't seen it for a certain amount of time, so we'll let you know that is a missed pass. Normally, we refer to -- when we have a location, we'll know (Simultaneous speaking) it's going to go over the top of it at a certain time. If we don't get any data, that's considered a missed pass. On the geo side, if we know we haven't received data any longer, therefore that's a missed pass.

PARTICIPANT: Or a signal cease. It's not really a missed pass.

MR. REICH: Right, it's (Simultaneous speaking).

MR. FITZMAURICE: It's just terminology, but (Simultaneous speaking). No, it's important, but it's important to know what we call a missed pass means -- in the geo side, you don't change your field of view. You're still looking at the same area. You're looking at the same antenna, and nothing's changing. In a LEO, that thing's going through the sky in --

PARTICIPANT: (Inaudible.)

MR. FITZMAURICE: So the definition of missed pass is different for the two constellations.

The ancillary data in here tells you everything that went out from this control center.

MR. FURUKAWA: Patty?

MS. FINSTERBUSCH: The good information I got out of that is that it was definitely an active ping. If it had been a test, we never would have seen it, so that answers my question.

MR. FURUKAWA: (Inaudible) when they grabbed it out of the -- because we only got that one message, we're all kind of speculating is that when you're getting ready to abandon ship, what we normally do is the second mate will go out and grab the EPIRB and bring it into the bridge and wait over there until you go to the life boats. So we kind of thought that's probably the second mate grabbing it, and then went to the bridge and maybe couldn't get the --

PARTICIPANT: (Simultaneous speaking.)

MR. FURUKAWA: -- right, it shielded it from another satellite. So this is all very good new information that it was --

MR. REICH: (Simultaneous speaking) possible because don't know why (Inaudible).

MR. FURUKAWA: But it was 24 minutes --

(Simultaneous speaking.)

MR. FITZMAURICE: All I know, from our

perspective, is we saw it for 24 minutes. We saw it for that period of time on the geo system, and we saw it in the MEO system from a European LUT in Cyprus, the Florida MEO LUT, and Hawaii, three different -- tracking different satellites.

PARTICIPANT: If it had floated free, you would still have seen it, even if it was on the water's surface.

MR. FITZMAURICE: Just the -- yes. We had enough satellites in view, and we had enough different ground stations tracking the different satellites, so we're highly -- we've corroborated that it was active in the MEO system and in the geo system, and they line up. The fact that the LEOs weren't there, and then the LEOs didn't see it any other time, and neither did the MEO and geos, we're highly confident it was transmitting at this period, not outside.

MR. REICH: So it had either ceased, somebody had either turned it off, it had been damaged, it had gone underwater -- something would have had to happen. If it was floating along, it's still active, we would have gotten it (Simultaneous speaking).

MR. FURUKAWA: But you can't tell if it was inside a bridge?

MR. FITZMAURICE: No. You can only --

(Simultaneous speaking.)

MR. FITZMAURICE: It's binary. It's one and zero. If we got it, we know that the radiation pattern was such that we could do hypothetical geometries and say, "We think your ship was here, and it was in this orientation. You should have seen the GOES East satellite. You should have seen the GOES West. You should have seen this MEO satellite, No. 319, 323. You should have seen this satellites, and this is why you missed it on this satellite, because you were probably oriented--" We can go through the hypothetical forensics.

PARTICIPANT: (Inaudible.)

MR. MANSELL: This is Doug Mansell. I have one more follow-up question. Several minutes ago, I believe someone made a statement that the EPIRB would not have been detected within the pilot house. Is that a true statement, or it still could be detected (Simultaneous speaking).

MR. FITZMAURICE: It depends on the composition of the pilot house. If it's a Faraday cage, you can imagine it's going to severely attenuate the radiation pattern. If you have a metal pilot house and you're sitting in there, the only way you're going to get out is through the glass window, and even then,

you've got a metal loop around there. At 406, you'll get some signal out, but I don't know. I don't know enough about the El Faro. I don't know enough about the radiation pattern to tell you.

I will tell you we just ran a test on the U.S. NOAA ship Ron Brown. Our NOAA corps (Phonetic) officer took a PLB, which isn't even as robust as an EPIRB, put it on the front of the boat. I have fields of view, but looking to the back, 45 foot, he's got the ship housing behind him. I know our MEO satellite performance, whenever it was behind the boat, was terrible. Because he had a block up to 45 degrees. So unless the satellite was between 45 and 60 degrees elevation, we didn't get the burst when the ship was in a certain orientation.

I have the satellites -- Jesse's looked at them; I've looked at them. We do know that there are blockages depending on where you are on the ship. There's a good chance they were in cover somewhere, I'm guessing, in that kind of storm. Because I had a guy -- and I had blockages on a ship, and I had a nice, sunny day. I've got pictures. I had blockages to the rear of the boat.

MR. REICH: We can't tell for sure.

MR. FITZMAURICE: No. There's no way for us

to tell from what we got.

MR. FURUKAWA: From those 26 hits, you can't tell if they're -- if it was continuous for 24 minutes, or if there were -- you got it for a few minutes, and then there was a blockage, a few minutes, a blockage?

MR. REICH: The beacon itself has a (Inaudible) pattern of about 50 seconds, so --

MR. FITZMAURICE: Every 50 seconds, a half-second burst.

MR. REICH: Yes, so we couldn't tell if it was down for 30 seconds because it wouldn't have hit that other burst. Every 50 seconds, it sends off a burst.

MR. FURUKAWA: Every 50 second burst?

MR. REICH: Yes, that's correct. Every 50 seconds, it sends off a half-second burst.

MR. FITZMAURICE: Right, and it's randomized, so it's not -- once it starts, it's not 50 seconds. Next time, it might be 47 and a half, next time after that, 52 and a half. They do that on purpose so that when you have everybody going overboard, if we're all on the same channel, eventually our bursts won't align. The first burst may align because they all get wet, or they all get turned on at the same time. But they're randomized -- they're built

to do this in the spec.

MR. REICH: We could look to see exactly -- we could try to pin down exactly -- because we have the data from the geos, we also have the data from the MEOs -- and try to see if we can account for every single burst. That's another layer of (Simultaneous speaking) that we try to do.

MR. FITZMAURICE: So if you want us to do that, we can go and do that.

MR. REICH: I would say it's pretty well -- with those 13 and being a little staggered, and it went off for 24 minutes, so with the 50 seconds, you're probably talking about 30 total bursts that you want to see or expect to see in that time period. It seemed like there was a large percentage of bursts that got through.

MR. FURUKAWA: That would mean if it was floating, it was out in the open, or maybe it was --

MR. FITZMAURICE: Blocked.

MR. FURUKAWA: -- blocked in the house?

MR. FITZMAURICE: Inside the house, either one.

MR. REICH: We could try to do a burst --

MR. FITZMAURICE: We could do a burst on it, yes, because we know first burst, last burst. We say,

"All right, we know every 50 seconds it went off," but you don't know the orientation of it. But we could go and do that on it, line them up, and we could do the same thing on the MEO side and kind of co-align, say, "This burst was received by all three satellites, this one was received by seven satellites." We could go through and do that and, like Jesse said, for 20 minutes, you got 1,200 seconds. You divide by 50. I don't know, what is that, 60 --

MR. REICH: (Inaudible) 30 bursts or something.

MR. FITZMAURICE: Yes.

MR. FURUKAWA: Doug, this is Jon. Does that sound good? Doug?

MR. MANSELL: Yes, Doug Mansell, NTSB. That would be nice to see the results of that audit, but I think if were just -- like you said, if we were just provided the first and last burst, or, I guess, a time stamp with each of the bursts that was detected, I think that would -- you wouldn't necessarily need to do that analysis (Simultaneous speaking).

MR. FITZMAURICE: Not in the detail you want. If you want every single burst that was received, we go to the LUTs, and we get the bursts that those messages were made from.

MR. REICH: We had every burst on the geo system in here. These are all individual bursts. What we could do is we could go to the MEO level. Because right here, we're only providing the -- did I already skip it?

MR. FITZMAURICE: It's right there.

MR. REICH: Each one of these is an actual location (Inaudible) location. You can see this one here is only one burst. However, this is three. So we could see --

MR. FITZMAURICE: Any time we got three, it tries to make a position, as you see. Number of satellites, when the number of satellites is three, it tries to make a position. If it's less than three, it doesn't even try.

MR. REICH: But going with the 50 seconds, here you can see it's about 50 seconds from this burst to this burst. That looks like it's about a minute and 40 seconds, so that looks like we missed the burst at 11:37. We can go through that and try to pin down exactly which bursts (Simultaneous speaking).

MR. FITZMAURICE: If it's supposed to be every 50 seconds, and it's randomized, if we get to 100 seconds --

MR. MANSELL: So this table we're looking at

here, that identifies the 13 bursts from each of them, so --

MR. FITZMAURICE: No, this is different. This is the MEOs.

MR. MANSELL: Understood.

MR. FITZMAURICE: The table above this one identified the burst that we received from the geo, the geosynchronous. This is the positions that were caught by the MEO LUTs, the one in Florida, and the one in Hawaii, acting alone. So the first two, if you look in the left-hand column, they give you the LUT ID, and they tell you one's Florida, one's Hawaii. They detected that burst together. Then the next burst, 50 seconds later, they got that one, but that was a foreign LUT, which was Cyprus, and Florida. Then, oh, it looks like Hawaii got it, too. So the second burst they all got. The next one, it looks like only Cyprus got it, that 11:38:26. That looks like there was a missed burst by everybody in there at 11:37:50, I guess. Was that right? Yes.

MR. REICH: Thirty.

MR. FITZMAURICE: Thirty, yes, going the other way, right? Yes.

MR. REICH: We'll go through and try to (Simultaneous speaking).

MR. FITZMAURICE: Yes, and annotate. We can tell you the MEO system, that's the first burst it got. That's the last burst Hawaii got. We can tell you what satellites it came through because it was three satellites. We've got that raw data, so we can account for bursts and be fairly confident in the timing of those bursts. That's another advantage of the MEO system because you have more than one satellite.

Like Jesse said, if the clocks get skewed a little bit on our geo LUTs, we're going to go back and figure out what the bias was, but we'll line up those 13 bursts, and it shouldn't be too hard to go back and figure out because we have a test beacon going off, so we know -- we can easily shift those and say the test beacon shows this through the GOES West, and this through the GOES East. Oh, we had an offset of a quarter of a second, so we'll go line up those 13 bursts. There you go. There's the MEO burst, and they tell you what LUTs we got it through.

PARTICIPANT: Okay, great.

MR. FURUKAWA: Doug, anything else?

MR. MANSELL: On Tables 1 and 2, they have the GOES bursts. You mentioned the time on that, that's the transmission time from the satellite to the LUT, or is it the LUT recording time?

MR. FITZMAURICE: That's the receive time at the LUT, on the ground. Those two LUTs happen to be here at Suitland, Maryland, right on top of this building. My point to anybody -- and Jesse, you can back me up on this -- is that receive time, we'd have to go and look and adjust and make sure -- because if you look at the times, they don't really line up anywhere. I look at the --

MR. REICH: This is the best example, here (Inaudible) at 11:58:46 and 11:58:29. That should never happen because they should be received within probably a couple milliseconds of each other -- either milliseconds or 50-second increments. The fact that they're off by approximately 17 seconds means it's off either 17 seconds or 33 seconds.

MR. FITZMAURICE: Thirty-three seconds, one of the two. We have a reference beacon that we go and look at, and we'd adjust those clocks and say -- if you're trying to get down to the second and figure out which bursts were the same and which ones are different, that's not hard for us to go back and do after the fact. When we wrote this report, we didn't know, but it's easy to do. It's not (Simultaneous speaking).

MR. REICH: It's actually -- like I said,

this brought up the instance or -- it made me aware of the fact that they weren't in sync when they should have been.

MR. FITZMAURICE: That's our operational system.

MR. MANSELL: Do the GOES satellites record the received time stamps? Because I understand you're reporting, in this summary, the received at the LUT. Do you have the data of when it received at the GOES satellite, east or west?

MR. FITZMAURICE: No. You could calculate it, but no, we don't do that.

MR. MANSELL: Okay, they don't transmit that or record that?

MR. FITZMAURICE: There's no need to because you're not trying to triangulate a position off the GOES. Jesse, that's one of his pet projects. He's been saying for years he'd love to do an experiment to see (Simultaneous speaking) multiple GOES satellites, then you would have to work your way back up to the satellite.

Here, we're just telling you when we got it at the LUT, so you're relying on the LUT clock. Then you say, "I got an alert." If they're within 25 seconds of each other, it doesn't really bother us,

because we're not doing anything other than relaying information. Timing in the geo LUT world is not as critical. Jesse being the stickler he is, he wants to get those two lined up, and we do talk about this, but it doesn't have any effect. Until we go and do an audit and tell you which bursts were received by both satellites, you could probably go back and kind of guess at an antenna pattern moving around. If you saw a burst through the east satellite, and you didn't see it through the west, or vice versa, you could probably guess at one. But with 13 bursts, you can't really -- over 20 minutes, 24 minutes -- but those are -- like I said, those are actual bursts received. There's no test code. Those are all live bursts from that beacon. But I'll go look at the inverted frame sync for that week and see if there was one in the MEO system. Because if it's going to show up, that's where it would show up.

PARTICIPANT: (Inaudible) questions?

MR. FURUKAWA: Doug? Did we get dropped offline?

MR. REICH: Did we bore him to sleep?

(Simultaneous speaking.)

MR. FURUKAWA: Patty? Doug? I think we --

MR. MANSELL: I'm still here.

MR. FURUKAWA: Oh, okay. Any more questions, Doug?

MR. MANSELL: No more questions, thank you.

MR. FURUKAWA: Okay, Patty?

MS. FINSTERBUSCH: No further questions.

MR. FURUKAWA: This is Jon. One more question. The house can interfere with that half a second transmission. If the EPIRB is floating in mountainous seas, in a trough, I guess, for half a second, will that water, will that interfere with the --

MR. REICH: Yes.

MR. FURUKAWA: It can, also?

MR. REICH: In numerous ways. It could block it just by -- even if the antenna's above water, it could block the transmission. If it washed over the antenna, I think the 406 (Phonetic) megahertz frequency is very impermeable through water. Even a little bit will block out the transmissions. Yes, very much those waves and water could, in fact, block out the signal.

MR. WEBB: This is Paul Webb. Yesterday, we learned from Art Allen about how the surface of the water foams up in hurricane-type conditions. Would that foam block it?

MR. FITZMAURICE: The foam will cause a

ground plane issue. If you're in thick foam and you're sitting there, you don't have a hard surface. So now you're moving around in a foam. That can cause further attenuation. I'm not aware -- when you told me that, it makes sense. I can imagine churning up, and you get a thick foam.

MR. FURUKAWA: Art said inches to about a foot.

MR. REICH: In that case -- I don't know this particular EPIRB. I've never seen one in person. Usually, an EPIRB antenna's going to be about this high, and you're going to -- when they're floating out on the water, it would be sticking about a foot out of the water.

MR. FITZMAURICE: But the water's used as the ground plane.

MR. REICH: (Simultaneous speaking.)

MR. FITZMAURICE: Now you throw a thick foam in there --

MR. REICH: That could very well --

MR. FITZMAURICE: -- that would attenuate the reflection pattern. You're expecting positive and negative constructive and destructive interference patterns using a ground plane to get you your 5 to 60 radiation pattern around you. If you're in thick foam,

that would cause issues. It's like being on sand. You don't have a solid surface, like you do when you have flat water or hard surface. That could be an effect.

MR. FURUKAWA: Anything else, Paul?

MR. WEBB: No.

MR. FURUKAWA: Doug and Patty, last chance.

MS. FINSTERBUSCH: I'm good.

MR. MANSELL: I'm good.

MR. FURUKAWA: Mickey, thank you for your time. As the interview's over, like to ask you a couple more questions more. Is there anything that you'd like to add or change?

MR. FITZMAURICE: No, other than the fact I wasn't aware that the last reported AIS position wasn't from the IHDB. I was mistaken. I'm glad Jesse corrected me. We found out where it's from. We'll get that amended to this report. That's the only thing I'd like to make sure -- go on record as correcting.

MR. FURUKAWA: Are there any questions that we should have asked, but did not?

MR. FITZMAURICE: With regards to what we received here and the MCC, how we operate, I can't think of any. I hope we told you how our system works, how our future system's being developed and will work. I don't think we missed out on the opportunity to tell

you about something. The fact that we've gone on this long, I've probably told you way more than you wanted to hear. Jesse, can you think of anything?

MR. REICH: No, the only thing I would say is that -- and we haven't provided it here because this is more of an engineering report -- is a little bit of background on the registration information that we have on it, when it was kept up to date, and then the points of contact. We could give you a little bit more information on that and how timely it was. We usually maintain it, and we ask people to update it every two years (Inaudible) commercial vessels (Inaudible) usually pretty good about it. I would just say that. There's a little bit more information that we could provide you there that might help.

MR. FITZMAURICE: The fact it was registered accurately and within the timelines, there's no issues there.

MR. FURUKAWA: Next question is do you have any suggestions for preventing a recurrence of an accident like this?

MR. FITZMAURICE: Other than not leaving the port. I can give you my maritime expertise was very minimal, but not from a SARSAT engineering standpoint.

MR. REICH: I've got a few (Inaudible). A,

the registration was good, but the beacon didn't have a GPS-enabled location so, therefore, we couldn't -- our operation system couldn't provide that location. Even when we get to the MEOSAR, when we're able to locate it, having that GPS-encoded location is a huge benefit because it allows us to confirm through two independent sources of information that we do have a good location. In the case that it's not registered, even though we don't have the information of what kind of vessel and who it is and can contact them, we know it's going off right here.

MR. FITZMAURICE: Plus, if you don't want to get it through less than three satellites, but you have an encoded location, because we have more MEOs in orbit than we do geos, and those MEOs clear obstacles -- just because you're blocked out by a 50-foot wave to the west and you don't see GOES West, you might have a MEO due north in the trough. You'll see that perfectly. That's a good point, Jesse, thanks.

MR. REICH: (Inaudible) multiple EPIRBs sometimes can help as well. I don't know if that's necessarily something that would prevent the accident, but it would assist us in having two EPIRBs. Sometimes they have POBs that people can have in their life vests. That's another possibility of providing more

locations and more data on an incident like this.

MR. FITZMAURICE: Having personal locator beacons for the crew, those are inexpensive, couple hundred dollars -- having those in a situation like this, should it be a man overboard situation, you're not all in one life raft. Now we get multiple bursts, and we're like, "Okay, we detected someone here, here, here."

MR. REICH: The life rafts, themselves, sometimes have these POBs (Inaudible).

MR. FITZMAURICE: I know that the cruise ships -- I just got off of a cruise. I know they do.

MR. FURUKAWA: Just the fact that it was, I guess, an older EPIRB that wasn't GPS enabled, that --

MR. FITZMAURICE: Yes, that --

MR. FURUKAWA: -- it would've helped out if it was GPS enabled?

MR. FITZMAURICE: It would have.

MR. REICH: It's not necessarily older. It's just some do and some don't.

MR. FITZMAURICE: It's like buying a car. You get the technology package or you don't. It did what it was supposed to do. We received it. The radiation pattern wouldn't be any different, but it would have had GPS encoded if it got the GPS signals

in. There are different frequencies, many satellites, there's a good chance.

MR. FURUKAWA: Would you like to add anything else to that, how to prevent the ambiguity or what would have helped you guys?

MR. REICH: I think those two are (Inaudible).

MR. FITZMAURICE: Those are good points, too.

MR. REICH: (Inaudible) it's beneficial that it was registered. Otherwise, that unlocated (Inaudible), and that just drives our rescue coordination centers crazy when they get these unlocated alerts.

PARTICIPANT: (Inaudible.)

MR. REICH: Somebody's in trouble somewhere. That was a good thing that it was registered.

PARTICIPANT: (Inaudible) distress.

MR. FURUKAWA: The last one we throw out is there anyone else that we should interview, in your opinion?

MR. FITZMAURICE: No, in my opinion, if you wanted to get into the details of how the decision logic works in the MCC, I'd recommend you come back -- and we have a senior analyst who's not here today, Tom Griffin (Phonetic). I'm sure Chris O'Conner was

alluding to that. He's our senior MCC systems analyst.

He's been instrumental -- he's been on the SARSAT program probably the longest in this building, if I'm thinking right. He's very aware of the logic that goes into when alerts come in and go out. Jesse and I -- Jesse's the ground systems guru, but he's one layer in there that says, "Okay, you got this. What was the logic that I send the data to the RCCs, and what's the data --" the 20-30-minute ambiguity thing I couldn't think of for LEO, for geo, he's going to know the answer. He's going to have the document, so Mr. Tom Griffin. That would be the only thing, if you had concerns about how these messages were parsed out to the RCCs. That's about the only person in the U.S. SARSAT program, I think.

MR. FURUKAWA: Thank you very much, Jesse. Thank you very much, Mickey. It's 1317 on Friday, the 4th of March, 2016. We're at the NOAA --

MR. FITZMAURICE: Satellite Operations Facility.

MR. FURUKAWA: -- Satellite Operations Facility in Suitland, Maryland, and we're ending the interview.

(Whereupon, the above-entitled interview was concluded at 1:17 p.m.)

C E R T I F I C A T E

MATTER: El Faro Incident
Accident No. DCA16MM001
Interview of Michael Fitzmaurice, Jr.

DATE: 03-04-16

I hereby certify that the attached transcription of page 1 to 103 inclusive are to the best of my professional ability a true, accurate, and complete record of the above referenced proceedings as contained on the provided audio recording; further that I am neither counsel for, nor related to, nor employed by any of the parties to this action in which this proceeding has taken place; and further that I am not financially nor otherwise interested in the outcome of the action.

[redacted]

US SARSAT Engineering report on MV El Faro incident, Oct. 1, 2015

Executive Summary

The US Search and Rescue Satellite Aided Tracking (SARSAT) system detected Emergency Position-Indicating Radio Beacon (EPIRB) transmissions from the Motor Vessel (M/V) "El Faro" cargo ship. These transmissions appear to have occurred from 1135 – 1159z on October 1st. The EPRIB detected did not have GNSS (Global Navigation Satellite System) location encoding capabilities. The operational Geosynchronous Earth Orbiting Search and Rescue (GEOSAR) system detected these transmissions, but this system is unable to locate any beacon that does not have GNSS location encoding capabilities. During this timeframe, no Low Earth Orbiting Search and Rescue (LEOSAR) capable satellites were in view of the approximate location of the El Faro. As such, the operational SARSAT system was unable to provide a location of the ship in distress.

The developmental Medium Earth Orbiting Search and Rescue system (MEOSAR) was able to detect and produce a location of an EPIRB within 4 minutes of the first detected transmission. Additionally, the US MEOSAR ground segment was operating in a limited capability configuration due to maintenance on three of the six antennas at one of the two MEOLUT (MEOSAR Local User Terminal) sites. If the MEOSAR system were configured in what is anticipated to be the operational mode, with all six antennas functioning, and networking data exchange between the two US MEOLUTs, the MEOSAR system would've located the EPIRB after the first transmission.

Scope of Analysis

The SARSAT Program engineering staff analyzed the data from the operational LEOSAR and GEOSAR systems as well as the data received by the experimental (and still under Demonstration & Evaluation testing) MEOSAR for the Motor Vessel (M/V) "El Faro" cargo ship incident that occurred on Oct. 1, 2015.

This analysis used external data from the international maritime Automatic Identification System (AIS) obtained from the website;

http://www.marinetraffic.com/en/ais/details/ships/shipid:454389/mmsi:-7395351/vessel:EL%20FARO

Position Received at: **2015-10-01 04:01**
Area: **Atlantic North**
Latitude / Longitude: **24.2747° / -74.94522°**
Status: **Underway Using Engine**
Speed/Course: **19.0kn / 152°**

Read more at http://www.marinetraffic.com/en/ais/details/ships/shipid:454389/mmsi:-7395351/imo:7395351/vessel:EL_FARO#Y7iyuIXvaeXtrVzK.99

The last reported position of the M/V El Faro from the AIS was 24.275N, 74.945W at 0401z and the reported position from an Inmarsat beacon was 23.28N, 73.48W at 1115z.

Summary of USMCC data

Analysis is based on ID ADCD028F4A40C01 from day 01 October 2015 (DOY 274)

GEOSAR

The US Mission Control Center (USMCC) received an unlocated alert from the MD1 GEOLUT (GEOSAR Local User Terminal) through the GOES-E satellite at approximately 1135z. The MD2 GEOLUT detected what is likely the next burst at 1136z. MD1 delivered the unlocated 406 message to the USMCC at 1136z. Various other MCCs (Argentina - ARMCC, Brazil - BRMCC, Spain - SPMCC, Chile - CHMCC, and Canada CMCC) sent these unlocated alerts to the USMCC as well.

Both MD1 and MD2 GEOLUTs (looking at GOES-East and GOES-WEST respectively) intermittently detected the beacon transmitting from 1135 – 1159z. Both GEOLUTs detected a total of 13 bursts from the beacon; however, not all of the detected bursts were the same bursts (time) between the two GEOLUTs. Table 1 below shows the time of bursts detected and a 1 annotates that it was received as a valid transmission by the GEOLUT from the appropriate satellite (MD-1 s GOES-East, MD-2 views GOES-West).

Burst #	Time (UTC)	MD1	MD2
1	10/01/15 11:35:05.000	1	
2	10/01/15 11:35:55.000		
3	10/01/15 11:36:45.000	1	1
4	10/01/15 11:37:35.000	1	
5	10/01/15 11:38:25.000	1	
6	10/01/15 11:39:15.000	1	
7	10/01/15 11:40:05.000	1	1
8	10/01/15 11:40:55.000		1
9	10/01/15 11:41:45.000	1	
10	10/01/15 11:42:35.000		1
11	10/01/15 11:43:25.000		1
12	10/01/15 11:44:15.000		
13	10/01/15 11:45:05.000	1	
14	10/01/15 11:45:55.000	1	1
15	10/01/15 11:46:45.000		
16	10/01/15 11:47:35.000		1
17	10/01/15 11:48:25.000		
18	10/01/15 11:49:15.000		
19	10/01/15 11:50:05.000		1
20	10/01/15 11:50:55.000		
21	10/01/15 11:51:45.000	1	1
22	10/01/15 11:52:35.000		1
23	10/01/15 11:53:25.000		1
24	10/01/15 11:54:15.000		
25	10/01/15 11:55:05.000		
26	10/01/15 11:55:55.000		
27	10/01/15 11:56:45.000		
28	10/01/15 11:57:35.000	1	
29	10/01/15 11:58:25.000	1	1
30	10/01/15 11:59:15.000	1	1

Table 1 – MD1 / GOES-E Data – 13 Bursts MD2 / GOES-W Data – 13 Bursts

LEOSAR

The LEOSAR system had two satellites in view of the reported incident area from 1022-1047z and again at 1204-1224z on Oct. 1, 2015. These satellites, NOAA-15 (SARSAT-7 or S7) and NOAA-18 (SARSAT-10 or S10) are in almost identical orbit planes.

The time period and detections from the GEOSAR system seem to confirm that the distress beacon was not transmitting when either LEOSAR satellite, S7 or S10, was in view of the incident area. These conditions did not allow for the current operational LEOSAR system to detect or locate the distress beacon. No LEOSAR solutions or data was collected.

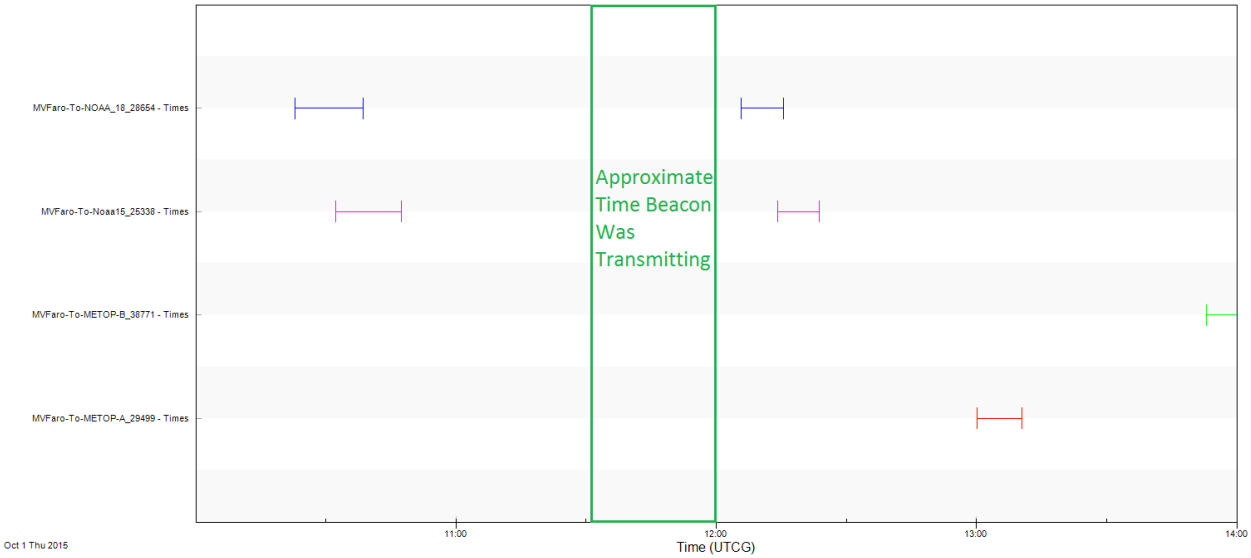

Table 2 – LEO Satellite In-View Periods

Developmental MEOLUTs

The US MEOSAR system consists of two (2) NOAA ground stations each comprised of 6 antennas. One of these systems is located at the US Coast Guard Communications Station (USCG Commsta) Miami and the other is located at the USCG Commsta Honolulu. These two systems are undergoing Demonstration & Evaluation, Phase II testing and their data was not being used operationally at the time of the incident. Furthermore, the Florida MEOLUT also had 3 antennas (out of 6) off-line for corrective maintenance at the time of the incident. Because the Florida MEOLUT was not in a normal configuration, networking between the Florida and Hawaii MEOLUTs was not enabled during the incident period.

The data retrieved from the MEO Mission Control Center (also non-operational and under verification testing) shows that the Florida MEOLUT received the distress beacon at 1136z through 2 of the 3 operating antennas from satellites 323 and 309 *(Figures 3, 4, and 5 show possible 3 and 4 satellite coverage areas with those satellites if combined with Hawaii)*. The Hawaii MEOLUT also received the distress burst through 2 of its 6 antennas from two other satellites, 330 and 319. Had networking been enabled at the MEOMCC (a future planned operational configuration) a location would have been produced off the first detected burst at 1136z.

Since networking was not enabled during D&E testing, the first locations produced by the MEOLUTs in "stand-alone mode" were the Florida MEOLUT, the Cyprus MEOLUT, and the Hawaii MEOLUT at 1139z. These locations were calculated and their times are noted in Figure 1. Note that the reported (not confirmed) distress location was about 900 miles from the Florida MEOLUT, which produced a location approximately 17nm away from the location provided by the Inmarsat SSAS beacon. With a calculated Dilution of Precision (DOP) of 9 due to satellite geometry, it can be reasonably estimated that with more than 3 antennas (either the rest of the Florida antennas or through MEOLUT networking with Hawaii), the DOP and error would've been significantly reduced.

Figure 1 – MEOLUT Locations

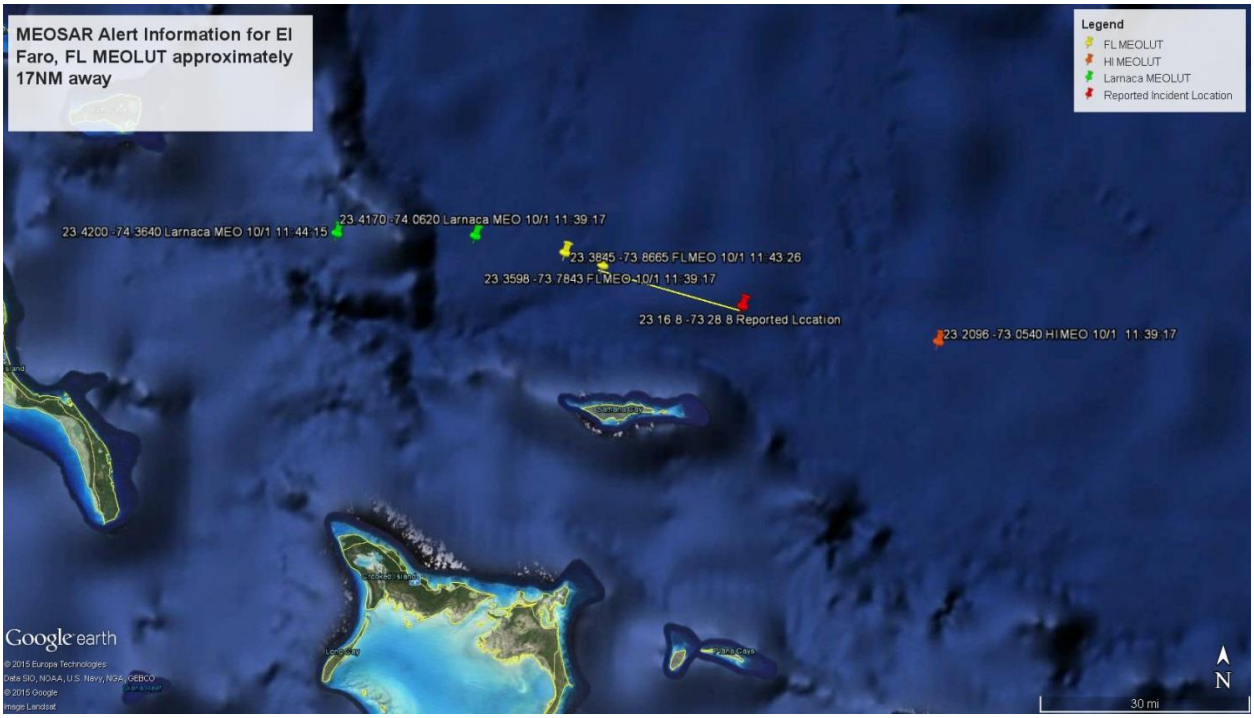

Figure 2 – MEOLUT Locations (same data as above displayed with time)

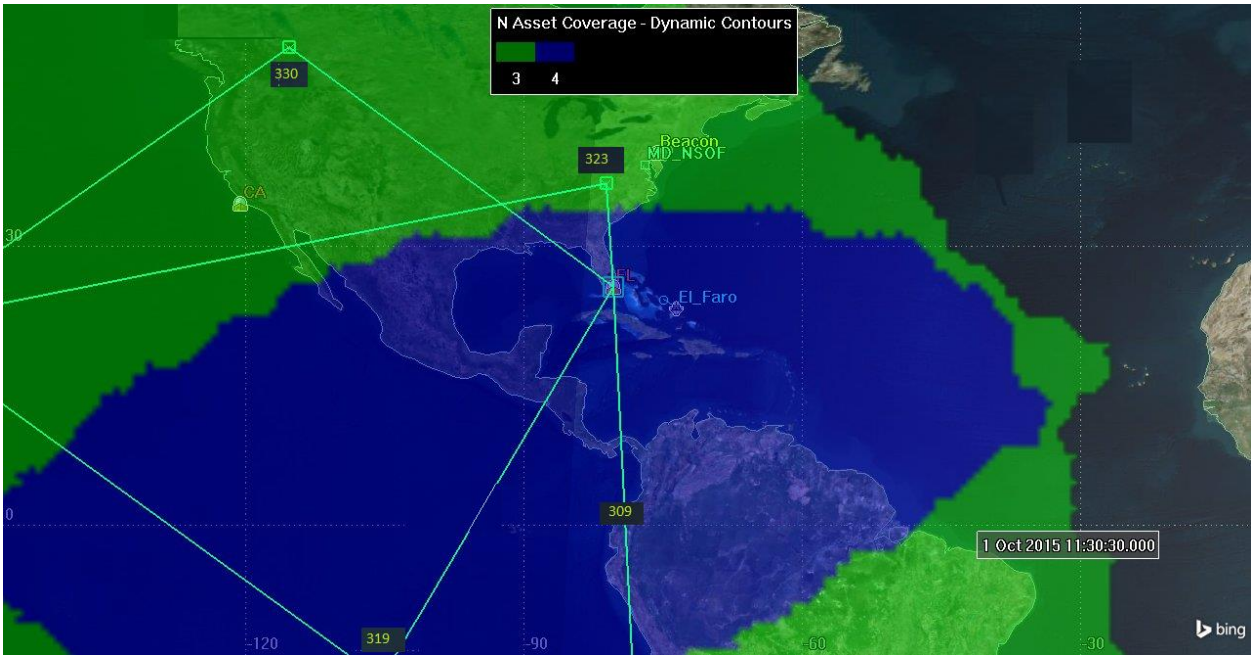

Figure 3 – MEOSAR Satellite Coverage at 1130z on Oct 1 2015

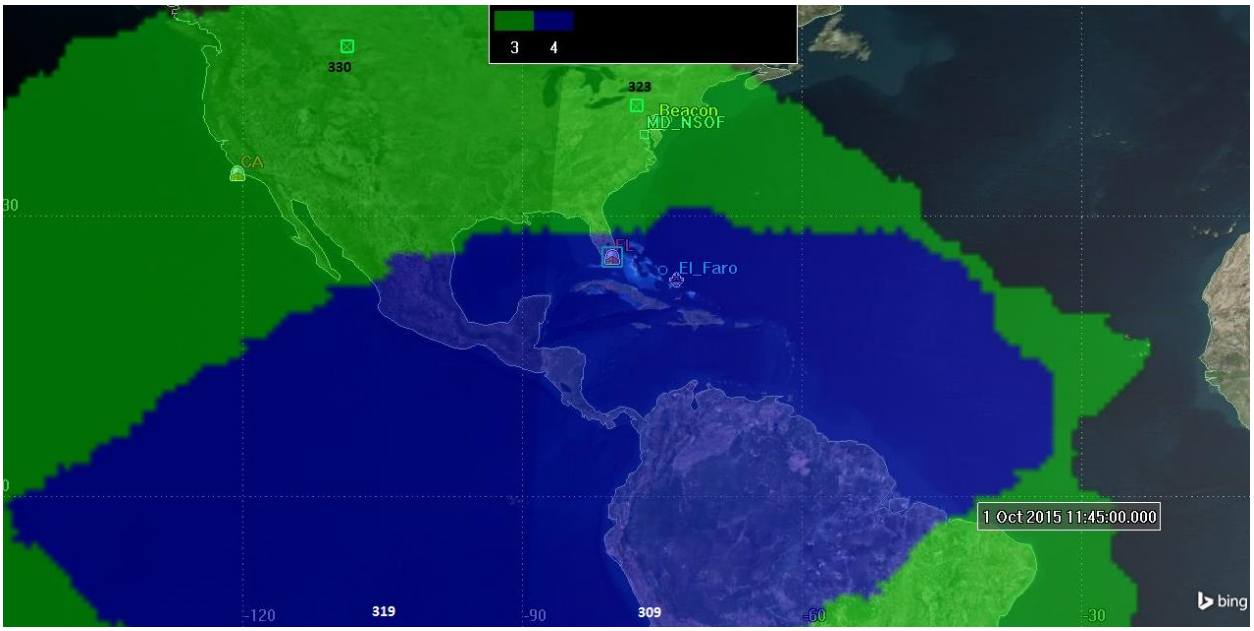

Figure 4 – MEOSAR Satellite Coverage at 1145z on Oct 1 2015

Figure 5 – MEOSAR Satellite Coverage at 1200z on Oct 1 2015

MEOLUT ID	MEO LUT	BcnId15	Num Packets	Num Satellites	DOP	Time First	Time Last	Latitude	Longitude	Quality Factor
3669	Florida	ADCD028F4A40C01	2	2	NULL	11:35:51	11:35:51	NULL	NULL	NULL
3385	Hawaii	ADCD028F4A40C01	2	2	NULL	11:35:51	11:35:51	NULL	NULL	NULL
7106	Foreign	ADCD028F4A40C01	1	NULL	NULL	11:36:44	11:36:44	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	1	1	NULL	11:36:44	11:36:44	NULL	NULL	NULL
3385	Hawaii	ADCD028F4A40C01	2	1	NULL	11:36:44	11:36:44	NULL	NULL	NULL
2274	Foreign	ADCD028F4A40C01	1	NULL	NULL	11:38:26	11:38:26	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	3	3	9.63395	11:39:17	11:39:17	23.35983	-73.78426	773
3385	Hawaii	ADCD028F4A40C01	4	3	13.9581	11:39:17	11:39:17	23.20961	-73.05403	671
3385	Hawaii	ADCD028F4A40C01	4	2	NULL	11:40:06	11:40:54	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	2	2	NULL	11:40:06	11:42:39	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	3	3	6.46297	11:43:26	11:43:26	23.38451	-73.86646	847
3385	Hawaii	ADCD028F4A40C01	4	3	3.76202	11:43:26	11:43:26	23.41988	-73.88403	911
3669	Florida	ADCD028F4A40C01	3	3	6.7327	11:47:34	11:47:34	23.25298	-74.13012	841
3385	Hawaii	ADCD028F4A40C01	4	3	3.73089	11:50:06	11:50:06	23.44788	-74.40668	912
3669	Florida	ADCD028F4A40C01	4	2	NULL	11:50:06	11:51:46	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	2	2	NULL	11:53:25	11:53:25	NULL	NULL	NULL
3669	Florida	ADCD028F4A40C01	2	2	NULL	11:57:40	11:57:40	NULL	NULL	NULL
3385	Hawaii	ADCD028F4A40C01	4	3	3.7518	11:58:28	11:58:28	1.26551	-136.50848	911
3669	Florida	ADCD028F4A40C01	3	3	7.6277	11:59:19	11:59:19	23.35016	-74.11591	820
3385	Hawaii	ADCD028F4A40C01	5	3	NULL	11:59:19	12:00:07	NULL	NULL	NULL

Table 3 – MEOLUT Input to MEOMCC DB

Data Sent to Rescue Coordination Centers (RCCs)

The USMCC sent a 406 Unlocated alert to the CGD07 at 1139z based on the initial MD1 detection. No additional information was collected on the alert site by the operational system, and therefore, no additional alerts were sent to the RCCs until the site was closed 02-Oct 0559z

System	MsgAddTime	MsgName	Destination	Sol#	SourceId	Source	LutName	SatType	EncLat	EncLon	Lat	Lon	QF	LocErr
MEO	11:38 05	MEOUnlocated	CGD07	1	3669	USMEO3	Florida_MEO	M						--
LEOGEO	11:39 03	406Unlocated	CGD07	1	3674	MD1	MD1	G						--
MEO	11:40:10	MEOFirstAlertDOA	CGD07	5	3669	USMEO3	Florida_MEO	M			23 3598	-73.784	773	32 31
MEO	11:40:27	MEOBlownNoCompDOA	CGD07	6	3385	USMEO1	Hawaii_MEO	M			23 2096	-73.054	671	44 22
MEO	11:41:54	MEOBlownNoCompDOA	CGD07	7	2091	CYMcc1	EULarnaca-MEO	M			23.417	-74.062	3	61 34
MEO	11:46 07	MEOBlownNoCompDOA	CGD07	10	2091	CYMcc1	EULarnaca-MEO	M			23.42	-74.364	3	91 58
MEO	11:50:22	MEOFirstCompDOA	CGD07	11	3669	USMEO3	Florida_MEO	M			23 3845	-73.867	847	41.13
MEO	11:59:45	MEOBlownCompDOA	CGD07	19	3385	USMEO1	Hawaii_MEO	M			1 2655	-136.51	911	7209.17

Table 5 – What would've been sent to CGD07; Operational LEO/GEO versus MEO

Conclusion

The operational SARSAT System was able to detect the distress beacon, but due to the apparent short duration of transmission and the satellite geometry at the time, it was unable to provide a location. The beacon also lacked GNSS encoding capabilities which would've allowed the operational system to provide a location.

The Developmental MEOSAR system has the potential to provide added value to the operational LEO/GEO system. In the case of the M/V FARO, the experimental MEOSAR system would have provided a location of the EPIRB within 5 minutes of beacon transmission whereas the operational system was not able to provide any location. Operating in its anticipated nominal configuration, the MEOSAR system would've detected and provided a location to RCCs within 2 minutes. A summary of the MEOLUTs detected bursts through the tracked MEOSAR satellites is below (*note-for the MEOLUT to compute a location, the burst must be detected through 3 different satellites*, highlighted).

		HI				FL			
		323	309	301	317	330	319	309	317
1	10/01/15 11:35:55.000	1	1			1	1		
2	10/01/15 11:36:45.000			1			1		
3	10/01/15 11:37:35.000								
4	10/01/15 11:38:25.000								
5	10/01/15 11:39:15.000	1	1	1		1	1	1	
6	10/01/15 11:40:05.000	1				1	1		
7	10/01/15 11:40:55.000						1		

8	10/01/15 11:41:45.000								
9	10/01/15 11:42:35.000			1					
10	10/01/15 11:43:25.000		1	1	1	1	1		1
11	10/01/15 11:44:15.000								
12	10/01/15 11:45:05.000								
13	10/01/15 11:45:55.000								
14	10/01/15 11:46:45.000								
15	10/01/15 11:47:35.000		1	1	1				
16	10/01/15 11:48:25.000								
17	10/01/15 11:49:15.000								
18	10/01/15 11:50:05.000		1			1	1		1
19	10/01/15 11:50:55.000								
20	10/01/15 11:51:45.000			1					
21	10/01/15 11:52:35.000								
22	10/01/15 11:53:25.000		1	1					
23	10/01/15 11:54:15.000								
24	10/01/15 11:55:05.000								
25	10/01/15 11:55:55.000								
26	10/01/15 11:56:45.000								
27	10/01/15 11:57:35.000		1	1					
28	10/01/15 11:58:25.000					1	1		1
29	10/01/15 11:59:15.000		1	1	1	1	1		1
30	10/01/15 12:00:05.000						1		
31									

Input Messages to MEOMCC *(experimental, still under test)*

Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26536.txt
/26536 00000/3674/15 274 113836 /761/3681/122B/213/001 /3674/+11930.6 000.2 +00.27/15 274 1136 43.42/0002
/N/0 0 0/-142.21 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [MCC1FTP]\OpsInputArmcc\
File: ARMCC_USMCC_51505.TXT
/51505 00000/7010/15 274 1138
/122/3660/213/01
/7011/+11930.9 000.1 +00.09/15 274 1137 53.13/02
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [MCC1FTP]\OpsInputSpmcc\
File: SPMCC_USMCC_75880.TXT
/75880 00000/2240/15 274 1139 /122/3660/213/01 /2242/+11935.1 999.9 +99.99/15 274 1137 33.49/02
/56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [MCC1FTP]\OpsInputBrmcc\
File: BRMCC_USMCC_03701.TXT
/03701 00000/7100/15 274 1139
/122/3660/213/01
/7105/+11929.2 001.0 -01.12/15 274 1137 32.35/02
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [MCC1FTP]\OpsInputChmcc\
File: CHMCC_USMCC_86248.TXT
/86248 00000/7250/15 274 1139 /122/3660/213/01 /7253/+11938.2 999.9 +99.99/15 274 1137 39.20/02
/56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [MCC1FTP]\OpsInputCmcc\
File: CMCC_USMCC_60642.TXT
/60642 00000/3160/15 274 1141
/122/3660/215/01
/3166/+11940.5 000.5 -00.62/15 274 1140 06.17/02
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd2\
File: MD2_USMCC11_22272.txt
/22272 00000/3676/15 274 114249 /761/3681/122B/215/001 /3676/+11934.3 001.3 -00.73/15 274 1140 20.91/0002
/N/0 0 0/-145.20 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [MCC1FTP]\OpsInputPemcc\
File: PEMCC_USMCC_38816.TXT
/38816 00000/7600/15 274 1142
/122/3660/215/01
/7602/+11932.8 002.2 -00.53/15 274 1138 58.92/02
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26542.txt
/26542 00000/3674/15 274 114347 /761/3681/122B/213/001 /3674/+11931.8 001.4 +00.32/15 274 1140 03.89/0005
/N/0 0 0/-141.17 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG

==========
Folder: [MCC1FTP]\OpsInputAumcc\
File: AUMCC_USMCC_33372.TXT
/33372 00000/5030/15 274 1141
/122/3660/215/01
/5122/+11935.4 000.2 -00.29/15 274 1140 06.67/02
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26547.txt
/26547 00000/3674/15 274 114844 /761/3681/122B/213/001 /3674/+11930.1 000.3 +00.29/15 274 1145 07.07/0007 /N/0 0 0/-142.60 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26554.txt
/26554 00000/3674/15 274 115349 /761/3681/122B/213/001 /3674/+11933.5 003.1 +00.32/15 274 1151 43.57/0008 /N/0 0 0/-143.14 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [MCC1FTP]\OpsInputFmcc\
File: FMCC_USMCC_32471.TXT
/32471 00000/2270/15 274 1157
/122/3660/263/01
/2273/+11932.3 000.0 +00.00/15 274 1152 33.60/01
/56E68147A5206009EB2C1000000000
/LASSIT
/ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26560.txt
/26560 00000/3674/15 274 115924 /761/3681/122B/213/005 /3674/-03000.8 000.3 -00.00/15 274 1158 22.70/0121 /N/0 0 0/-141.39 /4E8FE7D3D586CC8153614000000000 /3674/-03145.8 000.2 -00.03/15 274 1158 26.12/0121 /N/0 0 0/-136.45 /4DB10CBE5381A802EECCC000000000 /3674/-03156.0 000.1 -00.00/15 274 1158 10.79/0121 /N/0 0 0/-136.93 /53CF771371970E85941B4000000000 /3674/+11994.1 000.2 -00.02/15 274 1158 20.41/0121 /N/0 0 0/-139.40 /56FFFFFFFFFFFFE694960000000000 /3674/+11931.2 000.8 +00.25/15 274 1157 37.78/0009 /N/0 0 0/-143.96 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd2\
File: MD2_USMCC11_22278.txt
/22278 00000/3676/15 274 120246 /761/3681/122B/215/001 /3676/+11934.2 001.4 -00.28/15 274 1158 46.25/0011 /N/0 0 0/-143.81 /56E68147A5206009EB2C1A00000000 /LASSIT /ENDMSG
==========
Folder: [LUTFTP1]\OpsInputMd1\
File: MD1_USMCC11_26564.txt
/26564 00000/3674/15 274 120434 /761/3681/122B/213/005 /3674/-03000.4 000.3 +00.04/15 274 1203 27.25/0121 /N/0 0 0/-141.33 /4E8FE7D3D586CC8153614000000000 /3674/-03145.4 000.5 +00.06/15 274 1203 23.53/0121 /N/0 0 0/-137.45 /4DB10CBE5381A802EECCC000000000 /3674/-03156.1 000.2 -00.01/15 274 1203 07.82/0121 /N/0 0 0/-137.01 /53CF771371970E85941B4000000000 /3674/+11992.5 002.1 -00.23/15 274 1203 20.41/0121 /N/0 0 0/-139.70 /56FFFFFFFFFFFFE694960000000000 /3674/+11929.2 001.2 -00.08/15 274 1159 17.36/0011 /N/0 1 0/-143.51 /56E68147A5206009EB2C1000000000 /LASSIT /ENDMSG
==========

Output Messages *(experimental still under test)*

/59260 00000/3660/15 274 1139
/160/366M

********** 406 BEACON UNLOCATED FIRST ALERT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753

********** DETECTION TIME AND POSITIONS FOR THE BEACON **********

PROB SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER
N/A N/A N/A 01 1136 OCT G13 MD1 CGD07

DETECTION FREQUENCY: 406.0369 MHZ

********** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION **********

COUNTRY : USA BEACON TYPE: EPIRB SERIAL CATEGORY I
MID CODE : 366 CRAFT ID : SPECIFIC BEACON:
MANUFACTURER: JOTRON MODEL : UNKNOWN
SERIAL NUM : 41938 HOMING : 121.5 MHZ
POSITION DEVICE: NIL POSITION RESOLUTION: NONE

********** BEACON REGISTRATION DATABASE INFORMATION ********

OWNER: Sea Star Line LLC
8710 Longshore Way TEL 1: WORK [redacted]
Jacksonville FL TEL 2:
32226 USA TEL 3:
TEL 4:
EMAIL: [redacted]

CONTACTS: LEE PETERSON, PORT ENGINEER DON MATTHEWS, PORT CAPTAIN
TEL 1: WORK [redacted] TEL 1: CELL [redacted]
TEL 2: CELL [redacted] TEL 2:
TEL 3: TEL 3:
TEL 4: TEL 4:

VESSEL NAME: EL FARO
TYPE: POWER Cargo LENGTH OVERALL (FT): 791
COLOR: white/blue CAPACITY: 42
RADIO CALL SIGN: WFJK REGISTRATION NO: ON 561732
RADIO EQP: VHF,HF,SSB,iridium,MF INMARSAT NUMBER: 870 764667272
CELLULAR NUMBER: [redacted]

NUMBER OF LIFE BOATS: 2 NUMBER OF LIFE RAFTS: 2

HOME PORT PRIMARY SRR: CGD07 SECONDARY SRR:
HOME PORT: BLOUNT ISLAND TERM JACKSONVILLE FL

MANUFACTURER: JOTRON MODEL NUMBER: UNKNOWN
ACTIVATION TYPE: CAT1 (MANUAL AND AUTOMATIC)

BEACON CONTAINS SVDR: NO

DATE FIRST REGISTERED: 01 FEB 2012 DATE REGISTRATION EXPIRES: 03 DEC 2015
DATE LAST UPDATED: 03 DEC 2013

REMARKS: EPIRB #2

SPECIAL STATUS: SPECIAL STATUS DATE:
SPECIAL STATUS INFO:

********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 01 1139 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO: N/A

PREVIOUS PASS INFORMATION: N/A

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG

==========
/49987 00000/3660/15 274 1139
/160/CGOP

********** 406 BEACON UNLOCATED FIRST ALERT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753

********** DETECTION TIME AND POSITIONS FOR THE BEACON **********

PROB	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	SOURCE	SRR	/BUFFER
N/A	N/A	N/A		01 1136 OCT	G13	MD1	CGD07	

DETECTION FREQUENCY: 406.0369 MHZ

********** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION **********

COUNTRY : USA BEACON TYPE: EPIRB SERIAL CATEGORY I
MID CODE : 366 CRAFT ID : SPECIFIC BEACON:
MANUFACTURER: JOTRON MODEL : UNKNOWN
SERIAL NUM : 41938 HOMING : 121.5 MHZ
POSITION DEVICE: NIL POSITION RESOLUTION: NONE

********** BEACON REGISTRATION DATABASE INFORMATION ********

OWNER: Sea Star Line LLC
8710 Longshore Way TEL 1: WORK [redacted]
Jacksonville FL TEL 2:
32226 USA TEL 3:
TEL 4:
EMAIL: [redacted]

CONTACTS: LEE PETERSON, PORT ENGINEER DON MATTHEWS, PORT CAPTAIN
TEL 1: WORK [redacted] TEL 1: CELL [redacted]
TEL 2: CELL [redacted] TEL 2:
TEL 3: TEL 3:

TEL 4: TEL 4:

VESSEL NAME: EL FARO
TYPE: POWER Cargo LENGTH OVERALL (FT): 791
COLOR: white/blue CAPACITY: 42
RADIO CALL SIGN: WFJK REGISTRATION NO: ON 561732
RADIO EQP: VHF,HF,SSB,iridium,MF INMARSAT NUMBER: 870 764667272
CELLULAR NUMBER: [redacted]

NUMBER OF LIFE BOATS: 2 NUMBER OF LIFE RAFTS: 2

HOME PORT PRIMARY SRR: CGD07 SECONDARY SRR:
HOME PORT: BLOUNT ISLAND TERM JACKSONVILLE FL

MANUFACTURER: JOTRON MODEL NUMBER: UNKNOWN
ACTIVATION TYPE: CAT1 (MANUAL AND AUTOMATIC)

BEACON CONTAINS SVDR: NO

DATE FIRST REGISTERED: 01 FEB 2012 DATE REGISTRATION EXPIRES: 03 DEC 2015
DATE LAST UPDATED: 03 DEC 2013

REMARKS: EPIRB #2

SPECIAL STATUS: SPECIAL STATUS DATE:
SPECIAL STATUS INFO:

********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 01 1139 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO: N/A

PREVIOUS PASS INFORMATION: N/A

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG

==========
/04569 00000/3660/15 274 1139
/160/C2cn

********** 406 BEACON UNLOCATED FIRST ALERT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753

********** DETECTION TIME AND POSITIONS FOR THE BEACON **********

PROB	SOL	LATITUDE	LONGITUDE	DETECT TIME	SAT	SOURCE	SRR	/BUFFER
N/A	N/A	N/A		01 1136 OCT	G13	MD1	CGD07	

DETECTION FREQUENCY: 406.0369 MHZ

********** BEACON ID CONTAINS THE FOLLOWING ENCODED INFORMATION **********

COUNTRY : USA BEACON TYPE: EPIRB SERIAL CATEGORY I
MID CODE : 366 CRAFT ID : SPECIFIC BEACON:
MANUFACTURER: JOTRON MODEL : UNKNOWN
SERIAL NUM : 41938 HOMING : 121.5 MHZ
POSITION DEVICE: NIL POSITION RESOLUTION: NONE

********* BEACON REGISTRATION DATABASE INFORMATION ********

OWNER: Sea Star Line LLC
8710 Longshore Way TEL 1: WORK [redacted]
Jacksonville FL TEL 2:
32226 USA TEL 3:
TEL 4:
EMAIL: [redacted]

CONTACTS: LEE PETERSON, PORT ENGINEER DON MATTHEWS, PORT CAPTAIN
TEL 1: WORK [redacted] TEL 1: CELL [redacted]
TEL 2: CELL [redacted] TEL 2:
TEL 3: TEL 3:
TEL 4: TEL 4:

VESSEL NAME: EL FARO
TYPE: POWER Cargo LENGTH OVERALL (FT): 791
COLOR: white/blue CAPACITY: 42
RADIO CALL SIGN: WFJK REGISTRATION NO: ON 561732
RADIO EQP: VHF,HF,SSB,iridium,MF INMARSAT NUMBER: 870 764667272
CELLULAR NUMBER: [redacted]

NUMBER OF LIFE BOATS: 2 NUMBER OF LIFE RAFTS: 2

HOME PORT PRIMARY SRR: CGD07 SECONDARY SRR:
HOME PORT: BLOUNT ISLAND TERM JACKSONVILLE FL

MANUFACTURER: JOTRON MODEL NUMBER: UNKNOWN
ACTIVATION TYPE: CAT1 (MANUAL AND AUTOMATIC)

BEACON CONTAINS SVDR: NO

DATE FIRST REGISTERED: 01 FEB 2012 DATE REGISTRATION EXPIRES: 03 DEC 2015
DATE LAST UPDATED: 03 DEC 2013

REMARKS: EPIRB #2

SPECIAL STATUS: SPECIAL STATUS DATE:
SPECIAL STATUS INFO:

********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 01 1139 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO: N/A

PREVIOUS PASS INFORMATION: N/A

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG

==========
/59286 00000/3660/15 275 0559
/166/366M

********** 406 BEACON MISSED PASS/SITE STATUS REPORT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753 (CLOSED - TIME)

********** CURRENT ACTIVE SITE **********

SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER MP
U N/A N/A 01 1159 OCT G13 MD1 0

********** ABOVE BEACON WAS NOT DETECTED DURING THE FOLLOWING PASS ********

DETECT TIME SAT SOURCE
NA NA NA

********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 02 0559 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO:
CGD07

PREVIOUS PASS INFORMATION:

PROB SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER
N/A U N/A N/A 01 1136 OCT G13 MD1

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG

==========
/50066 00000/3660/15 275 0559
/166/CGOP

********** 406 BEACON MISSED PASS/SITE STATUS REPORT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753 (CLOSED - TIME)

********** CURRENT ACTIVE SITE **********

SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER MP
U N/A N/A 01 1159 OCT G13 MD1 0

********** ABOVE BEACON WAS NOT DETECTED DURING THE FOLLOWING PASS ********

DETECT TIME SAT SOURCE
NA NA NA

********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 02 0559 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO:
CGD07

PREVIOUS PASS INFORMATION:

PROB SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER
N/A U N/A N/A 01 1136 OCT G13 MD1

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG
==========
/04685 00000/3660/15 275 0559
/166/C2cn

********** 406 BEACON MISSED PASS/SITE STATUS REPORT **********

BEACON ID: ADCD0 28F4A 40C01 SITE ID: 38753 (CLOSED - TIME)

********** CURRENT ACTIVE SITE **********

SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER MP
U N/A N/A 01 1159 OCT G13 MD1 0

********** ABOVE BEACON WAS NOT DETECTED DURING THE FOLLOWING PASS ********

DETECT TIME SAT SOURCE
NA NA NA
********** SUPPORTING INFORMATION **********

USMCC PROCESSING TIME: 02 0559 OCT

THIS ALERT MESSAGE IS BEING SENT TO:
CGD07

ALERT MESSAGES FOR THIS SIGNAL PREVIOUSLY SENT TO:
CGD07

PREVIOUS PASS INFORMATION:

PROB SOL LATITUDE LONGITUDE DETECT TIME SAT SOURCE SRR /BUFFER
N/A U N/A N/A 01 1136 OCT G13 MD1

NEXT TIME SIGNAL SHOULD BE DETECTED: N/A

QQQQ
/LASSIT
/ENDMSG

==========