JOHN GARAMENDI
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UNITED STATES CONGRESS

2438 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
PHONE: (202) 225-1880
FAX: (202) 225-5914

DISTRICT OFFICES:

412 G STREET
DAVIS, CA 95616
PHONE: (530) 753-5301
FAX: (530) 753-5614

1261 TRAVIS BOULEVARD, SUITE 130
FAIRFIELD, CA 94533
PHONE: (707) 438-1822
FAX: (707) 438-0523

795 PLUMAS STREET
YUBA CITY, CA 95991
PHONE: (530) 329-8865
FAX: (530) 763-4248

April 13, 2016

The Honorable Douglas Loverro
Deputy Assistant Secretary of Defense for Space Policy
1000 Defense Pentagon
Washington, DC 20301-1000

General John E. Hyten
Commander, Air Force Space Command
150 Vandenberg St., Ste 1105
Peterson AFB, CO 80914-4500

Dear DASD Loverro and Gen Hyten,

I am writing to you to follow up on our conversation regarding positioning, navigation, and timing resiliency and eLoran during the March 15th House Armed Services Strategic Forces Subcommittee hearing "Fiscal Year 2017 Budget Request for National Security Space." I appreciated your insights and thank you for taking the time to discuss this critical issue with me.

The recent reports of North Korea's jamming of GPS signals in South Korea highlight the vulnerabilities facing space-based positioning, navigation, and timing (PNT) systems. To protect ourselves from such threats and ensure continuity of PNT services, we must build resiliency into our nation's critical infrastructure. Building this resiliency should be a multi-faceted approach which includes upgrading GPS signal resiliency, improving alternate timing sources where appropriate, and establishing a system to complement and back up GPS.

In December 2015, the co-chairs of the National Executive Committee for Space-Based Position, Navigation, and Timing, Deputy Secretary of Defense Robert Work and Deputy Secretary of Transportation Victor Mendez, sent a letter to five Members of Congress, including me, stating that eLoran "could be a viable nationwide complementary capability for GPS applications" and that that the EXCOM was taking steps to begin establishing this system. Having a terrestrial system to complement and provide a backup for GPS will not only protect satellites by reducing their value as military targets and by deterring deliberate disruption of GPS signals, but will also provide critical resiliency for critical infrastructure and the Department's supplies and service providers in the event of a disruption.

Your recent testimony seems to indicate a significant difference between your efforts and the EXCOM's stated direction. In addition, several of your points appear to conflict with other publically available information that has been given to me. To ensure that the information I have received is accurate and that I have a clear understanding of your viewpoints, I have attached a list of points in your testimony that I would like further clarification on, as well as additional

questions on this topic that I was unable to raise during the hearing but would like answers to. I appreciate your timely assistance with this matter.

Sincerely,

JOHN GARAMENDI
Member of Congress

Points Needing Clarification in Testimony Regarding eLoran
House Armed Services Strategic Forces Subcommittee Hearing: "Fiscal Year 2017 Budget Request for National Security Space," 15 March 2016

The following statements and assertions were made during the hearing. The statements appear to conflict with other information provided to me (noted in the right-hand column).

Statement: eLoran is not a DOD system.	**Inconsistent Data**: While that is true today, as the United States currently does not have such a system, DOD developed Loran in WWII, used it for navigation[i] and communications[ii] until 1994, and the services have shown continued interest in eLoran for the future. The Army issued an RFI for eLoran receivers in January 2015[iii], and the Navy identified eLoran as a candidate Assured PNT technology in 2016.[iv] GPS is a DOD system and eLoran will contribute to national security space by reducing GPS satellites' value as military targets and by deterring jamming and spoofing of GPS signals.
Statement: eLoran is a maritime system being investigated by Department of Transportation.	**Inconsistent Data:** Every variant of Loran can be and has been used for air, land, and maritime navigation. It has also been used for wireless precise timing, frequency dissemination, and for one-way communications with submarines.[v] Additionally, the military developed tactical bombing and portable versions of Loran and it is available today. The Department of Homeland Security has been demonstrating eLoran's utility as a timing source since 2012.[vi]
Statement: The lack of receivers for eLoran is a significant problem that needs to be addressed.	**Inconsistent Data:** Receivers are available today. The apparent lack of receivers is directly related to the US government terminating Loran-C signals and its lack of commitment to eLoran. The federal government is acting to make

	eLoran receivers inexpensive and widely available. The National Institute of Standards and Technology (NIST) has a project to enable an eLoran receiver to fit on a microchip. This will greatly aid in reducing receiver cost and incorporating the technology into mobile devices.[vii]
Statement: All other countries have all shut down their Loran systems.	**Inconsistent Data:** National Geospatial Intelligence Agency Publication 117 (2014)[viii] lists Russia, China, South Korea, the United Kingdom, and Saudi Arabia as having operating systems. Other nations are also shown, but I understand they have terminated their systems since the document was published. Note: Press reports have indicated that Norway is in discussion with the UK about reactivating the Norwegian Loran system to provide timing.[ix] The Danish government is delaying dismantling its Loran site as it may be useful as an eLoran site. India has plans to build an eLoran system[x], Japan is considering eLoran as an alternative to Decca for mine sweeping operations, and I understand other countries do as well.
Statement: New signals are problematic, as shown by GPS L2. Work began in 1996 and there are still no L2 receivers in the world today—20 years later.	**Inconsistent Data:** GPS L2 signals only began transmission in December 2014, less than 18 months ago, they are still classified as "pre-operational" and full navigation capability isn't scheduled until "about 2018," according to GPS.gov[xi]

Additional Questions

During the hearing and in other encounters, you referenced improvements to GPS and the Department's resilience to the vulnerabilities associated with GPS. Please provide answers to the following questions:

1. I understand that the new GPS III satellites will provide a stronger signal than older satellites.
   - When will enough satellites with this higher power transmission be in operation so that all users will have the benefit of the new signal?
   - How will the stronger signal decrease the ability of criminal and terrorist organizations to jam GPS signals?
   - How will the stronger signals decrease the effectiveness of "personal privacy" GPS jamming devices that are readily available to consumers over the internet? For example, if a 2-watt jammer is now able to disrupt reception for a radius of 40 miles, will that be reduced to 20 miles?
   - How will existing receivers need to be updated/modified to fully use new and improved signals and all their characteristics?
2. How will the Department of Defense continue operations during an extended GPS/GNSS outage that will impact its supplier and service providers?
3. What requirements and best practices has the Department of Defense set for its suppliers and service providers with respect to being able to continue operations in the event of an extended GPS outage?
4. DOD spends substantial sums at bases worldwide for backups and emergency supplies such as emergency generators, fuel storage, food, and water. How does that compare to the annual cost of the eLoran system Deputy Secretary Work and the National PNT Executive Committee say the nation requires?
5. Studies in the United States and abroad show high and increasing levels of GPS jamming by both state actors and ordinary citizens. What information does the Department of Defense have about this? What equipment and procedures does the department have in effect to prevent and detect criminal jamming and spoofing of GPS aboard its installations and purposeful jamming by adversaries in high threat or combat regions?

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[i] Air Forces Manual No. 37: Loran (Long Range Navigation) Handbook For Aircraft
[ii] U.S. Navy Clarinet Pilgrim system
[iii] Army Solicitation Number W56KGY-15-R-ELOR: "Enhanced LORAN (eLORAN) Receivers For Army Platforms"
[iv] Navy SBIR 2016.1 - Topic N161-002: Alternative Positioning, Navigation and Timing (PNT) Technologies for Global Positioning System (GPS)-Degraded and GPS-Denied Operation
[v] Federal Radionavigation Plan, 2008
[vi] US Coast Guard Notice of Intent and Request for Public Comments: "Cooperative Research and Development Agreement: Technology To Provide Wireless Precise Time; Alternatives to Global Positioning Systems," 77 Federal Register 1708 (11 January 2012)
[vii] National Institute of Standards and Technology SBIR Announcement of Federal Funding Opportunity: Single-Chip eLoran Receiver
[viii] National Geospatial-Intelligence Agency Publication No. 117: Radio Navigational Aids, page 601
[ix] Bladet Vesterålen: "Loran Demolition Stopped"
[x] Indian Ministry of Shipping: "Maritime Agenda: 2010-2020," pages 371 to 377
[xi] GPS.gov: New Civil Signals