



The Goose Gazette

The newsletter of the *Wild Goose Association*,
the international loran radionavigation forum.

Volume 94-3 - News of the Summer, 1994

President's Message

by Dale Johnson

It has been a busy year for WGA, a year that has both tested and expanded the organization's capabilities. WGA responded to the threat to the U.S. Loran-C system's continued future by forming the Committee For a Balanced Radionavigation Policy, with Lynn Roth as Chairman. This committee has done a fine job of getting the information that Loran-C might be closed early to the system's users. In turn, a large number of navigators have written letters to the Coast Guard, the FAA, the DOT, and their senators and representatives.

WGA has developed an improved ability to reach people who use the various radionavigation systems. We intend to invite a number of people to the Newport Convention who have a wider contact with the system users than many of us in the organization: editors, writers, and representatives of other organizations devoted to boating and flying.

WGA has launched a petition drive to keep Loran-C in operation well into the next century. We have thousands of signatures on the petitions. If you have an opportunity to visit boat shows or other groups, spread the word about Loran-C's value and its possible termination. Most users are unaware of the crisis that could make their equipment and their waypoint information valueless.

What about GPS? GPS has a combination of coverage and accuracy that is better than any previous navigation system. The system does, however, have limitations which must be understood and dealt with. GPS limitations are signal availability, integrity, and continuity of service. The fact that GPS operates worldwide on one (C/A) frequency is both a benefit and a limitation. The benefit is obvious, but any serious interference on the GPS frequency can disrupt service for a large number of users over a wide geographical area. Augmentation will be needed to overcome these limitations and produce a fully redundant worldwide navigation system for all aviation users.

Interference and unexplained anomalies have affected GPS receivers in tests, in flight and in ground operations. Loran-C: the lowest cost, most reliable, and most popular radionavigation system in the world, stands ready to fill the gaps in GPS coverage time and availability. Each system serves as a back-up to the other, and Loran-C offers a cost-effective DGPS capability as well.

We are experiencing a need to change our name, to reduce the continuing confusion to non-members about its purpose and function. It is causing difficulty in getting some participants' travel approved. We'll provide more information soon.

Even as we get ready to go to Newport, WGA is planning the joint meeting with INA in Moscow in 1995. John Beukers is spearheading the planning effort.

See you in Newport.

We Won't Go Away

Geese live a long time, and have long memories. Most of us remember several new radionavigation systems coming on line; *not one of them has lived up to its advance billing*. Many of us have been flying or cruising in perfectly lousy weather when the radionavigation system packed it up, or began giving "smelly" information. We *survived* because of keeping cool in spite of stark terror, by relying on our DRs, by finding a useful line of position from another system, by the grace of God, or by sheer luck.

No one who has ever lived through such an experience wants to trust a single navigation system again.

That philosophy, which has not altered for generations, leads navigators to use the depthfinder, radar, visual positions, and time our trip legs. Few of us can afford the high-tech systems--inertial, gyros, stabilized radars, and so on--that make reasonable backups. For many of us, Loran-C has been a major expense. In the past couple of years we have begun to enjoy the benefits of two accurate, near-continuous systems that provide identical information.

It has never been better in the history of navigation. When one system is out, the differences are obvious immediately. A little detective work usually reveals which one is bad, but if not, we still can steer clear of hazards.

That is why we feel that Loran-C is so valuable. GPS isn't perfect, and it never will be. The modest cost of both Loran-C receivers and the Loran-C system make it the most popular radionavigation system in the world. There were over 90,000 receivers sold in the United States last year, bringing the total to over a million.

Worldwide, Loran-C is growing rapidly, for many of the above reasons. Let's gather at Newport, to help guide the future of radionavigation.

The Goose Gazette

The Goose Gazette is an official publication of The Wild Goose Association (WGA). The Gazette is published quarterly, with cutoff dates of 1 March for the Winter issue, 1 June for the Spring issue, 1 September for the Summer issue and 1 December for the Fall issue.

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1993 Proceedings

Ellen Lilley advises that the Proceedings for the 1993 Convention and Technical Symposium in Santa Barbara have all been mailed. If you received a damaged copy, or registered for the convention and did not receive a copy, get in touch with Ellen at the WGA Operations Office.

Ellen also says that Mr. David Lausch registered with a St. Louis address, but the Post Office returned the Proceedings. Anyone know Mr. Lausch, or where we can reach him to send his copy?

Election Results

Walt Dean, WGA Secretary, has provided a summary of the election results:

- Four directors terms expire in 1994: Dave Scull, Laura Charron, Dave Amos and Walt Dean.
- They are replaced by Bob Lilley (83), Walt Dean (73), Bill Roland (66), and Durk van Willigen (52).
- Dale Johnson is reelected President but is in his third term as Director. His Director position is filled by Laura Charron (48) for one year only.
- Bob Lilley has been elected Director but holds the Ex-President position. His Director position is filled by James Alexander for one year only.

WGA Clothing

Show your colors! The WGA Operations Office has the following items of clothing available:

WGA baseball caps	U.S.\$ 8.00
WGA white golf shirts S, L, XL	18.00
WGA silver pins	5.00
WGA decals	4 (min) for 2.00

Payments may be by check, or by Visa or Mastercard.

WGA Charter

"The Wild Goose Association is formed to provide an organization for individuals who have a common interest in Loran and who wish to foster and preserve the art of Loran, to promote the exchange of ideas and information in the field of Loran, to recognize the advances and contributions to Loran, to document the history of Loran, and to commemorate fittingly the memory of fellow Wild Geese.

"The Association is named after the majestic bird that navigates thousands of miles with unerring accuracy. Its membership represents many interests including those of planners, promoters, designers and users of loran equipment throughout the world."

Membership

Any individual or organization that has an interest in loran is eligible for membership. There are several classes of membership:

Individual

Annual membership is \$25.00 for the first year and \$20.00 annually after the first year. Life membership is \$200.00.

Members in countries other than the U. S., Canada and Mexico are assessed an additional \$10.00 per year to defray international mailing costs.

Organizational

Corporate Class 1 and 2 memberships provide options for organizations that wish to be involved directly in WGA activities. Class 1 permits nomination of ten regular members from the corporate member; Class 2 permits five. Dues for Class 1 are \$435.00 for the first year and \$400.00 afterwards. For Class 2, dues are \$220.00 and \$200.00.

Associate membership is provided for organizations which desire only to receive WGA publications. Associate membership is \$105.00 for the first year and \$100.00 annually thereafter, and does not carry the privilege of voting or holding WGA office.

Payment for all WGA matters may be by check, Visa, or Mastercard.

WGA COMMITTEE FOR A BALANCED RADIONAVIGATION POLICY

The Special Issue of the Goose Gazette reported that WGA has formed the Committee For A Balanced Radionavigation Policy, with G. Lynn Roth as President. His report:

I am pleased to report that the Committee for a Balanced Radionavigation Policy is off to an excellent start and has made substantial progress in organizing and mobilizing support for Loran-C. Our initial work focused on the aviation community and generating user input to key government officials through our petition and write-in campaigns.

We attended the Experimental Aircraft Association Fly-In and some smaller meetings, and have obtained well over 5,000 signatures on the petition shown in the May 23 Special Issue of the Goose Gazette. Signers included voters from all 50 states, plus international advocates from 13 other countries. In addition, we have received support from two major private aviation organizations: the Aircraft Owners and Pilots Association (AOPA), and the Experimental Aircraft Association (EAA). AOPA has approximately 320,000 members and the EAA about 136,000 members. An important government aviation group, the National Association of State Aviation Officials (NASAO), has also endorsed the continuation of Loran-C.

The WGA will be presenting signed petitions to selected government officials in the U.S. and Canada in the near future. In the interim, we will be attending Fish Expo in Boston (mid-October) to obtain more signatures. If any WGA members plan to attend meetings where you can circulate petitions, please do so. I'll be happy to provide petitions and other information for your use.

In order to increase public awareness and generate mail-in support, Committee members have written articles/editorials and provided interviews for articles soon to appear in Pro Pilot, Sport Aviation, Private Pilot, etc.

Activities such as these have resulted in a substantial mail-in campaign. Well over 2,000 individuals have now written letters to various government officials listed in the last Goose Gazette. Since these letters have the most pronounced effect, the Committee is strongly urging all WGA members to send at least two letters, one to Admiral Kramek and another to Assistant Secretary Frank Kruesi. Mr. Kruesi is in a new position at DOT intended to coordinate all pos/nav policies, and his support is critical.

On the marine front, several other WGA members have generated articles and letters to the editor for boating and fishing publications. Bill Brogdon has played a key role in this effort, and is reporting his progress in another section of this issue.

In summary, we are beginning to get our concerns publicized and to have a positive impact in the continuation of Loran-C. However, it is vitally important that every WGA member does his or her part and continues the support effort. I would also urge everyone to attend the WGA meeting in Newport, share your ideas, and actively participate in these efforts.

I will provide another update at the annual meeting, and please be sure to mail your letters now. Thanks for your support.

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SYSTEM COMPARISONS

GPS

Accuracy 100 m horiz, 156 m vert; 95%
300 m horiz, 500 m vert;
99.99%

Repeatability 141 m horiz, 95%;
(424 m horiz. 99.99%)

Availability 99.7% to 95.8%

Coverage Worldwide

Time to notify of out of tolerance transmissions: seconds to several hours

RIAM availability 70% to 95%

Loran-C

Accuracy 500 yards, 2DRMS

Repeatability 20 to 90 m; 2DRMS

Availability 99.7%

Coverage U.S. + many world routes and countries.

Time to notify of out of tolerance transmissions: seconds to 1 minute

Within its coverage area, Loran-C exceeds the capabilities of GPS for repeatable accuracy and fault notification. With a one-time correction to positions within a one-degree square, its absolute accuracy is about 20 to 80 yards: **considerably better than GPS.**

IALA Membership

The Wild Goose Association is a member of the International Association of Lighthouse Authorities, a worldwide organization devoted to aids to navigation. IALA has developed systems which member nations use for buoys, beacons, lighthouses, sound signals, and radionavigation systems. For example, the United States follows IALA "System B" for visual aids to navigation: the familiar "red, right, returning."

By being an IALA member, WGA is able to remain a strong voice for Loran-C as a part of balanced radionavigation systems. IALA policy recommends both satellite and terrestrial systems operating simultaneously, for the many advantages with which we are all so familiar.

Loran Coverage Problem?

WGA member Jim Carroll wrote a fine letter to RTCA to correct an error in a summary of SC-159 meetings in the August RTCA Digest. RTCA noted, under WG-3B (Loran-C): developing MOPS for Loran-C augmentation to GPS. "Loran-C coverage may be a problem." We quote portions of Jim's letter:

"This statement greatly distorts the situation... In fact, Loran-C coverage in the CONUS ceased being an issue with the installation of the four mid-continent transmitters a few years ago.

"The real story is that the availability of a GPS approach navigation system improves by roughly a hundredfold when that system is augmented by Loran-C. This result is based on very detailed and controlled analyses conducted at the Volpe Center, using conservative parameters. That is, taking all airports together, GPS by itself has an availability of about 98.5%. The Loran-C (and barometric altimeter) augmentation improves this availability to 99.997%. This is a dramatic improvement and has the consequence of improving the approach availability of the vast majority of the 2300 CONUS airports to full, 24 hour, 100% availability. It is true that this leaves a handful of CONUS airports with unavailable periods of 36 to 48 minutes over 24 hours, but this cannot be compared to the thousands of airports which experience unavailability for much longer periods each day, using GPS alone. Loran-C reduces the GPS approach availability problem by a hundredfold."

Excellent work, Jim. More of us in WGA should be on the lookout to correct misinformation (or disinformation) about Loran-C. Please let us know when you see or hear bad information about Loran-C. It's up to us to do like Jim did; set the record straight. Do send copies of articles and your replies to WGA and to the Gazette.

International News

John Beukers has provided a number of news items from the international community:

The allocation of GRIs on a worldwide basis is now the responsibility of the IALA Radionavigation Committee under the direction of the IALA Technical Advisor. This is currently Peter Kent who is shortly to turn over the responsibility to Frank Holden. John Beukers is the WGA representative to IALA, serving on the IALA radionavigation committee.

The Far East Loran-C system (FERNs) members (CIS, China, Korea, and Japan) have agreed on the system GRIs. The rates chosen are not optimum but represent a compromise made necessary to accommodate certain existing equipment. A change at a later date can be expected as new equipment replaces old.

The C.I.S. issued its Radionavigation Plan on 15 April, 1994 under the signatures of the 12 States. The WGA was provided with copies of the plan, which calls for a complementary mix of terrestrial and satellite systems to satisfy land, sea and air transportation into the 21st century.

The Glonass program appears to be alive and well judging by the recent launch of 3 satellites and the promise of 3 more by year end. *Aviation Week* reports that the GLONASS program office is committed to an operational system in 1995, under a joint military/Minsitry of Transport agreement.

John Beukers wrote a letter to DOT Assistant Secretary Frank Kruesi describing the international concerns with radical FRP policy changes as expressed by the USCG at the FRP User Conferences last fall (See Winter 94 GG for USCG announcement) and the FAA announcement that MLS is being can-

celed. The letter emphasized the importance of consistency and continuity of the FRP since a number of nations rely on the document as an expression of official US radionavigation policy for coordinating their activities with the U.S. The contents of this letter were brought into the public domain by an article in *Aviation Daily* on August 24. We quote part of it here:

"The U.S. Federal Radionavigation Plan has been the international bible that many States have used for their own planning purposes. Their understanding was that this document reflected U.S. policy and that dates given were firm, and backed by Congressional commitment, especially the years given for transition periods. Recent events have knocked this document off its pedestal. ... the U.S. stands to lose its credibility in this major international discipline and along with it a potential loss of market share for products and services.

"This loss of credibility is already having an effect on the promises made for GPS (covered by no international agreements). It is now commonplace in the international community to hear the statement expressed that: 'If the U.S. can make radical changes in policy every two years, rescind published transitional periods and prematurely terminate radionavigation systems, what credence should be given to GPS longevity and transition period promises? How do we know that, just as we are going to operational GPS (or GPS supported GNSS), GPS won't be abandoned by the U.S. for some new-found technology, as has just happened with MLS?'"

Both nationally and internationally, the disappointment with the U.S. DOT runs deep and requires a firm hand at the helm of U.S. radionavigation policy to stabilize the situation and restore credibility. It is with anticipation that I look forward to seeing you provide this leadership."

CG Statement on Loran-C Phaseout

We've been looking for a high level USCG statement concerning early Loran-C phaseout, and now have found it. At the National Boating Safety Advisory Council, 16-17 May 1994, a Council member asked RADM Ecker (Chief, Office of Navigation and Waterway Services) to comment about the phaseout of Loran-C and its effect on boating safety. The following summary of RADM Ecker's next-day reply appeared in the meeting report; we substituted initials for some familiar titles.

"RADM Ecker responded to ... concerns about the phaseout of Loran-C by saying that we are also dealing with Omega in the same context. He said that this was also part of the multiyear budget strategy to cope with reductions. He indicated that Loran-C is operated by the Coast Guard for DOD and will no longer be needed overseas by DOD after December 31, 1994 because it is totally committed to GPS. For the past two years the Coast Guard has been either shutting down or turning the overseas stations over to host nations who will keep them in operation.

"The Admiral briefly described the FRP which is the vehicle establishing radionavigation policy in this country. It is a combined effort between DOD and DOT and is published every two years. The current plan calls for Loran-C to be around until the year 2015 while Omega

is scheduled to be around until 2005. As a result of a hearing while preparing for the 1994 plan it was apparent that both systems could probably be shut down earlier than originally projected.

"He feels that Omega will be closed by 1997 and Loran-C may go right after the turn of the century. Admiral Ecker told the Council that the big, hot item is now GPS. By 1996 it is expected to have a Differential GPS system in place for most of the U.S. which will be maintained and operated by the Coast Guard. The Admiral indicated in response to Mr. Villalon's concerns about DOD dropping selective availability (SA) that it is really not a problem. Even if SA was (sp.) turned off, DGPS will be needed to meet the accuracy requirements of all modes of transportation. With SA off, accuracy of 54 meters will be the best you can get. The accuracy requirements for the DGPS will be in the less than 10 meter range."

It is interesting that the Admiral claimed that the decision to shut both systems down early grew out of the FRP hearings. As you read the hearing statement printed in the Winter Goose Gazette, the Coast Guard presented Loran-C as a program that was difficult to support, with GPS coming on stream. Until the navigation community began to stress the folly of that idea, the future of U.S. Loran-C was indeed bleak.

Television Interference to GPS

Recent research by A. Dale Hutchinson and Dr. Jay Weizen of the University of Massachusetts Lowell for the MITRE corporation reported significant interference from commercial TV channels 10 and 66. Interference from the channel 10 transmitter near Providence, RI caused a hard-limited GPS receiver to lose lock on the signals within a 10 mile radius of the transmitter. Interference from channel 66 near Hudson, Mass. extended two miles. Airborne receivers may receive harmful

interference over a greater radius; transmitters near airports and harbors pose a potential threat to GPS receivers.

There are 57 TV stations on channel 10, and 9 stations on channel 66. The 32 stations broadcasting on channel 23 also pose potential interference threats to GPS. The interference comes from harmonics near the GPS C/A frequency used by civilian receivers. The interference comes from TV stations that are operating within the spurious emission requirements of 47 CFR Part 73.

GPS Non-Precision Approach Anomalies

The FAA approved a GPS stand-alone, non-precision approach for the Oshkosh air show in July, narrowly meeting the 100-meter accuracy requirement. The flight inspection team observed three anomalies during 45 approaches on 21 and 22 July, and four anomalies during approaches on 19 July. In some instances, the course deviation indicator (CDI) jumped to nearly full scale right for a couple of seconds, then full scale left, then returned to center. In one, the distance to go jumped by over a mile, then returned. One of the anomalies has been traced to a satellite error, but others remain mysterious.

The FAA has ruled out the flight inspection equipment as a source of these anomalies. Ohio University has agreed to investigate multi-path reflections over fresh water and frequency spectrum anomalies in the GPS L1 band.

The lack of continuous RIAM availability and the current lack of integrity monitoring raise serious concerns about GPS as a stand-alone navaid. The FAA has approved at least one receiver for aircraft use, even though the GPS constellation does not allow continuous RIAM. Approved receivers can merely provide an indication when RIAM is not available,

Funny how things change. Remember when the Bendix-King Loran-C airborne receiver experienced an anomaly in flight testing? The FAA notated all Loran-C non-precision approaches, and has yet to find a receiver to meet their specs. Now, with GPS, anomalies seem ho-hum.

NELS ASF Research

NELS is starting to develop a cost-effective ASF mapping methodology to improve the absolute accuracy of its Loran-C system. NELS regards ASF modeling as a necessary portion of Loran-C system costs.

DOD Issues GPS Signal Specification

The Department of Defense has issued the long-awaited Signal Specification for GPS Standard Positioning Service (SPS). There are some important changes to previous performance standards.

Accuracies are now stated as the percentage of time that position measurements are within the specified tolerance. This is R-95 rather than 2DRMS, yielding a smaller radius for an identical set of data. With the new definitions, the same weight is assigned to every fix outside the specified radius; whether it's one meter or 100 meters outside is immaterial. Navigators usually hold to the opposite viewpoint.

Horizontal accuracy is 100 m, 95%, and 300 m, 99.99%

Vertical accuracy is changed from 140 m to 156 m, 95%

DOD has acknowledged that the system with 100 m 95% horizontal accuracy gives 141 m 95% repeatability, not 100 m. This phenomenon isn't news, but the DOD announcement is. R.J. Wenzel and D.C. Slagle's 1983 report: Loran-C Signal Stability Study: Northeast and Southeast U.S. contains a thorough discussion of the reasoning behind it. (Combining the standard deviations of two uncorrelated sets of measurements by RSS) Prof. Borge Forsell of the University of Trondheim also reported this in a Professional Note on repeatable accuracy in the Spring, 1992 ION Journal. A gaggle of geese has pointed out these facts to DOT and DOD. We can infer that the 99.99% horizontal repeatability is 424 m. The vertical repeatability is 221 m, 95%.

The Signal Specification retains the relative accuracy +/- 1.0 m horiz. and 1.5 m vert., 95%, for receivers using the same satellites, computing simultaneously, and within 40 km of each other. A

footnote says that receivers not meeting these requirements may show relative accuracy approaching the repeatable accuracy (141 m horiz.) This confirms experience with different makes of GPS receivers on the same boat: simultaneous positions often differ significantly.

There are new definitions of accuracy, coverage, system availability, and system reliability. The percentages of available time are more believable than the "Availability Expected to approach 100%" and "Coverage: Worldwide continuous" of the 1992 FRP. The definition of Reliability changes from an estimate of the percentage of time that a specific number of satellites are operating to "Service Reliability" which incorporates a 500 m threshold to estimate the percentage of time that the system is providing valid information.

There is no discussion of Integrity in the Signal Specification. Some aspects of integrity are included in "Service Reliability."

The Signal Specification quotes extensively from Rob Conley's article *GPS Performance: What is Normal?* in the Fall 1993 issue of *Navigation*, the ION journal, but curiously enough leaves out that article's discussion of its *raison d'être* (integrity concerns), as well as findings about SPS velocity (0.32 m/s or 0.6 kt, RMS)

It also gives some conditions that a receiver must meet to achieve SPS accuracy. A receiver must use the satellites giving minimum PDOP; not all receivers do. A receiver must not experience more acceleration or jerk effects than a stationary receiver. The antenna must remain vertical. It's difficult or impossible to achieve these standards after you leave the pier.

MARINE MAGAZINES RESPOND TO USCG ANNOUNCEMENT

In the spring, WGA began a campaign of informing the boating public of the U.S. Coast Guard's announcement at the fall 93 Federal Radionavigation Plan User Meetings that they were "having a lot of trouble justifying Loran-C and Omega, in light of GPS," and requesting comments on the impacts if Loran-C were terminated in the year 2000 or earlier. Few editors, few people for that matter, attend the user meetings, and since the Coast Guard didn't announce this important policy change in their Weekly Notices to Mariners or in the Federal Register, few comments came in.

The marine magazine editors responded well to inform their readers of the potential early shut-down. Editors were adamant in supporting continued Loran-C coverage, citing widespread user investment in equipment and waypoint data. The following magazines printed editorials or notices of the proposed Loran-C policy change:

- Boating
- Boating World
- National Fisherman
- Ocean Navigator
- SAIL
- Salt Water Sportsman
- Soundings
- Yachting

In addition, we supplied information to a number of newspaper boating editors, who wrote columns on the subject of early Loran-C termination.

Elaine Dickinson of BOAT-US is a member of the Boating Safety Advisory Council, and thus was present when RADM Ecker made his statement on Loran-C as a follow up to another member's question. She published an article in BOAT-US Reports.

WGA plans a follow-up to these and other magazines to invite them to attend the WGA convention in Newport as participants or reporters.

FAA SUPPORTS LORAN-C PROGRAM

The Goose Gazette has obtained a copy of a message stating the FAA position on Loran-C approaches, as of last spring. (retyped)

Posted: Wed, Mar 23, 1994 2:32 PM EST
 From: AFS400/AFS.BB/AVR.BB/AHQ
 To: AFS400.BB
 Subj: LORAN-C

Msg: EJJE-610-1756

LORAN-C IMPLEMENTATION

PURPOSE. To provide Flight Standards with an effective resource to implement LORAN-C into the National Airspace System

RESPONSIBLE OFFICE. Flight Procedures Standards Branch, AFS-420, Best.

STATUS. Aviation blink (10-second flag) is being installed in the Loran-C transmitters by the Coast Guard. An aviation data collection network signal is being completed by the FAA with the last step being an interface through the VOR to the remote maintenance monitor sites.

Congress had required FAA to develop 125 Loran-C instrument approaches during FY 1993; 130 have been developed.

Some manufacturers have indicated that they will request certification of their avionics equipment for instrument approach procedures and begin marketing during 1994.

RTCA Special Committee 176 for Loran-C MOPS has recommended the adoption of course deviation indicator sensitivity similar to GPS technical standard order requirements. These are 0.3 nm in the final approach segment and 1.0 nm in the terminal area.

Area monitors of Loran-C have been installed approximately every 80-90 miles across the country to record variations in signal to determine suitability of airports for Loran-C approaches and to develop corrections for pilots while flying those approaches.

Approval has been given to initiate a "Phase I-type" overlay program for LORAN-C as requested by the Wild Goose Association (a group of LORAN-C enthusiasts). NASAO has offered to host a one-day conference on this subject.

March 1994

GPS Rumor Mill: Is SA Going Away?

In late August of 1994, high officials of the FAA and the Air Force hinted that GPS Selective Availability (SA) might be turned off in the relatively near future. Navigation equipment makers and users have asked (begged, we should say, to keep the relationship correct) DOD to remove SA and thus increase GPS accuracy.

The Air Force imposed selective availability in July 1990, and has since demonstrated the capability to adjust SA to various levels. When SA is minimum, civilian receivers have shown about +/- 40 meters horizontal accuracy, 95% of the time. That's about half the accuracy of a dual-frequency cryptographic PPS military receiver, and may be better than we can expect.

An accuracy of +/- 40 meters corresponds to repeatable accuracy (the ability to return to a measured position) of about 57 meters, considerably better than GPS has been delivering since achieving IOC. The change from 100 meters to 40 or 50 meters is more significant than might appear, since the SPS signals (100 meters) are distinctly non-random, making it impossible to improve accuracy or repeatability by the usual short-term averaging methods.

The hints about reducing Selective Availability come following the uproar about the Coast Guard's statements that they couldn't support Loran-C now that GPS is operational, and also following the marginal performance of GPS in non-precision approaches at Oshkosh.

We have no official confirmation of this rumor, but lots of hints. SA may be reduced during the Haitian crisis.

Wild Goose Association 1994 Convention

Newport, Rhode Island, October 31 to November 4, 1994

MED SEA News

The NELS newsletter for 18 July 1994 includes the following item:

"A meeting of the MED SEA LORAN-C Policy group was held in Brussels on June 30th and July 1st. The main objective of the meeting was to establish a draft agreement to be signed in September 1994 between the CIS, Turkey, Italy, Spain, and France and the European Union. This agreement consists of:

- a commitment of MED SEA LORAN-C host nations to finalize bilateral negotiations with USA (USCG) to continue the operation of LORSTA after the end of this year.

- an agreement to reach in 95 a solution for the upgrading and to complement the existing MED SEA LORAN-C chain with a view to ensure both coverage of the MED and BLACK sea, and all waters under the jurisdiction of the host countries with the LORAN-C signal.

- to have a whole coverage of the MED SEA, the implementation of an Iberian LORAN-C network would be necessary. Also, the authorities of Portugal will be invited to cooperate.

"Within the EU Policy, LORAN-C network is foreseen as a component of the TRANS EUROPEAN TRANSPORT NETWORK program. This program, agreed already by the commission of EU, should be carried out by both council and parliament by the beginning of 95.

"For the MED SEA, including Black Sea, and Iberian networks, technical studies and cost estimation have been carried out by France (DCN Brest)."

We hear that the EU, CIS, and the USCG are cooperating to replace the tower at Kargabarun, Turkey.

Coast Guard Navigation Center Opens

On 1 July 1994, RADM G. A. Pennington, Chief of the Office of Navigation and Waterways Services, commissioned the U.S.C.G. Navigation Center (NAVCEN) with Commander Tom Gunther as Commanding Officer. Since then Captain John Weseman, former Chief of Radionavigation Division in HQ, has been assigned as C.O. of the NAVCEN; Cdr. Gunther is the Executive Officer. The NAVCEN consolidates operational control of all Coast Guard radionavigation systems and incorporates the functions of the former GPS Information Center (GPSIC). The NAVCEN is the operational focal point for Omega, Loran-C, and the C.G. Differential GPS (DGPS) systems.

The LANTAREA Loran-C COCOs report to the NAVCEN, which has taken over all LANTAREA Loran-C functions. PACAREA COCOs continue to report to PACAREA; they will begin to report to the NAVCEN next year.

The NAVCEN also is responsible for gathering, processing, and disseminating timely system status and general information about GPS, DGPS, Omega,

Loran-C, and radiobeacons to U.S. and foreign users of the systems. It carries out this latter function through its Navigation Information Service (NIS), operating a computer bulletin board at 703-313-5910 and maintaining a 24-hour watch at 703 313-5900.

In addition to radionavigation information, the NAVCEN is providing Local Notices to Mariners, communications information such as WeatherFAX frequencies, and plans to open a boating safety forum on the computer bulletin board. For further information, call Master Chief John J. Mauro (NIS) at 703 314-5921. Address:

Commanding Officer
Navigation Center
7323 Telegraph Rd.
Alexandria, VA 22310-3998
703 313-5801

The Wild Goose Association had supported the idea to expand the name and mission of GPSIC to include information on all federally provided aids to navigation. This change represents a healthy consolidation of aids to navigation information.

NELS Timing

The 18 July NELS Newsletter discusses some of the difficulties in shifting from the traditional time delay/system area monitor synchronization to time of emission (TOE) control, which NELS plans to use beginning 31 December. NELS plans to synchronize transmissions within 100 nanoseconds of the time standard at Brest, France. This ambitious undertaking will provide enhanced capabilities for the Loran-C system, and is requiring the coordination of all concerned to be ready as the system shifts on 31 December.

Our Losses

We have received word that two of our members have passed away.

Vernon I. Weihe
Arlington, VA.

Philip H. Parsons
Laurel, MD

We extend our deep sympathies to the families and the many friends of our "fellow geese."

Wild Goose Association '94 Convention

Newport, Rhode Island, October 31 to November 4, 1994

REPLACE LORAN-C?

The Coast Guard seems to be proceeding on the assumption that GPS is a direct replacement for Loran-C: newer, more modern technology, worldwide, better. In fact, the CG has conducted extensive research on this matter as a part of the Loran-C Signal Stability Studies in the 1980s. We quote:

"... the repeatable accuracy of existing Loran-C is better than 40 meters, 2-drms, in 50% of the NEUS/SEUS coverage area. It is better than 80 meters in over 90% of the same coverage area. This means that GPS, at the 100 meter, 2-drms accuracy levels presently being planned for release to the public, does not qualify as a bona fide replacement for Loran-C."

"If GPS has to out-perform Loran-C in all major performance criteria (repeatable accuracy is certainly a major performance criteria) in most areas, then:

- The repeatable accuracy of GPS will have to be better than 40 meters, 2-drms.

- If the performance of the GPS system is degraded to the point at which the absolute accuracy of the system is worse than 28 meters, 2-drms then GPS cannot be considered a bona fide replacement for Loran-C as it exists throughout most of the NEUS/SEUS region."

"... In the above explanation, we established that for GPS, at least where the error is 'artificially induced,' repeatable accuracy is a factor of (the square root of 2) worse than the absolute accuracy."

Thus an absolute accuracy of 28 meters is equivalent to a repeatable accuracy of 40 meters. GPS with SA at the 100 meter level gives repeatable accuracy of 140 meters. This is much worse than Loran-C at 40 meters or so, in many regions of the coastal confluence zone. The report's authors are R. J. Wenzel and D. C. Slagle (Report No. CG-D-28-83, Government Accession No. AD A137628.) Available through NTIS, Springfield, VA 22161

LORAN/GPS Waypoint Program

Andren Software Co., 906 S. Ramona Ave., Indialantic, FL 32903, announces that their versatile software program to organize, store, and display waypoints in Loran-C, GPS, and Loran-A, is now available as an upgrade to a Windows version. The Windows version makes the program easier to use and eases compatibility with networks, printers, and monitors, according to Carl Andren (not the WGA treasurer), who wrote the program. The program is also available for DOS and Macintosh computers.

The Loran Program can display TDs with range and bearing from a selected point, TDs with latitude and longitude, or latitude and longitude with range and bearing. It can make high resolution maps with coastline files. The Windows version is much more flexible than the DOS version, with more data fields and display options.

The upgrade from version 3.0 to 3.5 is \$15; for versions 1.0 to 2.9 \$25. There are also high-resolution coastline files available for \$15 per area; the areas are relatively large. The complete program costs \$60.00 For further information call (407) 725-4115 in the evening.

Lighthouses of Newfoundland and Labrador

Yes, folks, there is navigation service at wavelengths of 600 nanometers or so, and also around 300 hZ. WGA member David John Malloy has written a new book about the lighthouses along the wild and magnificent headlands of Atlantic Canada, including their design, history, and operation. It has detailed accounts of ten of the oldest and most interesting lighthouses. Travel back in time to the stone and iron towers which have been so vital to safe navigation in this region. 160 pp, paperback, \$24.95 + \$5.00 shipping + 7% GST.

Breakwater
100 Water St, P. O. Box 2188
St. John's, NF Canada A1C6E6
1 800 563-3333 for orders

A Goose Bulletin Board?

The WGA is becoming more attuned to immediate problems and their need for rapid communications. The Officers' and Directors' FAX machines are hot, yet many members don't have the opportunity to keep up to date, or to add their valuable input. We would like to explore the possibility of operating a WGA bulletin board, primarily for items needing immediate attention. It would have been a big help during this year of crisis response.

The USCG NAVCEN bulletin board is a valuable source of information, but is primarily to provide information to users. It obviously isn't designed for private e-mail. Undoubtedly there are items, opinions, announcements that WGA members would like to send to the membership that would not fit the requirements of any other organization's bulletin board.

It would seem best to have the bulletin board somewhere in the center of the country to equalize long-distance costs. Or is it better to establish a forum on one of the many on-line services? If so, which one would serve the largest number of members? Is anyone interested in helping with this project? Let's discuss it during the Convention at Newport and see if it is possible, and if it would help our communications.

We're Looking For a Few Good On-line Communicators, Too.

The Wild Goose Association has barely begun to start reaching the many people who depend on the Loran-C system for their safety, their livelihood, or simply for making sailing, flying, or hiking easier and less hazardous.

Those of you who participate in on-line services like Compuserve, America On-Line, Prodigy, or Internet, please look for opportunities to post notices of our Convention and to spread the word about Loran-C: the world's most popular radionavigation system.

Terrestrial and Satellite System Capabilities and Limitations

In considering DOD and now USCG attitudes to Loran-C termination, it is important to remember that radionavigation has been dominated historically by military needs.

Land-based systems have limitations that make them less than desirable for U.S. military uses:

1. They rely on foreign-soil based transmitters.
2. They don't give worldwide coverage (Loran-C; Omega does).
3. They don't provide altitude information.
4. They don't provide time.
5. Their accuracy with respect to WGS-84 is less than GPS accuracy.
6. They don't provide immediate velocity information.

These limitations have led DOD to eliminate the requirement for overseas land-based navigation systems. On the other hand, these military limitations are unimportant to U.S. civil users. GPS altitude, for example, is insufficiently accurate for aircraft use, and uninteresting to marine navigators. Users have other sources of time. Civil users rely more on repeatable accuracy than on predictable accuracy, and find that Loran-C gives smaller errors than GPS.

GPS also has some obvious military limitations:

1. GPS availability is about 0.997, averaged over a day, with 4 satellites in view. It decreases below 0.95 at times.
2. GPS integrity is degraded by the 30 minutes to an hour that may elapse prior to detecting certain system errors.
3. GPS signals are stopped by vegetation, buildings, and by the sea surface.
4. GPS is susceptible to accidental and hostile interference.
5. GPS predictable accuracy with respect to WGS-84 is degraded by the inaccuracies of available charts, maps, and chart datums. This is true for both

weapons delivery and navigation, and will take many years to correct.

6. DOD doesn't consider GPS suitable for sole-means navigation of valuable resources, but will integrate GPS with inertial, altimeter, and other sensors.

7. GPS can provide great advantages to hostile forces. The Joint DOD-DOT Task Force Report states: "In particular, maintaining the ability to deny to an enemy in time of conflict a significant military benefit from GPS signals will remain a central objective in the national management of the system."

Civil users share limitations 1-6, but marine and air users are seldom affected by number 4 (shadowing). Civil users are particularly sensitive to limitation 7, which drives deliberate accuracy degradation. If DOD reduces the GPS accuracy in a crisis, U.S. military users will be unaffected, but civil users worldwide will be in deep trouble--especially those who have no alternate radionavigation system.

Civil users have an additional limitation from (SPS) GPS: its low repeatable accuracy. Not having access to the PPS, they are left with repeatable accuracy of about 140 meters.

The logic that leads DOD to eliminate the requirement for overseas Loran-C land-based systems as a cost savings is quite different from the logical steps needed to select the best combination of radionavigation systems for civil needs.

Civil navigation needs and the costs to civil users are important aspects of the national cost of radionavigation systems. Neither DOD or DOT have exerted a recent effort to determine the numbers of Loran-C users, much less determine their uses of the systems, their needs, and costs. For example, the Joint DOD-DOT task force ignores the

need for fishermen to navigate close to net snags, to find fixed gear pots in limited visibility, and to trawl without overlaps or gaps. It only discusses the 8 to 20 meter "requirement" for ships in channels. For finding pots and avoiding snags, Loran-C is superior to GPS, and DGPS will be superior to either Loran-C or GPS.

Omega has an important segment of civil users who deploy meteorological instruments to measure upper air conditions. Their costs will increase if they must use GPS.

DOD plans to retain control of GPS and operate it as a force multiplier, a weapons delivery system. For these purposes, it is unmatched. Yet the Joint DOD-DOT Task Force states, referring to "degrading civil use of the GPS system beyond that specified in the FRP": "the economic impact on U.S. civil users and the potential international political impact of such an occurrence make the event virtually inconceivable."

The action is not only conceivable, it is stated as policy earlier in the same report. This is a major inconsistency.

The navigator's tasks remain to find the aircraft or vessel position, and to go safely to a destination. A system that fails or gives erroneous information doesn't alter those requirements; it makes them more difficult. Every system yet invented sometimes fails, or gives erroneous data. A navigator spends much time and money on backup navigation methods and equipment. Failure to use backup methods isn't just a gap in coverage; it can lead to a grounding or a smoking hole. KAL-007 is a perfect example of an aircraft that depended on a single navigation system (in triplicate) yet went far off-course.

Capt. Bill Brogdon

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Policy Excerpt from the 1992 Federal Radionavigation Plan:

“Any decision to discontinue Federal operation of existing systems will depend upon many factors including:

- (a) resolution of GPS accuracy, coverage, integrity, and financial issues;
- (b) determination that the systems mix

meets civil and military needs currently met by existing systems;

- (c) availability of civil user equipment at prices that would be economically acceptable to the civil community;
- (d) establishment of a transition period

of 10-15 years; and
(e) resolution of international commitments.”

Sounds wise; lets hope it continues. -ed

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