



The Goose Gazette

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

Volume 94-1 - News of the Winter, 1994

President's Message by Dale Johnson

Today we see technology advancing at such a rapid rate that we often hear the terms "ballistic" or "explosive" used to describe it. I am sure that the next few years will be pivotal in developing a worldwide positioning system mix that will serve all modes of transportation for the next four or five decades.

The facts today indicate very strongly that Loran-C and/or Chayka will be an important part of the system mix for as far as we can see into the future. Loran/Chayka and the Global Navigation Satellite System (GNSS) offer a perfect hybrid partnership because the partners have no common limitations or vulnerabilities. The buzzword "seamless" is appropriate as technology continues to shrink the globe. We have a navigation system mix within our reach that will serve the entire world, as soon as the institutional issues can be resolved. Cost is more critical than ever before as governments struggle with economic problems.

Reports at the recent Federal Radionavigation Plan (FRP) users conferences made it clear that there is strong support for Loran from a large user community. Steve Brown, V.P. of the AOPA, reported that in a survey in August 1993, 70% of their members have Loran in their aircraft and most of the remaining 30% plan to install Loran within two years. The survey indicated that 5% of the membership have GPS now and 65% plan to install GPS in the next two years. This survey gives a clear indication that General Aviation pilots like the belt and suspenders approach with both systems available.

An FAA report given at the FRP meeting stated that augmentation of the GPS system will be required to meet all-weather aircraft precision approach criteria, even if selective availability (SA) is turned off. So, the argument for pressuring the DoD to turn SA off is a moot point. Differential GPS will be required; therefore, ground-to-air digital data communication is required. I am sure that digital data communications for a wide range of applications, including air-to-air information sharing, will become as commonplace in the very near future. This will dramatically increase reliability and the capacity of any frequency, to say nothing of minimizing human blunders.

Information presented in a paper entitled "Eurofix" by Lambert J. Beekhuts and Durk van Willigen of Delft University of Technology in The Netherlands, at the 1993 WGA symposium indicates Loran may be a good candidate for transmitting DGPS corrections to aircraft receivers. It appears that the viable options are (1) satellite communications, (2) a dedicated VOR frequency, (3) 1030 Mhz

(transponder frequency), or (4) Loran. In fact, some combination of two dissimilar options would be best. The satellite solution is elegant but expensive. VOR and 1030 MHz are line-of-sight limited, making them unusable for instrument approaches to some airports in mountain valleys. Since Loran is in place, with transmitters accessible on the ground, and not line-of-sight limited, it may be a cost effective datalink option.

A combination of Loran and Mode S or VOR frequencies is probably the best solution. Data capacity is a serious concern. Mode S frequencies do offer the option of providing collision avoidance data, weather data, NOTAMS and air traffic management data on one carrier if the capacity proves to be available.

RTCA Special Committee 176 is in the final process of updating DO-194 "Minimum Operational Performance Standards (MOPS) for Airborne Area Navigation Equipment Using Loran-C Inputs" to optimize Loran for aviation uses, based on experience gained over the past eight years. This document will be referenced by RTCA SC-159, Working Group 3 to develop a MOPS for GPS augmented by Loran.

Misinformation and misunderstanding is widespread. Many people think of Loran as old technology that is being replaced by GPS. In fact, Loran offers the best option for GPS augmentation as a hybrid partner and a capable backup in the event of GPS equipment failure. Even if GPS were perfect, I don't know of any pilot who is willing to rely on one system with no backup. Loran is the only option capable of providing an equivalent and affordable system to back up GNSS/GPS. Recently I have heard talk in Washington, DC about shutting down VOR stations as they age and become costly to maintain. The General Accounting Office has requested the FAA Administrator give them an estimated time frame for eliminating this O&M cost.

Some people have assumed that because the DoD is discontinuing its use of Loran, the transmitters will be shut down. Almost all of the off-shore Loran stations are being turned over to host nations for continued operation. Loran coverage is being improved in the North Sea, Baltic Sea and in Western Europe. Eastern Europe, Russia, China and Korea are also expanding Loran coverage.

The Central Pacific Loran Chain was shut down because it was no longer in use by the Navy. Its purpose was to provide position fixing for the US Navy in their training area.

Loran has more uses today than ever before. It is important that the users and system operators of Loran recognize its growing value. To fulfill our responsibility as a Loran advocacy group, we must be alert to correct the spread of misinformation when we see it and encourage the improvement of Loran for the 2 million users that have been using it for many years.

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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Receiver Certification Update

Arnav Systems, Inc. is in a joint venture with Benson Airlines of Missouri. Arnav will supply their FMS 5000 navigation receiver to the Branson fleet which serves Point Lookout in southwest Missouri. The FMS 5000 includes a loran receiver. A major portion of Branson's business involves flying country and western music fans to the Branson Music Theater. Point Lookout does not at this time have instrument approach capability. Branson projects that the costs of installing and operating the FMS 5000 will be recovered if only one flight per aircraft per year can complete a loran-aided approach which would otherwise have been diverted.

In return, the airline will supply and instrument one of their aircraft with the FMS 5000 receiver so that FAA certification tests can be conducted. Loran certification testing is expected to begin in January or February 1994. The Volpe Center will support this activity by installing an EIP monitor at Point Lookout to provide loran approach integrity until automatic blink is made available by the Coast Guard.

CYCLE SLIPS: The Spring issue (2-93) was mislabeled 1-93, "Winter" on page 1. Delays in this issue have been due to an illness and death in the Editor's family.

In order to get back in synchronization with the calendar, this will be the Winter, 1994 issue, Volume 1-94.

We also "built" two towers at Cape Race; in fact the station went on-air in August with the new 850' tower.

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.

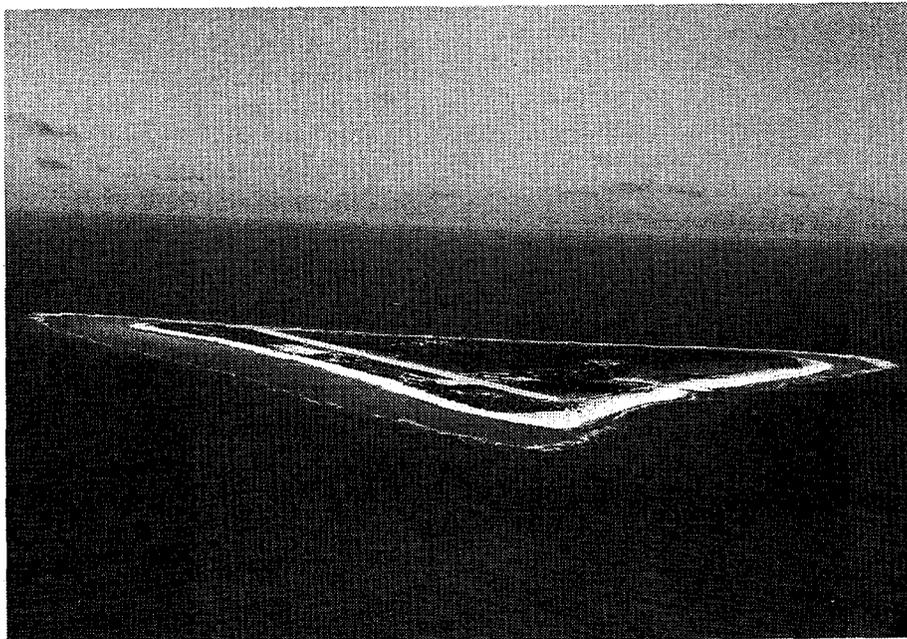
Associate membership is provided for organizations which desire only to receive WGA publications. Associate membership is \$105.00 for the first year and \$100.00 annually thereafter, and does not carry the privilege of voting or holding WGA office.

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

USCG Turns Marcus and Iwo Jima Over to Japan

The U.S. Coast Guard turned over control of Loran-C Transmitting Station Iwo Jima to the Japanese Maritime Safety Agency on 29 September 1994, and turned over the Marcus Island Station the following day. This closed 49 years of USCG loran operation on Iwo Jima, the site of the fiercest island battle between the two nations in WWII. The U.S. DOD requirement for overseas Loran-C has expired as GPS comes on line, but Japan and many other nations are unwilling to rely solely on a U.S. controlled system. Japan plans to replace the obsolescent Type 45 transmitters with solid state equipment.

The USCG turned over Loran-C Stations Hokkaido and Gseashi in July. Japan is involved in talks with Korea, China, and the C.I.S. to enhance Loran-C in east Asia. These talks open the possibility of enhanced, multinational Loran-C operations.



Loran-C/GPS Availability

Recent work at the Volpe Center has shown that a combination Loran-C/GPS navigation system can meet and in most cases exceed the integrity requirements for sole means systems. GPS alone has an availability of 94.7% in the CONUS, and 99% when supplemented by a barometric altimeter. When Loran-C is combined with GPS, and loran augments GPS by using its transmitters as GPS pseudolites, availability exceeds 99.997%, making this combination a highly robust and cost effective navigation system which can provide instrument capability to thousands of airports now lacking it.

This result means that only three out of 100,000 approaches will have to be aborted because of lack of availability of Loran-C or GPS. The analysis further indicates that Loran-C improves GPS integrity at least tenfold for up to four simultaneous GPS satellite failures.

In a related study, it was again confirmed that Loran-C can use the same approach geometry and cockpit display instruments now allowed for GPS. In particular, the Course Deviation Indicator full scale deflection can be scaled to +/- 0.30 nautical miles.

U.S. Coast Guard Considering Drastic Cuts in Loran-C Life

Severe Budget Cuts and GPS Fervor Behind Effort to Gut Loran-C

The U.S. Coast Guard, at the highest levels, is rapidly abandoning the Loran-C system during the current budget crisis. Never mind the promises, the written policies, the reassurances on which you have based expensive business decisions. Never mind the one million plus users, whose installed equipment costs far exceeds the Coast Guard's capital investment in Loran-C. Never mind that the Federal Radionavigation Plan establishes "a transition period of 10-15 years," and states that the Loran-C system will operate "through the year 2015." None of this means diddle.

What is important is that the Coast Guard can succeed in the budget cutting game by abandoning a unique national resource, and the users can go hang. The Coast Guard has been sending out trial balloons since Admiral Kime mentioned an early shut-down of Loran-C at a speech in San Diego. WGA sought clarification and got assurances that

Loran-C will continue in operation as scheduled. The CG shut down the Hawaiian chain in 1992 with little fanfare and little objection and is working to shut Angissoq down early. A Coast Guard spokesman at the fall 93 Radionavigation User Conferences asked for input on the impacts if Loran-C were terminated in the year 2000 or earlier. Now the Coast Guard is not seeking the funding necessary to keep the domestic system healthy. The latest ploy: Does anyone want to buy the Loran-C system?

An early shutdown would be a major abrogation of the Coast Guard responsibility to provide civil radionavigation aids under Title 14, USC. Just leave the civil radionavigation users to the tender mercies of DOD. Remember that the DOD-DOT Joint Task Force on Civil Use of GPS did not include, invite, or allow a civilian participants. And to think we trusted you. See page 5 for more information.

Federal Radionavigation User Conferences

The U.S. Department of Transportation's Research and Special Programs Administration (RSPA) sponsored the 1993 Radionavigation Users Conferences in November and December 1993. These public meetings are held every two years as part of the preparation cycle of the biennially-published Federal Radionavigation Plan. The meetings provide a forum for users, manufacturers, and others to provide comments on Federal radionavigation system operating plans and policies. Representatives from RSPA, Department of Defense, Federal Aviation Administration, U.S. Coast Guard, and Federal Highway Administration presented current and proposed operating plans for radionavigation systems and answered questions from the audience. User comments will be used in preparation of the 1994 Federal Radionavigation Plan.

The first conference, held on November 9-10 in Washington, D.C., attracted over 170 participants from a wide range of aviation, maritime, and land user organizations and industries as well as surveying, mapping, timing, and meteorological users. The second conference, in Columbus, Ohio, drew about 60 attendees, including represen-

tatives from Ohio, Wisconsin, Michigan, and Illinois state departments of transportation and aviation; avionics equipment manufacturers; general aviation pilots; and representatives from the mapping, surveying, meteorological, and communications network synchronization professions. The third conference, held in Seattle, Washington, drew about 75 participants, including port authorities; marine equipment suppliers; boat owners and operators; representatives from Boeing Corporation and Alaska Airlines; private pilots; and representatives from U.S. EPA, U.S. Forest Service, and Transport Canada.

Highlights of the comments include strong indications of established use, acceptance, and support of the Global Positioning System (GPS); strong and pervasive support for continuation of Loran-C; support for combined use of GPS and Loran-C, and use of Loran-C as a backup for GPS; and support, primarily by the meteorological community, for continuation of Omega service.

Submitted by Elisabeth J. Carpenter
Volpe National Transportation
Systems Center
Cambridge, MA
January 12, 1994

India Joins Loran-C Community

The Director General of the Department of Lighthouses and Lightships, Ministry of Surface Transport, Government of India, recently sent the following letter to the Wild Goose Association:

4th of January 1994

Dear Sirs:

I am glad to inform you that the Department of Lighthouses and Lightships has established two Loran-C Chains in East Coast and West Coast of India and the Chains are fully operational. Thus my country has the privilege of joining

the Loran-C Community which I understand is represented by your esteemed organization.

Two of my officers have made a paper on Modification of the Aerial Masts carried out by them to improve the performance of the Loran-C Chains. I shall be grateful if you can publish this paper or get it published in any forum you consider suitable for the benefit of the Loran-C Community.

Yours sincerely,

(A. R. Acharajyya)
Director General

Meetings

IEEE PLANS '94

IEEE has announced the call for papers for the Position Location and Navigation Symposium (PLANS '94) to be held 11-15 April 94 at Bally's Hotel, Las Vegas, Nevada. The technical program has been expanded by 33% to offer a wider variety of topics than in the past. There are 24 technical paper sessions and two half-days of tutorials. For further information contact:

Ms. Julie Mevers - MS 104-M
PLANS '94
11601 Roosevelt Blvd.
St. Petersburg, FL 33176-2202
(813) 579-6128 FAX (813) 579-6027

Hydrographic Conference '94

The NOAA National Ocean Survey, the USCG, the Oceanographer of the Navy, DMA, the Hydrographic Society of America, and the International Federation of Surveyors (FIG) are sponsoring the Sixth Biennial International Hydrographic Conference 19-23 April 1994 at the Omni International Hotel, 777 Waterside Drive, Norfolk, Virginia. The theme of the conference is "Marine Information Partnerships." Abstracts of papers are due by 15 Oct. 93 to:

U.S. Hydrographic Conference '94
P. O. Box 732
Rockville, MD 20848-0732

For further information call CDR George Leigh (301) 713-2783 or FAX (301) 713-4019

1994 SEL Users Conference

The Space Environmental Laboratory (SEL) conducts research in solar-terrestrial physics, develops techniques for forecasting solar and geophysical disturbances, and provides real-time 24-hour service to users in government and industry. SEL's Space Environment Services Center (SESC) in the national and world center for monitoring and

More Meetings

forecasting disturbances that can affect people and equipment working in the space environment.

SEL will host a Users' Conference in Boulder, Colorado May 3-5, 1994, at the Department of Commerce Boulder Laboratories, where SEL is housed. There will be a reception the night before, so please plan to arrive by May 2. The conference will finish by noon on Thursday, May 5.

The conference theme is Past, Present, and Future of space environment services and their impact on you. SEL is planning the presentations now; they will be both interesting and vitally important. For more information concerning the Conference (Registration Fees, Reservations, etc.) please contact SEL Customer Focus Group
R/E/SE
325 Broadway
Boulder, CO 80303-3328
ph (303) 497-3992

ION 50th Annual Meeting

The Institute of Navigation will hold its 50th annual meeting at the Doubletree Antlers Hotel, Colorado Springs, Colorado June 6-8, 1994. Its theme is "Partnerships for Technology Conversion," emphasizing the need to reevaluate technology development and emphasize projects that have "dual-use" applications, military and commercial. The purpose of the meeting is to present dual-use technology and current programs for partnership and technology conversion. Program Chair: Dr. Alison Brown, NAVSYS Corporation, 14960 Woodcarver Rd., Colorado Springs, CO 80921 (719) 481-4877; FAX (719) 481-4908

International Navigation Association

Incorporating the International Omega Association

The INA will hold its 19th Annual meeting 1-5 August, 1994 at the Latham Georgetown Hotel, Washington, DC, with the theme "Managing Global Radionavigation Services: Who Benefits? Who Pays?" Contact James Bethea. (818) 226-2057 FAX (818) 226-2835

INSMAP 94

The 1994 International Symposium on Marine Positioning will be held at Institut fur Erdmessung, University of Hannover, Hannover, Germany 19-23 Sept. 1994. The Symposium is to focus attention on special problems associated with positioning in a marine environment. Technical Chairman: Prof. Gunter Seeber, Inst. fur Erdmessung, University of Hannover, Hannover, Germany. 49-511-762-2475; FAX 49-511-762-4006

ION GPS-94

The Satellite Division of the ION will hold its 7th International Technical Meeting at the Salt Palace Convention Center, Salt Lake City, UT, 20-23 September 1994. The theme is "GPS Goes Operational: Applications and Technology." Submit abstracts by 15 April to the Program Chair: Dr. Richard Greenspan, Draper Laboratory, 555 Technology Square, Cambridge, MA 02139-3563. (617) 258-4041; FAX (617) 258-4444

Coast Guard Statement on Loran-C

The U. S. Coast Guard is sending out messages that they are considering cutting off Loran-C much earlier than the announced date of 2015. The following information is excerpted from the USCG statement at the 1993 Radionavigation User Conferences:

"Our program office is having a lot of trouble justifying Loran-C and Omega, in light of GPS. A lot of people look at GPS as being able to meet all civil needs.

"The Coast Guard, as part of DOD, participates in radionavigation planning with DOD. DOD and DOT have joint responsibility to avoid unnecessary overlaps or gaps between civil and military radionavigation services.

"Both military and civil needs must be met in a manner cost-effective for the government and the civil user community. As described in the 1992 version of the FRP, 1996 stands as the current decision point as to what the future will be for the U.S. operated Loran-C system. Considering the current rapid development and expanding use of the GPS in the civil community, this decision may be made before 1996.

"If GPS can meet all civil radionavigation needs previously satisfied by Loran-C, then the FRP developed for 1994 may very well reflect a different decision point -- perhaps earlier than 1996. We are interested in your comments on the role Loran-C should play in the future radionavigation system mix. For point of discussion this afternoon, you may also want to consider what your operational and economic impacts would be if Loran-C was terminated in the year 2000 or earlier.

"I must emphasize that this data is for discussion purposes only. It does not represent decisions already made."

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."

Wild Goose Association The International Loran Radionavigation Forum

The 22nd Annual Convention and Technical Symposium of Wild Goose Association in Santa Barbara, California, 18 - 21 October, 1993 had the theme: "GNSS and Loran-C - Partners into the 21st Century". At the conclusion the following Resolution was drawn up and approved by the members present and the Board of Directors.

RESOLUTION

Considering:

- a. The formal material presented during the Technical Sessions and discussions relating thereto.
- b. The Panel debate "Loran/GNSS Interoperability - The Future of Radionavigation - is the U.S. Listening?"
- c. The substance of informal meetings and discussions relating to the future mix for a Global Navigation System (GNS).

Noting:

- a. The Continental United States enjoys complete territorial and coastal coverage of an operational Loran-C system for use on land and water and in the air.
- b. The deliberations of RTCA Special Committee 159 for the development of Receiver Minimum Optimum Performance Specifications for GPS augmented with Loran-C for sole-means navigation in U.S. national airspace.
- c. The international acceptance and expansion of Loran-C by States assuming responsibility for U.S. Loran-C assets under U.S. Circular 175 authority.
- d. Progress with the Northwest Europe Loran-C initiative and agreement for the reconfiguration and expansion of Loran-C in Northwest Europe (NELS).
- e. Progress in the Far East for cooperation and expansion of Loran-C and the Russian equivalent, Chayka, under and agreement between China, Korea, Japan, and Russia (FERNS).
- f. The expressed interest of other States in Asia and the Pacific Rim to join the FERNS activity.
- g. The continuing work to extend coverage of the Russian Chayka system within the CIS.
- h. Agreements between Russia and surrounding States for the cooperation and combining of Loran-C and Chayka.
- i. Progress in discussions between States directed toward entering Loran-C agreements in the Mediterranean, Iberian Peninsula and surrounding areas.

Recognizing:

- a. The worldwide interest in civil satellite positioning technology.
- b. The growing worldwide use of the United States Global Positioning System.
- c. The forming of a global navigation satellite system office in Europe by the International Association of the Institutes of Navigation.

- d. The existence and on-going preparation of independent State Radionavigation Plans developed with full cognizance and consideration of the United States Federal Radionavigation Plan.

Recognizing Also:

- a. That an international organization to coordinate and implement a multimodal Global Radionavigation System (land, sea and air) does not currently exist.

RESOLVES:

- a. The United States Government agencies responsible for the development of the 1994 FRP are urged to take into account international trends in global radionavigation, and in particular, worldwide expansion of Loran-C and Chayka, and the growing implementation of the Loran-C/Chayka intermix. To that end, and to eliminate uncertainty among the international community, it is further urged that any reference in the FRP regarding a "decision" in 1996 on the future of Loran-C be removed, since it has been publicly announced that the Loran-C system will remain in place until at least 2015.
- b. The United States government should give due consideration to the worldwide use of Loran-C and the system's role complementary to satellite navigation within the United States territorial boundaries.
- c. The United States government is urged to continue recognition of the national Loran-C asset and to recognize the system's role as an integral component of the Global Navigation System and as a complement to GPS.
- d. The international radionavigation community is encouraged to work with State governments in directing an effort to set up an appropriate international organization to coordinate the implementation of a multimodal Global Navigation System.
- e. The United States Government be urged to identify and appoint an appropriate government agency to facilitate becoming a party to the above international organization using the established Circular 175 procedures.

RECOMMENDS:

Bringing this Resolution to the attention of the United States Secretary of Transportation and to international organizations such as the International Association of Lighthouse Authorities (IALA), member Institutes of the International Association of Institutes of Navigation (IAIN), the Northwest Europe Loran System Coordinating Office (NELS), the Far East Radionavigation System Committee (FERNS), the Internavigation Committee of the C.I.S. (IRN) the International Maritime Organization (IMO) and other organizations as deemed appropriate.

WILD GOOSE ASSOCIATION AWARDS

Awarded at the the WGA Convention, 19 and 20 October, 1993.

MEDAL OF MERIT 1993

JAMES F. CULBERTSON

The Medal of Merit of the Wild Goose Association is awarded to Captain James F. Culbertson, USCG (ret.) in recognition of his significant contributions to the development and fostering of loran for over thirty years. During his Coast Guard career, Jim held various engineering and management positions involving loran, and was a leader in its development and implementation. Since his retirement from the Coast Guard, Jim has continued to be a major contributor to the loran community through his efforts as a Director, Vice-President, and President of the WGA.

MEDAL OF MERIT 1993

LEO F. FEHLNER

The Medal of Merit of the Wild Goose Association is awarded to Leo F. Fehlner in recognition of his significant contributions to the development and fostering of loran. These contributions span from 1966 to the present and encompass the period of Loran C/D development/application to precision aircraft guidance and use in a common grid system, followed by efforts to refine loran transmission and receiving techniques to achieve the inherent high accuracy of the loran system.

1993 PRESIDENT'S AWARD

ROBERT H. ERIKSON, FAA Technical Center: for his continuing contributions to the Loran-C System and the FAA's implementation program.

1993 PRESIDENT'S AWARD

TERRY PEARSALL, Technical Products, Ltd.: for his contributions to airborne Loran-C and hybrid-system standards, including his role in RTCA Special Committees.

BEST LORAN PAPER AWARD 1993

"Loran-C Receiver Performance in the Presence of Carrier-Wave Interference" **YI BIAN** and **DAVID LAST**

STUDENT PAPER AWARD - 1993

"An Improved Cycle Identification Algorithm" **ANDRE NIEUWLAND**

STUDENT PAPER AWARD - 1993

"Realtime Mitigation of GPS SA Errors Using Loran-C" **SOO Y. BRAASCH**

OUTSTANDING SERVICE AWARDS:

JOHN M. BEUKERS as General Chairman of the 1992 Convention

MAURICE J. MORONEY as General Co-Chairman of the 1992 Convention

JOHN D. ILLGEN as Chairman of the 1992 Technical Symposium

DAVID LAST as European Co-Chairman of the 1992 Technical Symposium

FRANK CASSIDY as U.S. Co-Chairman of the 1992 Technical Symposium

WILLIAM BROGDON as Editor, WGA Newsletter, The Goose Gazette, 1992-1993

ROBERT W. LILLEY as President of the Association, 1992-1993

Loran Early Implementation Monitors

As of December 29, 1993, all 12 Loran EIP monitors continue to be fully functional. This includes annunciator boxes at the approach control centers which regulate traffic into the airports within 90 nautical miles of the monitor. The boxes display a green light to indicate that loran may be used for nonprecision approaches, and a red light if there is no reliable loran navigation. The monitors consist of a receiver, a microprocessor and modem, the annunciator boxes, and phone lines. System status can be monitored remotely by phone, and loran data can be received. The USDOT/Volpe Center in Cambridge, Mass. upgrades and maintains the monitors.

Operational Loran EIP monitors:

Portland, OR
Columbus, OH
Burlington, VT
Orlando, FL
Utica, NY
Lansing, MI
Lakefront, LA
Leesburg, VA
Lafayette, LA
Millville, NJ
Bedford, MA
El Paso, TX

Roughly 130 approaches now exist within the 90 nautical mile radius of these monitors. NOTAMS currently suspending the use of loran navigation for these approaches will be lifted as soon as a loran receiver obtains the Supplemental Type Certificate allowing nonprecision approaches. It should be noted, however, that aircraft *with receivers approved for the EIP* can make these nonprecision approaches now.

Wild Goose Association '94 Convention

Newport, Rhode Island, November 1-4, 1994

LOCUS Investigates Loran Transmitter TD Instability

Authors: Paul W. Schick and Thomas P. Blandino, Project Engineers at LOCUS, Inc., 1842 Hoffman St., Madison, Wisconsin. 53704 (608) 244 0500

Using new linear averaging digital (LAD)-LORAN receivers, we have learned that older, tube-based LORAN transmitters can contribute a substantial amount of TD noise to signals available to receivers based on this technology. First we consider data from the newer, solid-state transmitter in Baudette, MN, which is dual-rated as 8970Y and 8290W. Figure 1 shows a January 5, 1994 overnight TD recording made in Madison, Wisconsin from 1700 to 0900 hours, with TD divisions of +25nS on the ordinate. The figure illustrates 8970Y time of arrival (TOA) minus 8290W TOA, with the receiver's averaging time set at 60 seconds. Since those two rates are on the same tower (Baudette, MN), ASF and other effects cancel out, leaving only noise components and four local phase adjustments (LPAs) (a, b, c, d). From these data, we cannot determine which LPA is associated with which TD. In the worst possible case, all four LPAs could be associated with one TD.

Figure 1.

16 hour, overnight TDs determined from 8970Y TOA minus 8290W TOA.
Note four LPAs (a,b,c,d) of approximately 20nS (a,b and c) and 40nS (d).
LAD-LORAN LRS receiver averaging time set at 60 seconds.

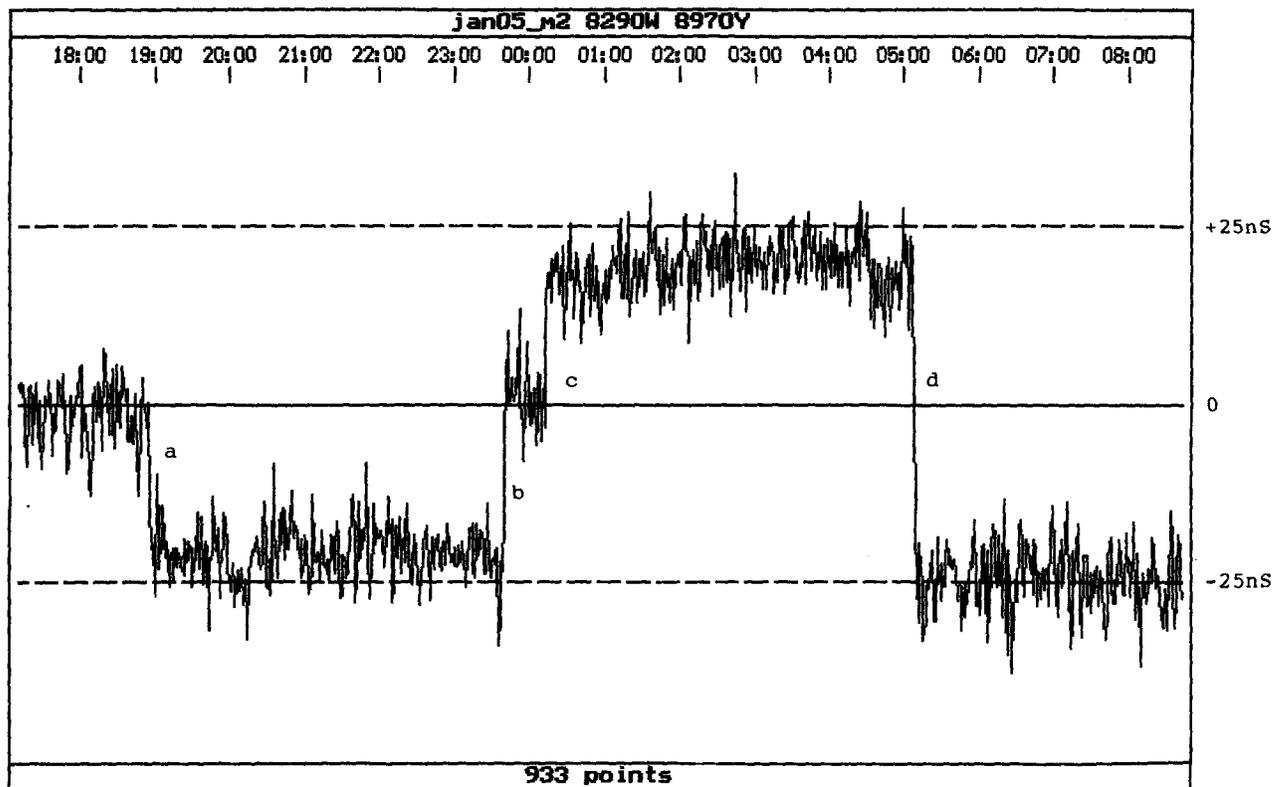


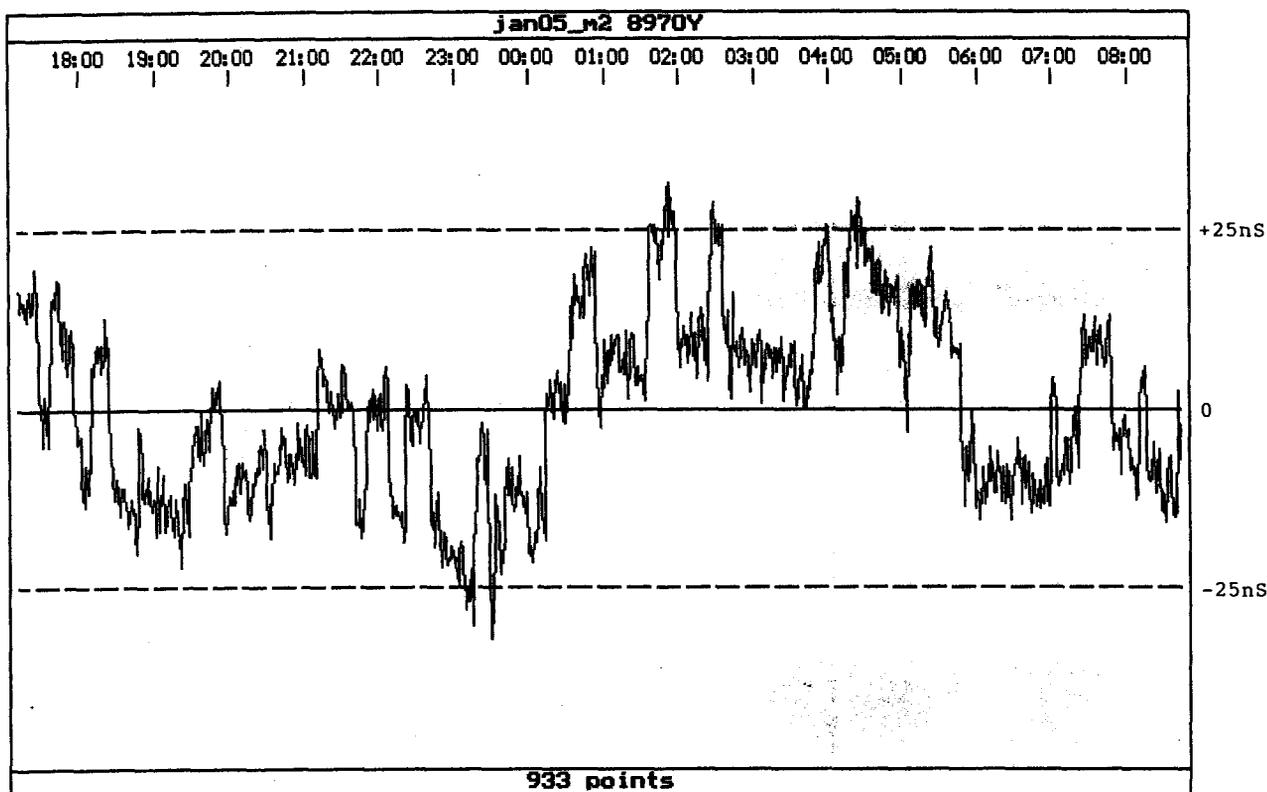
Figure 1. 16 hour, overnight TDs determined from 8970Y time of arrival minus 8290W TOA. Note three LPAs (a,b, and c) of approximately 20 ns and one of approximately 40 ns (d). LAD-Loran receiver averaging time set to 60 seconds.

Loran Transmitter TD Instability (continued)

Figure 2 shows data derived from the same recording, and illustrates the 8970Y TD, which is 8970Y TOA minus 8970M TOA. 8970M (Dana, IN) is an older, tube-based transmitter. Using the same +25nS divisions on the ordinate, it is evident the basic background noise seen by the receiver is about 2.5nS RMS. However, this background is clearly dominated by TD shifts and oscillations of approximately 20nS. Based on these (and additional) data, we speculate these jumps/oscillations are in the 8970M transmitter timing controller. The controller attempts to adjust the transmitter based on some interpretation of the antenna current pulse, and it is presumably "hunting" about the correct value.

Figure 2.

8970Y TD data derived from 8970Y TOA minus 8970M TOA and taken from same recording as Figure 1. Note numerous TD shifts/oscillations of approximately 20nS, and background noise of approximately 2.5nS RMS.



These data indicate the USCG's planned electronic equipment replacement program is opportune, particularly with regard to timing controllers at tube-based transmitters. It would be highly desirable to replace these timing controllers with modern devices having high or infinite resolution. This change would enable station timing to be held steady, except at the relatively infrequent occasions when an LPA or UTC adjustment is actually commanded. With these oscillations removed, very high precision LORAN timing receivers would receive a steady signal; those using a secondary could easily identify the LPAs and remove them from the data. In addition, differential repeatability would be about 1 meter under appropriate conditions.

Signal Availability: Loran-C and VOR

The Volpe National Transportation Systems Center has completed a report comparing signal availability for Loran-C and VOR in the northeast United States. The study was to determine the probability of having signals available continuously from the Initial Approach Fix to touchdown.

The study assumed that the systems would be available at the IAF, about five miles from the runway. It examined outage data for 9960 Seneca, Caribou, and Nantucket for a 3.25 year period and 38 VORs for a year, and found those probabilities to be 0.9980 for Loran-C and 0.9999 for VOR. For a subsequent attempt following a missed approach, Loran-C and VOR each give a probability of 0.9999 that there will be no interruption of signal from IAF to touchdown.

The Loran-C triad had an average of 376 outages per year:

	No.	MTTR (minutes)
Momentary	343	.11
Short term	8.5	2.78
Medium term	21	15.29
Long term	2.9	340

On average, each of the 38 VORs in the study experienced 14.4 outages per year:

	No.	MTTR
Momentary	4.2	0.20
Medium Term	1.9	3.0
Long Term	8.3	208

Loran-C is far more likely to show a momentary outage than VOR. VOR is more likely to have an outage long enough to require going to another airport. Although Loran-C has fewer than half the long-term outages of

VOR, they affect a large area. It would be possible to reduce this problem considerably with today's receivers except for the requirement to use specific stations for non-precision approaches.

The Loran-C momentaries cause most of the disparity in the time from FAF to touchdown. Some Loran-C chains have over 1000 momentaries per year. Fox Harbor and Port Hardy, on the other hand, have only about 10% of the momentaries of a typical USCG Loran-C station. The report mentioned longer-term personnel, different maintenance philosophy, and the lower incidence of lightning as factors which contribute to their fine performance.

Pilots should be quite interested in the fraction of time that signals would be available at the Initial Approach Fix. It appears from the data that there were 1368 minutes of unusable time per year for Loran-C and 1728 minutes for VOR. Data in an appendix gave 1526 minutes unusable for Loran-C and 1531 minutes for VOR. Thus each of the systems were usable about 99.7% of the time. This is hardly surprising for two terrestrial navigation systems with similar power, control, and equipment limitations.

If we examine the fraction of time that each system will be available at the initial approach fix *and* during the two or three minutes to touchdown, Loran-C gives 0.995 and VOR gives 0.997. At least one of the two systems would be available about 99.9985% of the time, since they are truly independent of one another.

This examination of existing systems is expected to lead to requirements for air navigation system availability. - Ed.

GPS Forges Ahead

The Global Positioning System reached an important milestone on 8 December, 1993, when Secretary of Defense Aspen notified DOT that GPS had achieved Initial Operational Capability, or IOC.

At IOC, Standard Positioning Service will be available 98.16% of the time, with a minimum 48-hour notice of disruption. Subsequently the FAA has approved a GPS receiver for non-precision approaches.

Bits & Pieces

NELS Newsletter

The Northwest European Loran-C System (NELS) has started publishing a newsletter with Issue Number 1, 4 November 1993. This small publication is packed with news, projects, test information, installation progress, and events. It is available from:

Northwest European Loran-C System
Coordinating Agency (NELS/CA)
Norwegian Defence Communications
and Data Services (NODECA)
Oslo mil/Akerhus
N0015 Oslo, Norway

NELS Information Pamphlet

The Northwest European Loran-C System Coordinating Agency has published an informative pamphlet (NELS/CA) that is an excellent statement of Loran-C policies and capabilities, in cooperation with WGA and IALA.

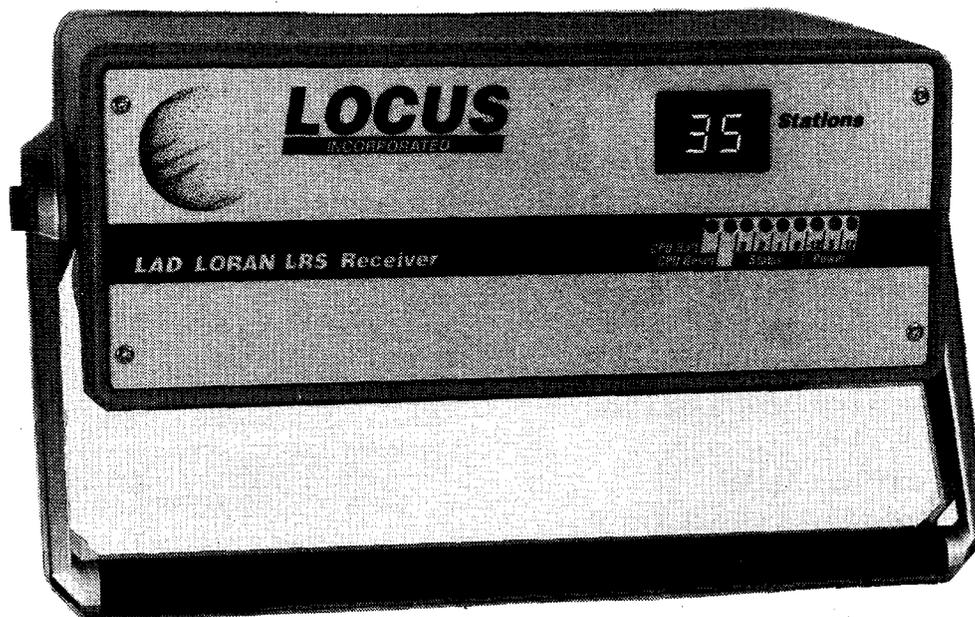
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Canada Building New Loran-C Transmitting Station

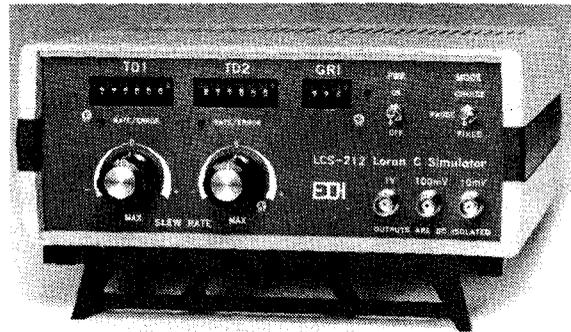
The Labrador Sea Chain (7930) will shut down late in 1994. Canada is building a new station at Comfort Cove, to be the master of a new chain, the Newfoundland East Coast Chain (7270). Existing stations at Cape Race will be the W secondary and Fox Harbor will be the X secondary. The new chain will go on line when 7930 is secured. For information, call Mr. Eric Schening, Canadian C.G. at 1 (613) 998-1538 FAX (613) 998-9258

Comfort Cove	Master	49 19' 53.57"N		200 kW
		54 51' 42.57" W		
			emm. del.	
Cape Race	W Sec.	46 46' 32.29"N	12037.49	500 kW
		53 10' 27.61"W		
Fox Harbor	X Sec.	52 22' 35.25"N	26148.01	800 kW
		55 42' 27.86"W		

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