

Loran Lines

The newsletter of the International Loran Association; the international loran radionavigation forum. (Formerly the Wild Goose Association's journal, the Goose Gazette)

Volume 95-4 - News of the Fall, 1995

President's Message

by Dale Johnson

This is the text of my Loran Status report to ION on January 22, 1996

It is clear that satellite technology is here to stay and will be the heart of positioning and navigation systems for as far as we can see into the future. Still, many governments and international navigation organizations recognize the need for a mix of navigation systems to meet integrity and continuity-of-service requirements. Coverage of Loran and its Russian equivalent, Chayka, is being improved and expanded in Europe, Russia, and the Far East. Other nations are considering the use of Loran as a low cost component of their navigation infrastructure. Even today, with the rush to adopt GPS technology, Loran has the largest navigation user base of any system available, with over one million users. The user base is still growing as a result of the expansion of Loran coverage outside the US.

At a meeting of the International Association of Lighthouse Authorities in Cape Town, South Africa, last November, the primary focus was on providing a proper mix of satellite and terrestrial technologies to meet acceptable navigation requirements for marine users. Scandinavian, European, and United Kingdom representatives made it clear that Loran will definitely be included in the navigation mix for their part of the world. There is a strong feeling among the international community that relying solely on one technology, or system, is simply unwise. Further, the application of a mix of systems offers the best way of meeting navigation requirements for all users.

Following the Cape Town meeting, an International Radionavigation Users Conference was held in Washington, DC. This conference was jointly sponsored by the GPS International Association, the International Loran Association, and the International Navigation Association. The presidents of the Aircraft Owners & Pilots Association and the National Business Aircraft Association opened the conference. Both delivered strong messages that their membership wants to keep Loran in operation well into the next century as a partner and back-up for GPS. The National Association of State Aviation Officials representative made it clear that NASAO supports a plan to operate a mix of terrestrial and satellite systems to assure a high level of performance, safety, and reliability.

The second day of the conference was devoted to Department of Transportation presentations and an open forum with users and user representatives. Many user concerns were raised about the plan to quickly shift to total reliance on a single technology that has yet to reach maturity. It was agreed that a resolution should be written to state the user requirement for maintaining a mix of navigation systems; and that this document should be sent to appropriate government agencies. This resolution is in final draft form and will be published in the near future.

The Northwest Europe Loran System was placed into operation last year. The NELS consortium consists of France, Germany, Denmark, Norway, The Netherlands, and Ireland. The Far East Radio Navigation Service joint Loran/Chayka system will be operational early this year. The FERNS group of nations consists of Russia, Japan, Korea, and Peoples Republic of China.

In contrast to international focus on expanding Loran coverage, the U.S. 1994 Federal Radionavigation Plan (FRP) calls for the phase-out of Loran in the United States after the turn of the century, but this is still subject to validation of a continuing requirement. Many user groups are complaining that this is a drastic change from the commitment in the 1992 FRP, which indicated there would be a 10 to 15 year advanced notice given for the phase-out of any navigation system.

As of December 1994, all former U.S. Loran stations outside the United States had been turned over to host nations for ownership, operation and control. European host nation reaction to the US announcement to phase out Loran early has been one of strong disappointment. This is a sensitive issue to many people in the international community. It is important to remember that the United States has agreements with Canada and Russia for the shared operation of Loran chains which cross our international borders. I am sure we can expect a similar negative reaction from these neighboring governments as well.

At least six Senators and several House members have stated their concern about safety and an orderly transition to satellite technology; they have indicated strong support of the GPS/Loran partnership concept. Virtually all of the aviation and marine user organizations and the National Association of State Aviation Officials support maintaining Loran as a part of the navigation system mix.

A document has just been released by the General Lighthouse Authorities for the United Kingdom and the Republic of Ireland to identify navigation aids and user requirements for the 21st century. This document states that the assessment of requirements recognizes that: (1) no aid to navigation should be relied upon in isolation; (Text continued on page 3)

Loran Lines Formerly the Goose Gazette

Loran Lines is an official publication of the International Loran Association (ILA). This newsletter is published quarterly, with cutoff dates of 1 February for the Winter issue, 1 May for the Spring issue, 1 August for the Summer issue and 1 November for the Fall issue.

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ILA Decals

The Operations Center has International Loran Association decals available. There are two versions, one with stickum on the back, as for a filing cabinet, and the other with stickum on the front, as for the inside of a window. The decals are \$1.00 each. You can pay for all ILA items by Visa or Mastercard.

Election Results

In 1995, the International Loran Association elected Dale Johnson as our President, for a one-year term. Four threeyear seats on the Board of Directors were elected:

James Alexander William Brogdon David Last David Olsen

Robert Lilley will continue to serve as Past President. He is in his second year as an elected Director, so his elected spot will be filled by one-year elected Director G. Linn Roth.

Many thanks to our outgoing directors, and congratulations to our incoming directors. Your dedication keeps the International Loran Association vital and valuable as a voice for LORAN users worldwide.

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ILA Charter

"The International Loran 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 members.

"The Association was originally 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, with an initiation fee of \$5.00 for the first year. Life membership is \$250.00.

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 ILA activities. Class 1 permits nomination of ten regular members from the corporate member; Class 2 permits five. Dues for Class 1 are \$400.00, or \$500.00 for overseas corporations. For Class 2, dues are \$200.00 and \$250.00.

Associate membership is provided for organizations which desire only to receive ILA publications. Associate membership is \$120.00 per year, with a \$5.00 initiation fee. Associate membership does not carry the privilege of voting or holding ILA office.

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

PRESIDENT'S MESSAGE Continued from page 1

(continued:) (2) there must always be cross-checks between systems, and (3) cost and efficiency are important factors. Earlier this year, a cruise ship ran aground off Nantucket island en route Boston Harbor as a result of total reliance on one navigation system, without maintaining an adequate cross check of other navigation aids. If there was ever any doubt, this proves the validity of the point.

The annual operating cost of the domestic Loran system is \$17 million. If the system were optimized, this cost could be reduced to \$14 million, resulting in improved service and a total payback within 12 years. Loran is the least expensive, and most cost-effective, area navigation system available. Latest Loran technology developments promise improved accuracy and coverage, with the ability to receive stations from up to 5000 miles away, and track as many as 40 stations simultaneously. This new receiver technology has proven the ability to offer repeatable accuracy comparable to the Wide Area Augmentation System in primary coverage areas, and acceptable accuracy to provide a backup for GPS using skywave over the North Atlantic and North Pacific oceans. A more detailed report on this new Loran receiver technology will be given by its developer this afternoon in the Integrated Navigation session.

The use of a GPS/Loran partnership for precise timing is equally as important as the application of both technologies for navigation. Precise timing is an absolute requirement of almost all communications systems, including telecommunications, television, and radio. Precise timing is also critical for maintaining electrical power grids to the standards required by modern computerized equipment. Some large companies have been using Loran for many years and now that GPS is available, they want to use both systems for improved integrity and continuity-of-service.

Both the House and Senate versions of the FY 96 Coast Guard Authorization bill include language requiring user input and a plan for the operation, maintenance and upgrade of the Loran-C navigation system. This includes mechanisms to make full use of compatible satellite and Loran technology by all modes of transportation, the National Weather Service, and the communications industry. This language also calls for ensuring that Loran receivers purchased before the year 2000 will have a useful economic life.

We now know that geomagnetic storms, which usually result in ionospheric storms, affect all navigation systems, but in different ways. Papers written by Mr. Joe Kunches of the Space Environment Laboratory in the National Oceanic and Atmospheric Administration lay out important facts for all navigators. His work has shown that large increases in the total electron content of the ionosphere will directly affect the accuracy of satellite systems, while having a minimal affect on Loran in primary coverage areas. Conversely, solar flares, a different phenomenon, affect low frequency systems such as Loran, but are not a problem for the high frequency satellite systems.

It is clear that a large number of users and policy makers around the world agree that utilizing a mix of terrestrial and satellite systems is the wisest, safest and most prudent course to follow for at least the next 10 to 15 years. United States policy should reflect the input and wisdom of these distinguished groups and individuals. Keeping Loran in place makes good sense from an operational perspective, to the marine, aviation and precise timing users. It also makes good business sense to the federal government as the provider of safe and reliable positioning services.

It is important to carefully consider the degree to which terrestrial radionavigation systems will be abandoned in favor of the new satellite technology. A quick answer might be to make these decisions purely on budgetary grounds. A closer study of the situation reveals that political, legal, and technical issues are even more important and will result in significant long term economic benefits.

Dale E. Johnson, President, ILA

Safety Board Forum

The National Transportation Safety Board plans to hold a public forum in the Washington, D.C. area in early March to examine ship integrated bridge systems. This forum is related to the *Royal Majesty* grounding in June of 1995 and the safety recommendations that NTSB subsequently issued. It is expected to involve three panels:

a. Design Standards for Integrated Bridge Systems

b. Industry/Government Oversight of Manufacturers, Installers, and Operators of Integrated Bridge Systems

c. Training and Certification of Mariners Responsible for Operating Integrated Bridge Systems, and Impacts on Safety, Workload, and Watch Keeping

Panel members will submit short papers and answer questions from the the Board, its staff, panel members, and the attending public. The Board will consider allowing the public to submit papers, and possibly to make brief statements.

This forum is important to marine navigators concerned with the design, capabilities, safety, integrity, faultdetection, and training associated with integrated bridge systems. At press time we do not have details of the meeting; contact the National Transportation Safety Board for specifics.

Please try to attend.

Silver Anniversary Convention and Technical Symposium of the International Loran Association

San Diego, California November 3-7, 1996 *at the* Catamaran Resort Hotel

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International Radionavigation Users' Conference Summary Report

An International Radionavigation Users' Conference was convened by the GPS International Association, the International Loran Association, and the International Navigation Association at Westfields, Chantilly, VA in the Washington, D.C. area on November 16 and 17, 1995 for the purpose of discussing, in open forum, the requirements and concerns of users the world over relating to the future of radionavigation systems.

The conference was well attended by representatives of the international community, U.S. user organizations, and the U.S. government in spite of the government's temporary shut-down caused by on-going negotiations for a balanced budget.

Following the welcoming remarks by the Presidents of the three sponsoring organizations, presentations were made by Mr. Phil Boyer, President of the Aircraft Owners and Pilots Association, and Mr. John Olcott, President of the National Business Aircraft Association. Both speakers strongly supported a transition to satellite navigation but stressed the need to retain current systems while satellite augmentation systems for accuracy and integrity are being implemented. Further, both speakers endorsed the continued provision of Loran-C as a complement and back-up to GPS after full operation of GPS and its augmentations is achieved.

Other presentations on the first day covered timing applications by Dr. William Klepczynski from the U.S. Naval Observatory, and maritime operational requirements by Andrew Bass, Fleet Navigator, U.S. Naval Academy for Sailing. These were followed by a summary reports of the Radionavigation Planning meeting held in Moscow in June given by Mr. Beukers; the Royal Institute of Navigation's GPS Interference Workshop held in London during October provided by Dr. David Last; and the recent Far East RadioNavigation System (FERNS) Council Meeting held in Tokyo and provided by Mr. Peter Kent.

In the afternoon presentations covered intermodal operational requirements by Mr. Ken Kelly of Amtech Systems; railroad applications by Richard Shamberger from the Federal Railroad Administration; and the benefits of precision location in construction and mining by Mr. Adam Gudat from Caterpillar, Inc. The day concluded with a presentation on Differential Navigation by Andy Bogle of John C. Chance & Associates.

The second day of the Conference was devoted to presentations by officials from the Department of Transportation and other government agencies. This was followed by an open forum for questions and discussion.

The Conference ended with a plenary session, moderated by David Scull, at which conclusions were established and recommendations made. In addition, suggestions for the text of a Conference Resolution were proposed and discussed. by John Beukers

(The Resolution is printed on page 11 of this issue. Observations, Concerns, and Recommendations, follow on pages 11 and 12.)

GPS Wormholes Reported Plugged

The FAA and DOD recently completed a study to solve the ``wormhole" problem found north of St. Louis, Missouri, in October of 1994.

The tests first examined possible TV interference, and found that GPS is less succeptible to channel 23 TV interference than previously reported.

Then the tests looked at the infamous "wormhole" in GPS coverage within 20 miles of Charles Smartt County Airport near St. Louis. Test records from the McDonnell-Douglas antenna pattern measurment facility were consistent with the reported incidences of interference. Stay tuned for further information.

"True GNSS" Home Page.

3S Navigation has announced the World Wide Web "True GNSS" Home Page which contains information about satellite navigation systems which use both GPS and GLONASS signals, as well as future signals from the Wide Area Augmentation System (WAAS) and Inmarsat GNSS Integrity Channel (GIC)satellites. The Russian Space Forces GLONASS (GLObal Navigation Satellite System) reached the full deployment level of 24 satellites on 18 January 1996.

Hypertext address: http://truegnss.com FTP site address: ftp://truegnss.com/pub

The "True GNSS" Home Page includes:

1. Links to official governmental sources of GLONASS and GPS information.

2. GLONASS and GPS status from various sources and an archive of past GLONASS status.

3. GLONASS almanacs received recently from the GLONASS satellites are available in four different formats. An archive of past GLONASS almanacs and links to GPS almanacs are also included.

4. The official BIPM GLONASS Common View Tracking Schedule no 1.

5. Observation Campaign Data, coming soon. World-wide GPS and GLONASS high precision common-view time and frequency reference measurements will be posted soon. Differential 12-channel GPS/GLONASS data for zero baseline, fixed baseline, ground mobile, sea mobile and air mobile test cases will also be posted soon.

6. Information about 3S Navigation "True GNSS" GPS/GLONASS receivers: the GNSS-200 entered airborne testing with differential code and carrier phase measurements on 24 January 1996.

James Danaher VP Product Development 3S Navigation 23141 Plaza Pointe Dr. Laguna Hills California, USA 92653 Phone: 714-830-3777 FAX:-8411 E-mail: nav3s@aol.com

RAND/CTI Examines GPS Policy ANALYSTS SAY NATIONAL POLICY DIRECTIVE NEEDED STUDY FOR WHITE HOUSE OPPOSES USER CHARGES, URGES MILITARY SECURITY STEPS

CTI's report, "The Global Positioning System: Assessing National Policies," was released on 31 January.

"In addition to being one of the nation's key national security assets, GPS has become an international information resource supporting a booming industry -close to \$9 billion annually by the year 2000 -- and a wide range of commercial, civil and scientific functions. Civilian applications now dwarf the military market. The system's precision location and tuning signals facilitate management of everything from jet traffic in the skies to car navigation to data on the Internet.

"Those signals can also be used by the militaries of unfriendly powers, however. As applications and users have multiplied, so have the policy questions they raise.

``At the request of the White House Office of Science and Technology Policy, RAND's Critical Technologies Institute conducted a comprehensive study, led by analyst Scott Pace, to examine these problems and recommend solutions.

'The core recommendation of the 400page document is the need for a national policy statement to identify U.S. objectives and provide guidance for GPS management and development. "The United States has an important opportunity to shape the direction of GPS applications and mitigate the risks of this new technology," the report observes. If the U.S. fails to promote GPS as a global standard through international agreements, foreign competitors are likely to enter the field. "The United States would still have GPS for its own national security purposes, but would risk losing the economic and diplomatic benefits from past investments." National policy should incorporate these specific approaches, according to the analysis:

``* GPS should be funded and maintained by the U.S. government alone, free of direct user charges or payments by other powers. This would discourage foreign competition, spur GPS's adoption as a global standard and keep the GPS space system under U.S. control.

``* The Pentagon should reduce its reliance on civilian GPS equipment for crucial military missions, introduce more secure, anti-jam receivers, and develop adequate electronic countermeasures to selectively deny GPS signals to an adversary. Until countermeasures and diplomatic agreements discouraging misuse are in place, the U.S. should refrain from providing satellite-based, wide-area augmentations of GPS accuracy and encourage others to refrain as well.

`* The U.S. should quickly move to initiate discussions and agreements with Japan and Europe on regional security and economic issues associated with GPS. Washington should also work to minimize international barriers to commercial GPSrelated services, such as proprietary standards and inadequate spectrum allocations. "The magnitude of the current threat to the U.S. associated with hostile use of GPS is minor at present; however, future threats may be greater." particularly for U.S. allies, the authors note. Most worrisome is the possibility that the signals could improve guidance for cruise missiles aimed at fixed targets or carrying chemical or biological weapons. However, "GPS is a facilitator, not a driver of missile proliferation," they add. Solutions to that problem will require military, political and economic efforts going far beyond GPS policy decisions. The accompanying research brief provides a capsule explanation of GPS, along with a more complete summary of the report's conclusions."

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LORAN and GPS as DME

AOPA Calls For Use Of Loran And GPS As DME On Instrument Approaches

The Aircraft Owners and Pilots Association has asked FAA to approve VFR or IFR en route and terminalapproved Loran and GPS receivers for distance measuring purposes on instrument approaches. The association said it also is asking the agency to permit IFR use of panel-mount VFR Loran or GPS and hand-held GPS receivers. FAA wants to withdraw from a commitment to install DME at 87 locations in the U.S. and the Caribbean, saying it "might well be that the \$22 million budgeted for these...installations could be better spent to further the transition to the satellite-based Global Positioning System," said Doug Helton, VP-regulatory policy.

DME can reduce required minimum descent altitudes on instrument approaches, and general aviation "would not want to give up the advantage DME offers at those 87 additional sites," Helton said. Authorization of Loran or GPS for the DME job would be a "viable alternative." AOPA proposes that all Loran C and GPS receivers now approved for IFR en route and terminal operations receive FAA approval for DME purposes on instrument approaches.

Recommending that FAA consider approving "appropriate" panel-mount VFR-only Loran and GPS receivers for en route and terminal IFR navigation, AOPA said these units normally are more accurate and efficient than the traditional VOR and ADF receivers they succeed. VOR or ADF still could be required for backup, Helton said. AOPA also is proposing approval of hand-held GPS receivers for IFR, but only for en route navigation. Helton said this proposal "foresees hand-held GPS operation only with a hard-mounted antenna and external power, plus VOR or ADF on board for redundancy."

(From the Aviation Daily: 1/2/1996 Article: 48398)

MILITARY GPS RECEIVER POSITION/INTEGRITY FAILURES

PPS Receiver Positions Can Gradually "Run Off" up to 30 or 40 Miles

The following Air Force message addresses a severe position error and integrity problem with many types of military (P-code) GPS receivers:

P 080637Z DEC 95 ZUI ASN-D00347000039 FM HQ SMC LOS ANGELES AFB CA TO ZEN/HQ USAF WASHINGTON DC (and many others)

BT UNCLAS

SUBJECT: NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) NAVIGATION HAZARD NOTICE FOR RECEIVER 3A NOM: R-2332/AR, RECEIVER 3S NOM: R-2331/URN, RPU-1 (MANPACK) NOM: R-2401/U, RECEIVER UH V1 NOM: R-2400/A, RECEIVER OH V2 NOM: R-2399/A, AND RECEIVER C4 V3 NOM: R-2398/A.

1. USING COMMANDS, PLEASE RETRANSMIT THIS MESSAGE AS APPROPRIATE TO UNITS WITH THE SUBJECT GPS RECEIVERS.

2. THE POTENTIAL FOR THE NAVIGATION POSITION TO GRADU-ALLY "RUN-OFF" (AS GREAT AS 20-40 NM) WITH NO INDICATION TO THE OPERATOR (I.E. RECEIVER **DISPLAYS A FIGURE OF MERIT OF 1** (FOM 1)) HAS BEEN REPORTED BY C-17 AND VH-60 AIRCREWS. THESE PLATFORMS USE THE RECEIVER 3A. BUT THIS FAILURE MODE IS COMMON TO THE 3S, OH, UH, C4 AND MANPACK GPS RECEIVER PLATFORMS AS WELL. THIS PROBLEM IS CAUSED BY CORRUPTED DATA IN THE RECEIVER AND CAN OCCUR WHEN CRYPTO KEYS (GUV OR CVW) ARE LOADED INTO AN UNKEYED **RECEIVER. THE POSITION "RUN-**

OFF" TYPICALLY MANIFESTS ITSELF SHORTLY AFTER THE RECEIVER IS KEYED BUT MAY NOT OCCUR UNTIL LATER IN THE MISSION AS THE RECEIVER SWAPS SATELLITES USED IN ITS NAVIGATION SOLUTION. THE NAVSTAR GPS JOINT PROGRAM OFFICE (JPO) IS AGGRESSIVELY INVESTIGATING OTHER POSSIBLE SCENARIOS THAT CAN CORRUPT THE DATA RESULTING IN NAVIGATION ERRORS WITH NO WARNING.

3. AS AN INTERIM SOLUTION, THE FOLLOWING PROCEDURE SHOULD BE USED WHEN LOADING CRYPTO KEYS (GUV OR CVW): AFTER KEY LOADING AND ONCE THE RECEIVER INDICATES FOM 1 OR 2, THE OPERATOR SHOULD CYCLE THE RECEIVER TO "INIT" AND THEN BACK TO "NAV." THIS ACTION RESETS THE CORRUPTED DATA.

4. FOR THOSE PLATFORMS NOT HAVING AN "INIT" SWITCH, THERE ARE ALTERNATE ACCEPTABLE METHODS TO RESET THE DATA CORRUPTED AFTER CRYPTO KEY LOADING. THESE METHODS ARE DEPENDENT UPON INTEGRATION DESIGN, MISSION REQUIREMENTS AND OPERATOR PREFERENCE, BUT INCLUDE CYCLING POWER TO THE **RECEIVER OR COMMANDING A BUILT-IN-TEST (BIT). QUESTIONS REGARDING ALTERNATE ACCEPT-**ABLE METHODS SHOULD BE DI-**RECTED TO THE PLATFORM** PROGRAM OFFICES.

5. THESE PROCEDURES SHOULD MITIGATE THE OCCURRENCE OF THE POSITION "RUN-OFF" PROBLEM, BUT IF THIS FAILURE (LARGE POSITION ERROR WITH FOM 1 OR 2 INDICATED) DOES OCCUR DURING THE MISSION, THE OPERATOR SHOULD FOLLOW THE PROCEDURES ABOVE (PARAGRAPH 3 OR 4) TO "INIT" THE RECEIVER AND RECOVER NORMAL OPERATIONS (ASSUMMING A PEACE-TIME ENVIRONMENT).

6. JAMMING THAT OCCURS IN A HOSTILE ELECTRONIC WARFARE (EW) ENVIRONMENT CAN BE CONFUSED WITH THE GPS "RUN-OFF" ERROR. THE USE OF THE "INIT" PROCEDURE IN SUCH A SITUATION COULD RESULT IN COMPLETE LOSS OF GPS SIGNAL BECAUSE OF THE NEED TO REACQUIRE C/A CODE, THUS ADVERSELY IMPACTING MISSION ACCOMPLISHMENT. AS A RESULT, THE PROCEDURE SHOULD NOT BE ACCOMPLISHED DURING A WAR-TIME SITUATION.

7. GPS PROVIDES THE MOST USEFUL AND ACCURATE NAVIGATION SOLUTION AVAILABLE, BUT WE CAUTION OPERATORS NOT TO BE OVER-CONFIDENT IN THE SYSTEM. APPROPRIATE CROSS-CHECK OF GPS WITH OTHER FORMS OF NAVIGATION (INERTIAL NAVIGATION SETS, RADAR, RADIO NAVAIDS, DOPPLER, DEAD RECKONING, VISUAL METHODS, ETC) SHOULD BE EMPLOYED TO ENSURE SAFETY AND MISSION ACCOMPLISHMENT.

8. POC AT THE GPS JPO IS MAJOR JOHN KIRK, SMC/CZUI, VOICE: (310)363-6402, DSN:833-6402, EMAIL:KIRKJL@GPS1.LAAFB.AF.MIL, FAX:DSN 833-3844.

BT

FERNS NEWS

The FERNS (Far East RadioNavigation System) fourth Council meeting took place during the period October 23-27, 1995 in Tokyo. The following are highlights:

1. The FERNS joint Loran-C/Chayka service will become fully operational on January 1, 1996. Configuration of the chains is now finalized (see below).

2. Operating Guidelines for the radionavigation service have been adopted.

3. The Council has agreed to use the FERNS forum to discuss and coordinate other radionavigation services (DGNSS, Racons etc.) in member's geographic regions.

4. Chairmanship for the fifth Council meeting has passed to the Russian Federation.

Configuration of the FERNS Chains in Russia, Japan, Korea and China:

Station	Latitude	Longitude	Power	Rate	DRate
R) Petropavlovsk	N53 07 47.584	E157 41 42,900	700kW	7950	
R) Alexandrovsk	N51 04 42.805	E142 42 04.952	700kW	7950	
R) Odhotsk	N59 25 02.050	E143 05 22.916	10kW	7950	
R) Ussiriisk	N44 31 59.702	E131 38 23.403	700kW	7950	9930
J) Tokatibuto	N42 44 37.214	E143 43 09.757	1000kW	7950	8930
J) Niijima	N34 24 11.943	E139 16 19.473	1000kW	9930	
J) Minamitorishima	N24 17 08.007	E153 58 53.779	1100kW	8930	
J) Gesashi	N26 36 25.038	E128 08 56.920	1000kW	9930	8930
K) Pohang	N36 11 05.450	E129 20.27.440	150kW	9930	8930
K) Kwangju	N35 02 23.996	E126 32 27.295	50kW	9930	
C) Helong	N42 43 11.562	E129 06 27.213	1200kW	7430	
C) Rongcheng	N37 03 51.765	E122 19 25.954	1200kW	7430	8390
C) Xuancheng	N31 04 07.937	E118 53 09.625	1200kW	7430	
C) Raoping	N23 43 25.941	E116 53 44.826	1200kW	9390	6780
C) Hexian	N23 58 03.847	E111 43 10.298	1200kW	6780	
C) Chongzuo	N22 32 35.452	E107 13 21.665	1200kW	6780	

Further details are avialable relating to chain configuration, Master/Secondary, coding delay, and baseline length in microseconds to the nearest 10 nanoseconds.

GPS Availability for Second Half of 1995

	Н	%	
July	212.6	98.86	31
Aug.	25.3	99.86	31
Sept.	100.1	99.44	30
Oct.	84.0	99.55	31
Nov.	330.7	98 .16	30
Dec	39.5	99.79	31
totals	792.2	99.25	184

H = Total outage hours for month % = % signal availability for month Source: USAF data provided to the U.S.C.G. NAVCEN bulletin board: ph 703 313-5910, or INTERNET http:/ www.navcen.uscg.mil/

This data does not represent signal availability; rather it represents the average usable time from the satellites. It is comparable to, and over seven times the unusable time of a single Loran-C transmitting station (typically about 99.9%)

1996 RADIONAVIGATION USER MEETINGS

Sponsored by U.S. Department of Transportation

The U.S. Department of Transportation and the U.S. Department of Defense are conducting open meetings for all users of U.S. Government-provided radionavigation systems. The purpose of these meetings is to obtain user perspectives on Federal Policies and plans for these systems. Systems to be covered include the Global Positioning System (GPS); differential GPS and other GPS augmentations; Loran-C; Omega; VOR/DME; TACAN; radiobeacons; and ILS/MLS. Input on all applications of these systems is welcomed, including navigation, positioning, surveying and mapping, timing, network synchronization, and resource management. All users, equipment manufacturers, service providers, Federal, State, and local government personnel, and any others with an interest in these systems are encouraged to attend.

6 February 1996: Cambridge, Mass. 15 February 1996: Boulder, Colo.

NOTE: These meetings are required to be held prior to issuing each radionavigation plan. However, experience with the 1994 FRP has shown that issues raised at the meetings have little effect on policy. In response to requests for more meeting locations, there are fewer. There has been precious little publicity. Only one location is accessible to mariners. There have never been meetings at numerous important harbors. The announcement arrived after the deadline for requesting an information/ registration package. -ED



Marine Navigational Aids Into the 21st Century

A Joint View by the General Lighthouse Authorities

The General Lighthouse Authorities for the United Kingdom and the Republic of Ireland have issued an important document: Marine Aids to Navigation into the 21st Century. Some excerpts:

Operational Requirements:

Ocean Phase (50-200 n. miles) +/- 0.25 nautical miles Coastal Phase (up to 50 n. miles) +/- 100 metres Harbours, Harbour Approaches, and Routeing Schemes +/- 10 metres

Proposed Action Plan

The GLAs have drawn provisional conclusions which translate into an action plan for:

-the continuing provision of traditional aids to navigation for the next 25 years and probably beyond with necessary changes due to

-the ongoing review of the mix of aids within that period

-the acceptance of new radionavigation systems

-provision of an unencrypted and freely available DGPS service by 1996/97

-adoption of LORAN-C in 1997 subject to operational availability and adequate coverage of Britain and Ireland by the NW European LORAN-C Chain

-withdrawal of the UK Decca Navigator System in 1999

-closure of the present radiobeacon service by the year 2000 or sooner

-sustained effort at the IMO for the revision and modernization of Chapter V of SOLAS 1974, ensuring that attention is given to rapid developments in marine navigation technology worldwide

-encouragement for the development of operational requirements for a civil satellite system for 2015 onwards and a strategy for the international provision of such a system.

Today, mariners are commonly using and relying on new radionavigation systems:

-which give reliable and accurate positioning information at all times of the day and night almost anywhere in the world

-without the proper means to check their integrity

Both LORAN-C and GPS are required because:

-the mixture of systems is complementary enabling the user with a hybrid receiver to work both systems using a common display; as each receiver element is independent of the other a cross-integrity check is possible for each of these systems

-LORAN-C would provide the necessary ground-based radionavigation system backup to the GPS satellite system

-GPS is needed for differential GPS

-both systems will be used for navigation by the mariner in British and Irish waters

-IMO recommends that electronic charts (ECDIS) require two inputs wherever possible and it would be sensible if these were from two independent radionavigation systems.

Another Cruise Ship Grounds; Crew Blames GPS

On 23 June, 1995 the Princess Cruise Lines passenger ship *Star Princess* struck Poundstone Rock near Juneau, Alaska. Although the ship was damaged, there were no injuries. The ship's crew blamed the incident on a malfunctioning GPS receiver. The *Royal Majesty* grounded off Nantucket on 10 June; same excuse. Ancient Navigator's comment:

How can a malfunctioning receiver cause a grounding? Only if the watch officer has so much confidence in it that he doesn't bother to check the radar, other radionavigation receivers, the depthfinder, or the DR. It is navigators that prevent groundings, not receivers.

GLONASS is Operational

The GLONASS satellite navigation system is fully operational as of 18 January 1996, with 24 satellites. The GLONASS system does not have the accuracy degradation (SA) that is imposed on the U.S. GPS system. In spite of the general lack of receivers at present, the GLONASS system has great promise for navigation. It is obvious that a receiver using signals from both systems has twice the number of satellites in view, an integrity check, higher accuracy, and many times the availability that is possible with either system alone.

For years we have heard U.S. "experts" claim that GLONASS had such severe satellite longevity and system funding problems that it would never be completed. Don't hear much from them lately. Russia has a strong launch capability and has set priorities to ensure that GLONASS becomes a world class navigation system.

MAINE PATROL BOAT SINKS

The Maine Marine Patrol boat Northern Lights sank in October due to a navigational error helped by over-reliance on the Global Positioning System (GPS), according to the Portland Coast Guard Marine Safety Office. The Northern Lights ran aground on a ledge on a routine trip from Rockland, Maine to Vinalhaven. There were no injuries, but the boat sank. A Coast Guard spokesman said that the boat's operator was using a new GPS receiver. However, one of the navigational waypoints entered into the receiver was approximately 900 yards away from the correct position.

The boat operator had entered the waypoints earlier by going to points previously used with Loran-C and storing GPS positions. Apparently the receiver was not tracking correctly at the time the operator saved the critical waypoint. The Coast Guard noted that the error would have been detected in advance had the operator plotted the waypoints and the courses on a chart.

International Radionavigation Conference

An International Radionavigation Users' Conference sponsored by the GPS International Association, the International Loran Association, and the International Navigation Association was held in Chantilly, VA, on November 16-17, 1995. Participants in the conference included members of the above organizations and members of aviation, marine, and terrestrial user organizations and interests. In addition, a significant number of non-U.S. positioning, navigation and timing users attended the conference representing the international community's requirements and concerns relating to the continuity and quality of future radionavigation services. Presentations on a wide range of user requirements were made, followed by a discussion of the Federal Radionavigation Plan in open forum with officials from the U.S. Department of Transportation. The conference concluded with the adoption of the following

Resolution:

Noting significant technological advances in systems for radio positioning, navigation and timing, and,

Acknowledging the trend towards the use of common systems worldwide endorsed by member States of the primary international organizations,

Calling Attention to the Letter of Promulgation in the foreword to the U.S. Federal Radionavigation Plan (the FRP) signed by the U.S. President's representatives, the Secretary of Defense and the Secretary of Transportation, and,

Noting that the Letter of Promulgation states that the FRP represents the official radionavigation policy of the U.S. government, **Recognizing** that governments throughout the world consider the FRP to be a statutory document fully supported by the U.S. administration and depend upon it in developing their own national radionavigation policy, Further noting the radical policy changes that have appeared in the last two successive biennial issues of the FRP, and.

Recognizing that such changes are: (a) unresponsive to user-expressed requirements; (b) an indication of the need for better coordination within the Administration and government agencies; (c) disruptive to users and governments worldwide; and (d) responsible for the loss of confidence in the FRP, the process for its development, and those responsible for its adoption,

Calling attention to the United States and international user requirements, concerns, observations, and recommendations as expressed at this International Users' Conference and summarized in the Meeting Conclusions attached to this Resolution, **Resolves:**

1. That a recommendation is made to the Director of the Office of Science and Technology Policy that, in accordance with Title 22 of the U.S. Code of Federal Regulations, Section 2656b, to assume responsibility for the oversight and guidance of strategic planning aspects for the Federal Radionavigation Plan including provision of specific services, for the process of coordinating all national and international interests, and for the establishment of the FRP under the Federal Regulatory Process.

2. That this Resolution be transmitted to government departments, international organizations, user organizations, and others involved in the evolution of radionavigation systems for national and international use.

Observations, Concerns and Recommendations

At the final session of the Conference, delegates expressed their individual requirements and concerns and made a number of observations and recommendations. These are presented in the paragraphs that follow, in no particular order of importance:

1. Government-Supplied Services: The many benefits that have accrued to a user community of millions over years of government (taxpayer) support of radionavigation services was acknowledged.

It was accepted that governments have a responsibility to provide services in an efficient and cost-effective manner.

2. Satellite Technology: It was recognized that satellite technology as applied to positioning, navigation and precise timing is providing significant worldwide social and economic benefits and that the technology offers capabilities not available from previous systems.

It was also recognized that a global, centralized satellite-provided positioning, navigation, and precise timing service was being planned by the United States to become an alternative to a multitude of currently operating terrestrial services.

3. Worldwide Systems: It was noted that most long-range terrestrial and all services based upon satellites are inherently international and have a direct impact on governments and users. It was recommended that international agreements in force must be respected.

4. Transition Plans: Attention was called to the need for the transition from terrestrial systems to a mix of terrestrial and spacebased services to be based upon the provision of an assured service and not upon an arbitrary schedule.

It was noted that the transition to a satellite service from nationally owned, decentralized, terrestrial services raises substantial legal, financial, political, and technical issues that require time to resolve.

Observations, Concerns and Recommendations (continued)

5. Government Competition: Attention was called to the issue of the Government competing with the private sector in providing differential satellite services.

6. Mix of Systems: It was noted that aviation associations including AOPA, NBAA, EAA, HAI, and ALPA; Boat U.S. representing marine users; the European Union and international organizations: ICAO, IALA, IMO, IAIN, and other national organizations have all expressed a requirement for a mix of positioning systems to insure availability for all services and integrity for safety-critical applications. Many European and Far East states have already taken action to meet these requirements.

The provision of more than one independent means for deriving position information to ensure safe navigation was acknowledged as a mandatory requirement. The current activity within IMO to identify the requirement for a second independent navigation input to electronic chart displays (ECDIS) was also noted.

There was support for complementary satellite and terrestrial systems to ensure continuity, availability, and integrity of service.

7. National Plans: The regional and national activity around the world to develop long-term radionavigation plans was noted.

8. U.S. Federal Radionavigation Plan: In considering the 1994 Federal Radionavigation Plan, deep concern was expressed over the decision to transition to satellite technology in the short-term, and the decision to terminate all terrestrial services without input from the Department of Commerce and Department of State.

It was noted that the adverse impact on international trade, the weather services, and other non-navigation users had not been thoroughly assessed.

The lack of involvement and coordination with the Department of State throughout the FRP process was also noted. The announcement in the 1994 FRP of termination of Loran-C by the year 2000 in the United States has resulted in confusion and mistrust within those states (nations) which had, just one year previously, received encouragement from the U.S. government to take possession and financial/operational responsibility of Loran-C assets overseas.

9. Loran-C Service: The strong bipartisan support for continued funding and support for the Loran-C radionavigation system by the Authorizing and Appropriations Committees and by other key policy makers in the U.S. Senate and the U.S. House of Representatives, as reflected in statutory and other provisions advanced in H.R. 1361, H.R. 2002, and S 1004 was noted.

There was a strong recommendation that the Department of Transportation and its agencies, in active consultation with users, fully comply with the statutory provisions and Congressional intent reflected in the above Bills as acted upon by the respective bodies during the first session of the 104th Congress of the United States.

It was also noted that Loran-C for the Coastal Confluence Zone was formally adopted through notice in the Federal Register. It was recommended that termination of the system should follow this same formal procedure.

11. Omega Service: Concern was expressed over the imminent termination of the global Omega radionavigation service. It was noted that some airline operators do not have time to reequip, and weather station operators throughout the world do not have an economic equivalent.

12. User Consultation: Users of current and proposed institutionally-provided services recommended that they be consulted and become intimately involved in matters concerning:

(a) The radionavigation planning process and the development of radionavigation plans. (b) Establishment of a defined period of concurrent operation for any proposed service transition, based upon assured service. (c) Development of a transition plan and schedule. (d) Provision of complementary systems. (e) Dissemination of technical and non-technical limitations of a centralized positioning, navigation and precise timing system. (f) Exchange of information within the international community to facilitate international planning and setting of standards.

13. Government Intervention: The recommendation was made that no government departments, whether United States or any other states (nations), should obstruct by political, diplomatic, or commercial means, efforts to enhance peacetime performance of satellite navigation systems. Such enhancements were noted to include GPS augmentations, use of GLONASS, and the provision of an independent satellite constellation.

Coast Guard Announces Differential GPS IOC

The Coast Guard held a ceremony at the Navigation Center on 30 January to "implement the Initial Operational Capability of the Coast Guard Differential Global Positioning System." The Secretary of Transportation, Frederico F. Pena, and the Coast

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Guard Commandant, ADM Robert E. Kramek, presided at the ceremony, a milestone in development of DGPS.

It has been difficult to detect any effect of IOC on navigation. The Coast Guard DGPS system remains incomplete, is yet to be certified for navigation, and the radiobeacon part of the system requires major power and equipment upgrading to meet its stated reliability goal. The Coast Guard's warning concerning use of DGPS remains in effect.

Continuous Position Indication IS NOT Navigation. Capt. Bill Brogdon

There is a great divide between policy makers and system designers, and the radionavigaton system users, which has become dangerous. The number of ship and aircraft accidents attributable to misapplication of and overreliance on new technology is growing rapidly.

We are in part guilty for using the term "radionavigaton." In your humble editor's opinion, there is no such thing. There are radio *aids to navigation*, which a navigator can use. Yet a device which provides near-continuous position information is called a "radionavigation receiver." I call it "pseudonavigation:" raw data that can be manipulated to be an important input to navigation.

Navigation has traditionally been defined as the art and science of finding one's position, and proceeding safely to a destination. Navigation specifically involves the mature judgment of information from sources of differing reliability and accuracy, sometimes conflicting, to assess its value in providing fix information. Detecting malfunctioning equipment and erroneous data is a vital part of navigation. Comparing fix information with dead reckoning information continues to be the most powerful method of verifying new position information. LORAN and GPS systems are themselves no more capable of "navigation" than a pencil is capable of writing prose. They are tools.

The lure of the technological fix introduces ideas in Aids to Navigation system design that are patently false:

1. Improved technology will reduce accidents.

This presupposes that the new technology will be used within its limitations (which are often understated). It further supposes that new technology is so reliable as to require nothing else, such as training or expertise. The introduction of RADAR, Loran, inertial navigation systems, and GPS to name a few, have been replete with accidents that have occurred through over-reliance on equipment.

2. Since human error causes some

80% of all navigation accidents, substituting advanced technology systems for the human will eliminate accidents.

A. 100% of all safe voyages are due to human intervention to correct for incorrect initial assumptions, errors, the forces of nature, and to avoid other craft.

B. No technology yet devised, much less built, involves judgment equal to that of, say, an elementary school child.

C. No aid to navigation system is free from errors and integrity problems.

D. Overall navigation system performance (including the receiver) is far lower than the "signal in space" performance, due to local interference, receiver software design, receiver failure, and wrongful data interpretation.

3. A goal of DGPS/ECDIS has been "to reduce the workload on the watch officer." What work is more important than safe navigation? New equipment is accomplishing this goal to a remarkable degree. The watch officer of the Royal Majesty, for example, reduced his navigation workload to zero.

4. Performance statements usually ignore real-world conditions. For example, that which is reported as "accuracy" is usually precision, ignoring any bias with respect to coordinate system or chart. There have been numerous accidents due to this (frequent) misstatement of system performance.

The goal of advanced equipment should be to present data to a human navigator in such a way that he or she can evaluate it easily, compare it with secondary system and instrument inputs, and use it to make sound decisions. To navigate safely, it is vital to be actively involved in the process; today's equipment is reducing navigators to passive observers rather than active participants. Worse yet, navigators place a degree of reliance on new equipment that is unwarranted by its performance.

Meanwhile navigators must operate new equipment with little training, little information about its limitations, and great differences among manufacturers. No wonder they make some big mistakes.

U.S. Legislative Update

Both the House and Senate bills remain as printed in the last issue of Loran Lines. They have yet to be signed They call for studies to continue and improve the U.S. Loran-C system. Legislative activity now seems to be in the "election mode." This consists of "He did it/they did it" sound bites on TV, attempts to gain advantages in the polls, and positioning for the fall, 1996 elections. We are unable to predict any legislative outcomes in this situation.

ILA members are working to keep Loran-C on line until at least 2015 to protect the safety of flight and marine navigation. We know from hard experience that no one aid to navigation is reliable enough for safe navigation at all times. DOD, Coast Guard investigators. and the National Transportation, as well as numerous respected international organizations have issued statements in the past year cautioning navigators not to rely upon GPS alone. The 1995 edition of Bowditch states, " In practice, a navigator synthesizes different methodologies into a single integrated system. He should never feel comfortable utilizing only one method when others are available."

The rest of the world is moving steadily towards a mix of systems to meet the valid requirements of safe navigation, while the U.S. DOT seems to be heading towards putting all our eggs in one basket.



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Technical Chairman

John M. Beukers Beukers Technologies March-November: East Ridge, Longborough, NR. Moreton-in-Marsh, Glos. England GL56 OQX phone +44 1 451 870777 FAX +44 1 451 870722 e-mail jb@iunet.demon.co.uk December-February 5080-106 Harmony Circle Vero Beach, FL 32967 phone/FAX 407 563-0627 e-mail jb@iu.net

A Co-technical person will be named to concentrate on U.S. papers, while Mr. Beukers emphasizes the European LORAN community.

Conference Manager

Ellen G. Lilley ILA Operations Center phone/FAX 614 797-2081 e-mail ocenter@ohiou.edu

Outline of Technical Sessions

1. The Past: 25 Years of Loran-C in retrospect.

2. Satellites and earth-based systems as partners.

3. Loran-C Transmitting: Operations, modernization, automation.

4. Loran-C Receiving: New technology.

5. Panel/Group discussion.

6. The Prologue: The next 25 years in partnership.

Session Charipersons will be announced in the convention mailing.

Abstracts and Papers

Please submit a one-page abstract of your paper together with a brief biography of the author(s) and a mailing address, telephone and FAX numbers, and e-mail adddress for the responsible author. Please send professional photographs of authors if available, for use in the proceedings.

Please submit abstracts as early as practical, but in any case prior to 1 June, 1996. Authors will be notified of acceptance by 15 July. Complete camera-ready papers must be submitted before 15 September 1996 so that reprints may be prepared for the conference attendees.

Convention Volunteers

We will be recruiting conference committee members as time passes, as well as volunteers for publicity, golf and tennis tournaments, and spouse activities. This 25th annual meeting will be our Silver Anniversary milestone. Your participation in the planning will help ensure success.

Letters to the Editor

19 August 1995

Dear Captain Brogdon,

Your recent article in the September issue of Yachting is most interesting. The blind dependence on electronic aids, air and water, must have caused many accidents. Aviation aids, VHF, Loran, &tc. usually have a visual inoperative indication. Some have an audio indication as well. This should be part of marine aids. My recollection of inertial systems in aircraft, also had a voice annunciator.

The real reason behind the Royal Majesty grounding has to be the lack of training of Second Officer Evangelos Roukas. I just can't believe that I would turn an officer loose with an airplane enroute, that he wasn't fully trained on.

As you point out so well there is also the fallacy of depending upon a single aid to navigation. Dead Reckoning has to be the basis of navigation, updated by the various electronic aids.

The writer is a retired air transport pilot. Among my ratings endorsements &ct. is a Flight Navigator's certificate. Keep up the good work.

Very Truly Yours, I. W. Stephenson

From: jjester@free.org (Joe Jester) Subject: Loran Lines

I thought the Summer, 1995 edition was quite interesting. The cruise ship grounding article was excellent where Capt Bill Brogdon showed the centuries of navaids that were available to alert the bridge watch of his pending grounding.

The UT (unusable time) for GPS was quite enlightning. The comparison of GPS and Loran would be enhanced if the newsletter showed the Loran UT figures as well as the GPS figures in common terms. That way someone without knowledge of either system (Congressmen) could see the availability differences in the systems at a glance. I'm sure the public image (non-user) would be improved.

CPO Joe Jester, USCG(ret)

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Preliminary 25th Annual ILA Conference Registration

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