WILD GOOSE ASSOCIATION

D R A F T

Minutes of the 105th Meeting of the Board of Directors.

1. Call to Order

The 105th meeting of the Board of Directors was convened at 4:12 pm on 18 October, 1993, at the Radisson Hotel, Santa Barbara, California, by President Robert Lilley.

2. Attendance, Proxies and Statement of Quorum

The following Board members were in attendance:

Bob Lilley, President
Dave Scull, Vice President
Walt Dean, Secretary
Jim Culbertson, Past President
Jim Alexander
Dave Amos
Carl Andren, Treasurer
John Beukers
Laura Charron
John Illgen
Dale Johnson
Mike Moroney
David Last
Dave Olson

Also attending:
Bill Brogden, Gazette
Bill Roland, newly-elected member for 1994
Jim Van Etten, Awards
Durk van Willigen

The secretary reported that the number of Directors present constituted a quorum, and equaled the two-thirds required for ratification of amendments to the By-Laws.

3. Acceptance of Minutes of Last Meeting

Acceptance of the minutes of the 104th BOD meeting was moved by Culbertson, seconded by Dean and approved unanimously.

4. Standing Committee Reports

a. Convention 1993 - Illgen reported attendance of 83 to date, just above the break even point. An amount of $2900 has been allocated for the proceedings, which some thought inadequate. Stress was put on the need to not print extra copies, as we already have a room full of extra copies of old proceedings. A certain number more than the attendance (not defined) should be printed for sale and records.

The format for awards has been changed to put some at the Tuesday luncheon, to ease things at the banquet. Exhibitors have not been as evident as desired.

b. Executive Committee - Report accepted.

c. Vice President - Report accepted.

d. Secretary - Report accepted.

e. Membership Renewals - Paid membership 444. About 100 leave each year, so we have to run to keep even.

f. Nomination/Election - Results are confirmed, with Roland on for one year, Illgen, Culbertson, Beukers and Moroney for three years.

g. Treasurer/Audit - Summary, $37K in bank, net loss of $15K since last year, mostly due to expenses not picked up earlier. Details in Andren's suitcase coming later.

h. Awards - All awards had been approved by fax. Van Etten is stepping down, to be replaced (by Frank Cassidy?). Plan is to phone Leo Fehlner at the banquet for the presentation. Van Etten has a 3-page letter from Leo accepting the award.

i. Constitution - No report

j. Historical - No report

k. Newsletter - Some concern was expressed about the lateness of the Gazette, but no solution was forthcoming.

l. Journal - Beukers expressed his frustration at not being able to spend time on the Journal with all his other ~~problems~~ activities.

m. Technical and Applications - No additions to Amos report

n. RTCA - Lilley sent a letter to Jack Howell, AFS-400, FAA, containing a draft Loran-C Instrument Approach Overlay Plan. Five companies, Arnav, II Morrow, Goodrich, Northstar and Trimble are reported ~~ready to certify a loran receiver for NPA~~ having the combined Loran/GPS architecture,

o. Correspondence - No comments on attached letters.

5. Issues for Board Discussion and/or Action

a. 1994 Convention - In the absence of Bahar Uttam, Bill Roland reported that the Royal Sonesta Hotel in downtown Boston had been selected, but that other possibilities still existed. It was felt that a complete report would be needed for an Executive Committee meeting in January.

b. 1995 Convention - Beukers stated that Norm Matthews, who is leaving as head of IALA, could be our man to help organize the 1995 convention, as he has frequent contact with Denisov, and is now with him in Seoul at a meeting of the Far East Loran-C users. Mr.

c. Memorandum of Understanding - Considerable uncertainty existed among board members because of the apparent unstable situation in Russia. It was felt premature at this time to sign the MOU which had been drawn up between WGA, INA and IRN. Roland will be in Seoul on Thursday, 20 October, and will be able to talk to Matthews and Denisov.

d. Backup Plan for the 1995 Convention - Backup locations were discussed, starting with Munich. Last suggested that the Germans were more interested in GPS than loran, and that the Netherlands or Norway, where the governments are more favorable, might be a more suitable site in Europe. Van Willigen volunteered to make quiet investigations of possibilities in Amsterdam.

e. WGA Constitution/Terms of Office - Deferred — There was no discussion of the term of a candidate taking the vacancy left by a director being elected president.

6. Other Items

a. DOT User Conferences - Lilley & Dale Johnson plans to attend the conferences on the FRP in Washington and Columbus. It was felt that Beukers should have comments on the international aspects of the plan. It was also expected that AOPA would have an input, and coordination was recommended. ~~There was no formal plan for preparation of a WGA comment.~~ Lilley & Dale Johnson will comment at for WGA at the two conferences. Ed McCann will also comment.

b. Note was made of the death of Chick Longman, who was greatly liked and respected. He will be sorely missed.

7. Next Meeting

The next meeting will be held at the close of the Technical Symposium, on 20 October, 1993.

8. Adjournment

The meeting was adjourned at 5:55 pm.

WILD GOOSE ASSOCIATION

D R A F T

TO: All Directors

FROM: Walt Dean, Secretary

SUBJECT: Minutes of Annual Membership Meeting 19 October, 1993

The annual meeting of the membership of the Wild Goose Association was called to order by President Bob Lilley at 0805 in the La Cantina room of the Radisson Hotel, Santa Barbara, California.

President Lilley presented the results of the election, Dale Johnson new president, Bill Roland, director for one year, John Beukers, Jim Culbertson, John Illgen and Mike Moroney directors for three years. Bill Roland was leaving for a meeting of the far east loran using nations being held in Seoul, Korea.

A high point of the last two years was last year's convention in Birmingham, England, which had good representation from the European community, and resulted in two resolutions emphasizing the importance of a mix of ground-based and satellite systems for navigation, and supporting the expansion of Loran-C worldwide.

On the aviation front, the FAA has completed the 125 stand-alone loran nonprecision approaches required by Congress last year. RTCA SC-176, chaired by Dale Johnson, is rewriting the loran MOPS. Bob Anoll chairs RTCA SC-159, Working Group 3, preparing specs for combined loran/GPS. Chick Longman, whose inputs to the RTCA specs was so valuable, passed away this year, and will be sorely missed.

The NPA program is still alive. A loran overlay program patterned after the GPS overlay program has been drafted, and has the support of AOPA.

One recent accomplishment is an update of the Loran-C Signal Specification, in cooperation with the Coast Guard.

Note was made of the User Conferences for the Federal Radionavigation Plan, 9-10 November in Washington, DC, 30 November in Columbus, OH, and 2 December in Seattle, WA. Members were urged to attend and speak, identifying themselves as WGA members.

With NASAO support and endorsement, WGA asked Sen. John Glenn staff to insert language in the Airport/Airways Trust Fund Bill:

"In cooperation with the Coast Guard, FAA should take full advantage of the compatibility of Loran-C and GPS technology so that the substantial investment already made by users can be fully utilized, and Loran-C can be a cost-effective overlay for GPS,"

It appears that the first commercial Loran-C approach may soon be forthcoming in Branson, MO, by Branson Airlines, using Arnav receivers.

Despite the headlines, the Russians still are moving ahead with plans for their Chayka system, and talk about cooperation with other loran systems.

President-Elect Dale Johnson spoke briefly, principally to announce that he would appoint David Last and Durk van Willigen to the Board of Directors. as two of his three appointees.

To: Members of the Board of Directors, and Committee Chairs; Wild Goose Association

From: Robert W. Lilley, President

Date: April 8, 1993

WILD GOOSE ASSOCIATION
105th BOARD OF DIRECTORS MEETING
4:00 PM, OCTOBER 18, 1993
RADISSON SANTA BARBARA HOTEL, SANTA BARBARA, CA

Agenda:

1. **Call to Order** ("reminder" copy of our Radionav policy attached)
2. **Appointment of a Recording Secretary**
3. **Attendance, Proxies and Statement of Quorum**
4. **Minutes of the 104th Board meeting** (attached)
5. **Reports**

a. 1993 Convention (J. Illgen; report attached)

b. Executive Committee (R. Lilley; attached minutes of July meeting)

c. Vice President (D. Scull; Report attached)

d. Secretary (W. Dean; Report attached)

e. Membership Renewals (E. Lilley; Report attached)

f. Nomination/Election (B. Hensel; See Ellen's letter, Board chart and telephone list, attached)

g. Treasurer/Audit (C. Andren; Report to be presented at meeting)

h. Awards (J. van Etten; approved by fax)

i. Constitution (L. Charron)

j. Historical (W. Dean)

k. Newsletter (W. Brogdon)

l. Journal (J. Beukers; Report attached)

m. Technical and Applications (D. Amos; Report Attached)

n. Loran-C and Loran/GPS activities at RTCA (R. Lilley and D. Johnson; See also R. Anoll preprint paper, attached)

o. Correspondence (R. Lilley; see attached items)

6. **Issues for Board Discussion and/or Action**

a. 1994 Convention - B. Uttam

Report should be available for discussion at the meeting.

b. 1995 Convention

See two fax documents attached.

See also John Beukers' previously-referenced materials for the status of planning for the 1995 meeting in Russia.

c. Memorandum of Understanding - 1995 meeting (copy attached)

WGA is requested to enter into this agreement with INA; John Beukers suggested a Board discussion was desirable prior to signing up.

d. Backup Plan for 1995 Convention

Given the continuing changes going on in Russia and the former Soviet Union, it seems prudent for WGA (or WGA/INA) to give some thought to a backup location/schedule for a 1995 meeting. That way, if something really disqualifying happens in Russia, we will not be caught unprepared.

e. WGA Constitution - Terms of Office

There has been some comment that the WGA Constitution is unclear as to the correct term of office for a Director elected to fill the slot vacated by a sitting Director who is subsequently elected President. Our practice may not be consistent with the words, or the words may not say what we want to do. Please review this, for a discussion and possible proposals.

7. **Other items for information or comment**

a. DOT User Conferences (Materials attached) FRP INPUT.

These conferences support the "living document" known as the Federal Radionavigation Plan. WGA contributed to the 1992 version, and we should stay in touch with FRP during the important years ahead. There are large changes taking place in the navigation system mix, and the FRP is the official US document describing our position.

Attend and participate; identify yourself as a WGA Director!

b. Coast Guard Loran-C Signal Spec Review by WGA

A committee was appointed (Jim Van Etten, Walt Dean and Per Erik Kvam (NODECA), and asked to review the revised draft of the signal specification during April. If copies are not available at the 1993 convention, they will be made available soon after.

c. WGA Master Card Authorization

WGA can accept orders for merchandise items using Master Card. Ellen is working with Bill Brogdon to announce this in the Gazette, and get a feature in there about our "store" items (the hats, shirts, and decals plus archive copies of Proceedings, etc.) We will highlight this credit card use at the Convention, and maybe sell some items on impulse...

Let's move some of this merchandise! Maybe we should have a big SALE, to clear out a bit, and get some (more-popular) t-shirts/sweatshirts into stock.

d. GAO Report (copy attached)

This paper has made some blood boil; Glen Rizner (NASAO) has already met with GAO to help them understand what is really going on. He and I are seeking a meeting with Senate staffers and Senator John Glenn, to try for appropriations language to insure continued Loran-C consciousness. Dale Johnson has pursued a similar road with the new FAA Administrator.

e. Wall Street Journal Article (copy attached)

Just an interesting article, for your information.

f. ION Technical Meeting, January, 1994 (brochure attached)

Note there is a session specifically including Loran-C. Get those papers ready!!!

8. Round-Table

9. Next Meeting - To be held at the close of the Technical Symposium, with Dale Johnson presiding.

7. Adjournment

Beukers Technologies

"Defining Systems for Worldwide Radionavigation"

East Ridge, Longborough
Moreton-in-Marsh
Glos. GL56 0QX, U.K.
Phone: 0451 870777 Fax: 0451 870222
International Phone: +44 451 870777 Fax: +44 451 870222

September 27, 1993

Dr. Robert W. Lilley
Avionics Engineering Center
Stocker Center, Ohio University
Athens, OH 45701-2979, USA

Dear Bob:

Enclosed is the program for the INA Orlando Meeting, October 24-29th, 1993.

At the WGA board meeting under any other business, I would like to bring the matter of the INA and WGA holding meetings around the same time with overlapping technical agendas for discussion.

Sincerely,

John M. Beukers

enc. (4)

Wild Goose Association

The International Loran Radionavigation Forum

October 18, 1993

To the Members of the WGA Board of Directors, and Committee Chairpersons:

At the Santa Barbara meeting, we turn over our Association to its next administration. Continuity is essential, so that we can properly take advantage of events already in progress.

We have a 1994 Boston meeting and a 1995 meeting in Russia coming up. RTCA committees need our continuing attention. In the coming months we'll see certification of loran and loran/GPS receiver systems for airborne use. Differential GPS (loran?) will be upon us.

As I turn over the Presidency to Dale Johnson, I want to thank each member of the Board of Directors and each committee chairperson for your support of loran, dedication to the WGA, and for helping to make the past two years fun for me. This has not been a hard job, but it can take some time and thought. Please join me as I pledge my support and help to Dale as he takes it on.

Sincerely,

Robert W. Lilley
President

Wild Goose Association, Inc.
P.O. Box 556, Bedford, MA 01730, USA

Symposium Committee

Executive Director..... Ellen Lilley
Chairman..... John D. Illgen
Co-Chairman..... James O. Alexander
International Co-Chairman..... Dr. David Last
Technical Chairman..... Walter Dean
Technical Co-Chairman..... Durk van Willigen
Finance..... Mark Mandrell
Exhibits..... James F. Culbertson
Hospitality..... James O. Alexander
Tours..... Susanne Illgen, Jo Anne Culbertson
Video/Audio..... Carolyn McDonald
Convention Planner..... Erika Faust
Hotel Coordinator..... Amber Dahl
Travel Coordinator. Betty Smith 1-800/874-8889
Golf Tournament..... James F. Culbertson
Tennis Tournament..... David W. Gledhill

Wild Goose Association

22ND ANNUAL TECHNICAL SYMPOSIUM
SANTA BARBARA, CALIFORNIA

To: Robert Lilley

From: John Illgen

Subject: WGA 1993 Convention Report for BODs Meeting

Date: 7 September 1993

1. *Technical Program.* As seen in the registration package, the technical program, banquet speaker, and luncheon speakers have been finalized.

2. *Exhibits.* Letter has been sent to potential exhibitors. If you think of companies that may not be on the WGA mailing list, please let Jim Culbertson know.

3. *Golf.* Start time is set for Monday, October 18, 1993, at the Santa Barbara Golf Course off Las Positas Road. Please spread the word. Tennis to start at 9:00 am at La Cumbre Golf and Country Club.

4. *Finance.* Projecting an $8 to $10K profit as directed by the WGA President.

5. *Hospitality.* Jim Alexander to man hospitality suite. Jim Alexander and Jim Culbertson to buy liquor, wine, and beer at a discount in Los Angeles.

6. *Tours.* Tours have been established.

7. *Video/Audio.* Carolyn McDonald will be providing equipment and her time (no charge to WGA) in exchange for us promoting NAVTEK Seminars in WGA Convention registration package. If any of you see Carolyn, give her a "big" thank you.

8. *Travel.* Encourage the use of Your Travel Center. The break in price with United Airlines is real. Call Betty Smith at 800/874-8889.

If you have questions, contact Sharon Garland at 805/968-8661.

John D. Illgen
Convention Chairman

NOTE: Hotel name has changed to Santa Barbara Radisson. All contracts were novated.

Wild Goose Association, Inc.
22nd Annual Technical Symposium
c/o Illgen Simulation Technologies, Inc.
250 Storke Road, Suite 10, Goleta, CA 93117 USA

XCom
4
105 BOD

MINUTES OF EXECUTIVE COMMITTEE MEETING 15 July 1993

A meeting of the WGA Executive Committee was held by teleconference on 15 July, 1993, starting at approximately 1340 EST.

1. Attendance

Present were:
Bob Lilley, President
Dave Scull, Vice-President
Carl Andren, Treasurer
Walt Dean, Secretary
Jim Culbertson, Past President
Dale Johnson, President-Elect

John Illgen had been invited but was not available

2. Meeting with FAA

Bob Lilley reported on a meeting he and Dale Johnson had with Jack Howell FAA technical programs leader for Flight Standards on 7/14. He could put into place for us a Loran-C overlay approaches program which would greatly accelerate putting loran in as an instrument approach aid. He has asked for a draft of a plan which Lilley and Johnson are preparing

3. Election Results

Regarding election results, it was determined that Roland takes Johnson's seat on the Board for one year only, so that he must run again in 1994 if he desires to stay on the BOD. Lilley sent a copy of election results to Bill Brogden, and will correct them regarding Roland before the next newsletter.

It was agreed that the Constitution is not perfectly clear on succession to a seat of a board member elected president, and that perhaps the matter should be referred to the Constitutional Committee. If a question remains, it will be put on the agenda for the 105th board meeting.

4. Approval of Minutes

Minutes of the 104th BOD meetings were approved with the notation by Culbertson of the typo in paragraph 5e, where "now" should read "not". It was noted that Lilley had sent an errata sheet out on 6/2. Formal approval must made at the next BOD meeting.

5. Vice President's Report

Dave Scull reported discussions of the 1995 Moscow convention in which the ION and the Royal Institute indicate they may participate. It may be the International Association of Institutes

space at the conventir

9. President-Elect's Report

Dale spoke to (Dave Hensen?), the designated FAA administrator, yesterday and there is a possibility he could be persuaded to be a speaker. He is going into Senate hearings next week, but may not have any "show stoppers" in October.

Nobody knew the status of speakers. Lilley questioned whether we would have a keynote speaker, again unknown. A discussion with Illgen is required.

Johnson and Lilley have been in meetings in Washington where it is increasingly evident that loran is very definitely needed as a hybrid partner with GPS. We need to be looking for ways this can be conveyed to the users to counteract all the GPS hype that is causing heartburn in the industry by creating unrealistic expectations. Dale thinks he sees some light at the end of the tunnel. Jack Houset(?) seems receptive to our remarks. Dave Hensen understands the issues, and Dale will try to get an audience with him. Now is a critical time, and we need to raise awareness of what reality is in this field. Lilley suggests one way is through our newsletter, as Bill Brogden also writes for other publications. Johnson suggested that industry representatives have inputs to such as aviation publications. A representative of IFR magazine is currently trying to pull together a story on what is happening in the navigation scene, and he could do us a lot of good.

(Howell)

Culbertson offered to fax a copy of the draft letter to manufacturers to Johnson and Dean. Johnson spoke to Bob Anoll about the availability data on GPS, which is not very satisfactory when considered on the basis of hours downtime per year. A combination of GPS with Loran-C or inertial is now considered essential for sole means navigation. Loran seems to have the lead over inertial.

Lilley asked if everyone had a copy of the WGA Statement of Radionavigation Policy, and it turned out nobody did. Bob decided it would be a good idea to fax a copy to all XCOM members. Dale mentioned a remark by Phil Boyer of AOPA looking on WGA members as "those loran nuts". We need to be careful in our public statements that we present a balanced approach to navigation problems. Boyer's remark appears at odds with the fact that he was our banquet speaker in Williamsburg in 1991, but perhaps reflects a political tendency to go with the tide.

There was some discussion as to how to keep our message in front of the AOPA and similar organizations.

10. Moscow 1995

None of the U.S. groups will go to Moscow in 1994. The consensus of WGA BOD is that the 1995 Moscow meeting will be our

Wild Goose Association

The International Loran Radionavigation Forum

VICE PRESIDENT'S REPORT

9/10/93

I welcome Dale Johnson as our new WGA President and look forward to his term. I have informed Dale that I wished to step down from the Vice President position that I have held since 1990. It is time to develop some new ideas and give some one else a chance to play a role in the Executive Committee.

It has been a pleasure and a honor to serve as the WGA's Vice President in the last two presidential terms. Jim Culbertson and Bob Lilley have been outstanding leaders in their fields and have been very supportive to me through their roles as president.

Serving as the Vice President for Operations, 1991-92, gave me great insight into the internal workings of what I found to a highly respected professional association. I am sure this has helped me in my new job as The Institute of Navigation (ION) Executive Director.

I am extremely grateful to Jim Culbertson, John and Marilyn Beukers and Carl Andren for their moral encouragement and patience during the period I was learning to do the job. Bob and Ellen Lilley also made the transfer of operations to Ohio, in 1992, a relatively easy task. I also want to thank the many WGA directors who have helped me on some very tough problems when I called on them. I will not name them all at the risk missing some one. I do want to say, however, the 1991 WGA Technical Conference in Williamsburg was a success due to strong support I received from Co-Technical Chairman, Dave Olsen.

I realize it has been a long time since I boarded the USNS Compass Island in 1957 to perform tests on a bathymetric survey system using a Cytac (the forerunner of Loran-C) receiver. Little did I realize then how important the development of Loran-C would be to the progress made in navigation and its effect on my career. I feel very proud to have been closely associated with those who have contributed so much to the development of loran over the past two decades. I am not leaving the WGA, however, as I have another year as Director and feel there is still much to be done in WGA. I look forward to further expansion of loran throughout the world and I hope to help in this regard through my duties in the ION and the International Association of Institutes of Navigation (IAIN).

WGA FAX

Date: 11 September, 1993

To: Bob Lilley Fax No: 614-593-1604

From: Walt Dean Fax No: 503-694-2283
Phone: 503-694-1443

My only input to the meeting is not as secretary, but as a recipient of the FRP and the notices of meetings, I am stimulated to suggest we should discuss the latest versions and, if appropriate, attend some or all of the scheduled conferences. I can probably attend the one in Seattle on Dedember 2.

Walt

Note: I will attend the Columbus, Ohio November 30 meeting, along with others from Ohio University.

Bob Lilley

WILD GOOSE ASSOCIATION MEMBERSHIP SNAPSHOT

Membership Status as of 93.09.15
Details for Members With Dues Expired > 1992

Individuals-Regular:	244
Individuals-Sponsored:	12
Corporate 1 Lead Members:	7
Corporate 2 Lead Members:	8
Corporate1/2-Sponsored:	74
Associate:	4
Life:	52
Total Paid Members:	401
Honorary:	10
Complimentary:	43
Total Members:	454
Lost:	18
Revoked:	79
Resigned:	48

Dues Expir 89:		113
Dues Expir 90:		118
Dues Expir 91:		129
Dues Expir 92:		144
Dues Expir 93:		349
Dues Expir 94:		0
Subtotal	:	853
Prospects:		2655

Control; all dues_expir>1992: 444

(should equal Total Paid + Complimentary)

Control; Paid+Complimentary: 444

Wild Goose Association

The International Loran Radionavigation Forum

September 8, 1993

WGA Election Participants:

Please excuse the lateness of this letter. It got buried in summer activities. Sorry!

Congratulations to the new 1994+ WGA Board. Thank you to all of the participants for making this election possible and successful. It takes the willingness of everyone, giving of their precious time and experience, to keep WGA growing and successful.

Enclosed is the election results. Elected were: Dale Johnson, President; John Illgen, board, 3 years; Bill Roland, board, 1 year, (filling Dale John's seat). Re-elected to 3-year board terms were: John Beukers, Jim Culbertson and Mike Moroney. We look forward to seeing everyone at the 1993 Convention in Santa Barbara, CA.

Sincerely,

Ellen G. Lilley
WGA Operations

send do each of the members 9/13/93 runni

Wild Goose Association, Inc.
P.O. Box 556, Bedford, MA 01730, USA

Subject: WGA NOMINATING AND ELECTION COMMITTEE REPORT 2 JULY 1993

From: Ben Peterson

To: Walt Dean, WGA Secretary

WGA Ballots for the election of President and Directors were counted in New London, CT on 2 July 1993 in accordance with Article IV, Section 5 of the Bylaws. Results are as follows.

President:

James Alexander	83
Dale Johnson	92

Board of Directors:

James Alexander	53
John Beukers	136
Jim Culbertson	101
John Illgen	86
Mike Moroney	92
Bill Roland	81
Doug Taggart	93
Durk Van Willigen	72
Dale Johnson	1
Bill Pohemus	1

Election results are certified by the following members of the nominating and election committee.

Ben Peterson — Richard Hartnett — Michael McKaughan

Encl: WGA Ballots

Wild Goose Association

The International Loran Radionavigation Forum

Report for the 105th Board Meeting

submitted by John M. Beukers

1. WGA Radionavigation Journal. Directors will be disappointed and even annoyed that once again after a productive restart earlier in the year, activity on the Journal had to be displaced by other priorities. These were associated with GPS/GNSS and the future mix of worldwide radionavigation systems. The need for the Journal is greater now than ever before however the demands upon my time for written material, travel and presentations has not permitted the luxury to set aside a dedicated block of time sufficient to get the job completed. There is no lack of material or difficulty in getting contributor participation but there is very little industry support. International loran may change this situation. We want to get the Journal out, it is important to do so and it is long overdue. Recognizing this we will keep trying unless Directors have another avenue to use.

2. 1995 Convention in Moscow. Report on the site survey for the 1995 WGA/INA/IRN Convention in Moscow was circulated and a vote to proceed in 1995 was made. A subsequent meeting in June at the ION Annual Meeting selected a date at the end of May early June 1995. Since June there has been one way communication to Mr. Denisov to confirm a specific date, but, as of this writing, no date has been established. Dr. Andrew Stratton is the focal point for INA and I have been in regular communication with him. Since Mr. Denisov is scheduled to be at the WGA Convention in October (time of the Board meeting for which this is being written), establishing a firm date should be possible.

3. NW Europe Loran-C System (NELS). NELS is progressing but needs help from manufacturers and the user community. In addition the Coordinating Authority (CAO) needs support from those with loran expertise but has to set up an organization to accept this. I am involved in a Loran Awareness Program and am attempting to coordinate promotional activities. One example is the draft pamphlet attached to this report. Anyone is invited to comment or complain and all contributions will be well received. Since the credit includes the WGA, Board approval is needed. This pamphlet is, in addition to a more comprehensive technical document being prepared by the CAO, for distribution by the group member countries. Perhaps an invitation to the CAO by the WGA to submit its material for review might be in order.

4. ION National Technical Meeting Jan. 1994. There is to be session on GPS and Ground Based Radio Navigation Technology at the ION Technical Meeting to be held in San Diego, January 24-26. This is an opportunity for loran or loran/GPS type papers. I am chairing this session and would like to see terrestrial systems receive proportional representation. Please contact me.

Wild Goose Association, Inc.
P.O. Box 556, Bedford, MA 01730, USA

The Navigator's Dream

It has been long said that the prudent navigator does not rely upon a single source of data for position location and navigation. Northwest Europe is soon to get two all weather, 24 hr/day radionavigation services fulfilling the navigator's dream. In 1994 the area is to get the full coverage of precision terrestrial Loran-C supplemented by the United States-owned satellite Global Positioning System. But why *both* a terrestrial system and one in space? And what becomes of the current Decca system that has been used for decades in this area? What choice of user equipment will there be and what should be bought? This fact sheet provides some background on radionavigation systems and provides answers to some often asked questions.

Navigating by Satellite

In the 1993/4 time frame the United States Global Positioning System (GPS) is to be declared operational for civil use but under the control of the U.S. Department of Defense and with no European involvement. The former Soviet Union's Global Navigation Satellite System (GLONASS) continues to be developed with defence funds for civil operation sometime in the future. For general worldwide use, civil acceptance of both of these systems has yet to be achieved. In addition, and in keeping with the U.S. strategy for national security, the U.S. GPS system's accuracy is purposely degraded. To overcome these drawbacks the international community is actively working on plans to provide a worldwide satellite navigation system specifically designed for civilian use.

In the meantime while the full potential of satellite technology is being assessed and the issues surrounding ownership and control are being resolved, coverage of the precision Loran-C radionavigation system is being extended worldwide.

Terrestrial Loran-C

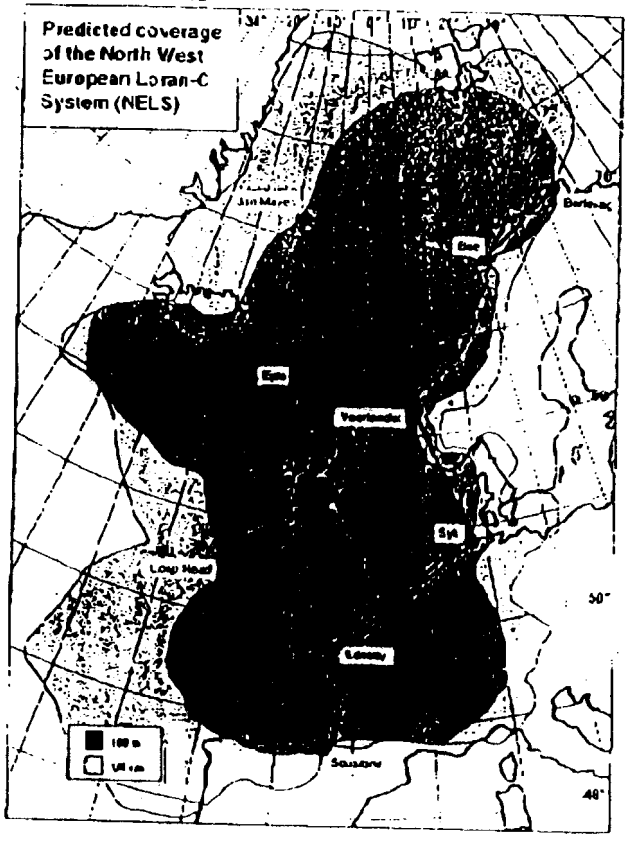
Developed by the United States Department of Defense and employed by that agency for almost 20 years before being turned over to civil use in 1974, Loran-C is now the world's most extensively used system of radionavigation. During 1994 the United States overseas Loran-C transmitting facilities will be transferred to host countries, an action that is causing unprecedented upgrading and expansion of Loran-C throughout the world. Adding to these existing facilities, new stations are being installed by other nations either as an individual initiative or in groups such as the Northwest Europe consortium consisting of Denmark, France, Germany, Ireland, Norway and The Netherlands.

Commonwealth of Independent States (CIS)

Extending from Europe to the East into the CIS, Loran-C is being coupled with a look-alike system known as Chayka. The same is taking place from the West Coast of the United States into the CIS. The CIS has plans for total land coverage and to couple the Chayka system with the Loran-C chains in the Mediterranean, the Baltic and the Barents sea area.

Northwest Europe, North Sea and North Atlantic Loran-C System

Under the agreement signed on August 6, 1992 by Denmark, France, Germany, Ireland, Norway and The Netherlands, the existing U.S. Loran-C transmitters being transferred to host countries will be joined with two from France and three new stations, one in Ireland and two in Norway. The nine stations will be operated in four chains. While part of the system is currently operational, full operation with the new stations is not expected before mid-1995.



Countries Involved in Loran-C Operations.
Belarus, Canada, China, Denmark, Dubai, Egypt, France, Germany, India, Ireland, Italy, Japan, Korea, The Netherlands, Norway, Russia, Spain, Saudi Arabia, Turkey, Ukraine, and the United States of America.

Complementary Systems

Loran-C and satellite systems are often portrayed as being competitive when, in fact, they are uniquely complementary for the user. Both systems have exceptional performance characteristics but also have their weaknesses. But because the signals and transmission paths are totally different the advantages of one system overcome the deficiencies of the other. Repeatable accuracy, signal availability, system integrity and redundancy are significantly improved to the point where the combination of the two systems satisfies the most stringent performance requirements without resorting to expensive augmentations and monitoring.

Decca and Loran-C

Decca has well served the marine community in many parts of the world for half a century but today the system's use is in decline. Loran-C provides significantly better performance with fewer transmitters than Decca. While both Decca and Loran-C operate in a similar part of the frequency spectrum, they are fundamentally different in signal format and use. The short range Decca system was designed for marine use. Loran-C signals reach 1000Km or more and are employed on land, at sea and in the air. The signal characteristics of Decca cannot discriminate against the effects of nighttime propagation whereas Loran-C is designed specifically to eliminate this source of error. And important to the service provider, the cost per square kilometer of coverage is significantly less when using Loran-C.

GPS and Selective Availability (SA)

Two levels of service are provided by GPS; Precision and Standard. The precision service is restricted to the military while the standard service has been offered to the world for civil use at no charge. As part of the U.S. national security strategy, errors are purposely introduced into the standard service signals (SA) that can produce errors in position of 300 meters or more depending upon satellite geometry. This is the repeatable accuracy of GPS unless a continuous stream of corrections are sent to a user during operation. This should be compared with a repeatable accuracy of Loran-C of 30-50 meters.

User Equipment Choices

Position fixing and navigating with Loran-C or satellites is based upon relating received transmissions to precise time. Since all Loran-C transmitter and all satellite clocks have a common time reference, receivers that are appropriately designed can use both terrestrial Loran-C signals and satellite signals to compute position. A receiver so designed increases the number of signal sources available (4 satellites and 3 Loran-C stations, for example) and provides a significant improvement in performance. Receiving equipment that processes both Loran-C and GPS transmissions is becoming available. The alternative is to employ either a standalone Loran-C unit or GPS unit or, if the pocket book can afford it, both units. But remember the repeatable accuracy of Loran-C is considerably better than GPS employed without supplemental communications for correction of errors.

105 BOD

To: Bob Lilley @ 614-593-1604 @ FAXGATE
cc: Dale Johnson @ 503-364-2138 @ FAXGATE
From: Dave Amos
Date: 09/03/93 12:47:42 PM
Subject: Items for 105th BOD Meeting

ITEM-Jungle Drums: It is rumored that at a recent ceremony opening the Loran-Chayka baseline, RADM Bill Ecker (G-N) announced that, among other budget cutting options, the USCG is considering ceasing support of US Loran-C operations by 1996 instead of 2015. This is an item on the table along with a number of others of course, and is potentially a posturing. However, also rumored is that the Clinton administration is talking about Government support of only one RNAV system, namely GPS, as opposed to two. Has anyone else heard corroborating talk? I believe it is true. I don't know what support options are being discussed in absence of USCG support, if any. WGA should come to Loran-C's defense again. Let's agree on our strategy and process and proceed. ANOLC

Report from the Chairman of the Loran C Technology and Applications Committee:

I an participating as a member of the ION Technical Workimg Group on accuracy definition. The goal of the group is to reexaming current definitions and metrics applied to radionavigation systems and publish an "approved" or recommended set for use by writers, manufacturers, advertisers, technical contributors, ect. The whole point is to get everyone talking the same set of metrics so that the user can see what he can really expect from a nav system. The discussions include various accuracy measures, various reliability and availability measures, and integrity; Loran-C, GPS, DGPS, OMEGA; GPS issues like CA, PPS, SA, AS; we are trying to avoid geodesy and datum issues.

For WGA, the prospect is to debunk a lot of claims being made about GPS. I will provide copies of the deliberations for review and comment by the WGA.

Respectfully submitted,

Dave Amos

POST

INTEGRATED GPS/LORAN-C RECEIVERS; A PERSPECTIVE ON USER ACCEPTANCE, INTEGRATION SCHEMES, AND CERTIFICATION STATUS

Robert Anoll
Systems Control Technology, Inc
Tel (202) 646-4830 Fax (202) 646-4790

ABSTRACT

This paper reviews the status of augmenting GPS with Loran-C to satisfy the required navigation performance of an airspace. Specific issues discussed are its acceptance by the aviation community relative to other options, RTCA SC-159's developing position on the recommended means of integration, and the status of the draft GPS/Loran-C Minimum Operational Performance Standards (MOPS).

INTRODUCTION

When the aviation community looked closely at the navigational performance delivered by GPS, they soon realized that this system does not, by itself, satisfy the required navigation performance of an airspace. Specifically, GPS delivers insufficient availability of position information with integrity [Table 1][1]. To satisfy this deficiency, a receiver which hybridized GPS and Loran-C was one of the first combinations analyzed as a potential solution. However, in the past few years considerable research has gone into investigating other augmentations. The author presents a perspective on how well the receiver will be accepted by the aviation community in light of recent developments and the working group's interim conclusions and status.

TABLE 1
AVAILABILITY OF POSITION INFORMATION WITH INTEGRITY[1]
GPS WITH BAROMETRIC AIDING
[24 SATELLITES WITH 3 FAILED]*

EN-ROUTE PHASE OF FLIGHT						
	A	B	C	A - AVAILABILITY		
JFK-LAX	94	45	70	B - AVERAGE OUTAGE (MINUTES)		
SFO-NRT	96	25	60			
DFW-CDG	99	20	30	C - MAXIMUM OUTAGE (MINUTES)		
	TERMINAL PHASE OF FLIGHT			NON-PRECISION APPROACH		
	A	B	C	A	B	C
SFO	94	30	75	86	26	100
DFW	92	22	55	79	38	80
ORD	93	26	80	81	35	125
JFK	88	58	140	78	79	210
ATL	92	30	90	80	42	180

21 satellites will be usable at least 98% of the time.[2]

ACCEPTANCE BY THE AVIATION COMMUNITY

After developing a supplemental GPS MOPS, RTCA Special Committee-159 (GPS) was tasked to continue its work and develop a sole-means GPS-based MOPS. The committee concluded that the navigational systems on which to develop certification procedures, for other than precision approaches, would be GPS augmented with GLONASS, GPS Integrity Channel, Inertial and Loran-C (GPS by itself was dismissed as an option). Possible other augmentations were dismissed due to known deficiencies, a lack of interest, and a shortage of expertise/manpower. In the author's opinion, GPS/Loran-C is emerging as the most desirable near-term navigational system for those who do not plan to venture into oceanic airspace. Its limitations in oceanic airspace may also not be insurmountable.

This conclusion has been reached by as much of a process of eliminating other augmentations as it is from the strengths of GPS/Loran-C. Integration with GLONASS was initially greeted with considerable enthusiasm but that enthusiasm diminished for several reasons. First, the Russians have publicly made conflicting statements about their country's willingness to maintain the system. Second, continuous wave interference from mobile communications systems and SATCOM remains a problem. Third, many pundits, particularly those in the European aviation community, strongly object to completely relying on two military systems; particularly since both could become inoperative for the same reasons. Of these three reasons, Russian statements about the uncertain future of GLONASS may prove the most daunting and by itself make users reluctant to purchase the receiver.

The GPS Integrity Channel (GIC) would enable GPS to satisfy the required navigational performance but is still a number of years away from being operational. The United States Government also continues to deliberate

3. "Minimum Operational Performance Standards for Airborne Navigation Equipment using Global Positioning System (GPS) Augmented with Other Systems/Equipment/Techniques Part 1," Third Draft, July 2, 1993.

4. van Graas, Frank, "Baseline Fault Detection and Exclusion Algorithm," 3rd Draft, Presented to RTCA SC-159 Working Group-5, July 10, 1993.

5. Ibid.

6. Enge, Per, et al. "Combining Pseudoranges from GPS and Loran-C for Air Navigation," Journal of the Institute of Navigation, Spring 1990.

7. Braasch, Soo Y., "Realtime Mitigation of GPS SA Errors Using Loran-C," Wild Goose Association Preliminary Proceedings, August 24-27, 1992.

8. Lachapelle, Gerard and Townsend, Bryan, "GPS/Loran-C: An Effective System Mix for Vehicular Navigation in Mountainous Areas," Journal of the Institute of Navigation, Spring 1993.

Wild Goose Association

The International Loran Radionavigation Forum

September 8, 1993

Mr. Joseph Pino, ACW-300A
Federal Aviation Administration
Technical Center
Atlantic City Int'l Airport, NJ 08405

Dear Mr. Pino:

I am writing on behalf of the Wild Goose Association to extend a specific invitation for Robert Erikson to attend and participate in our 22nd Annual Technical Symposium. The WGA provides the international forum for the Loran-C navigation community.

Bob has contributed significantly to the introduction of Loran-C into the NAS, and he continues to support our efforts to revise the system error budgets and test procedures to insure an available and safe navaid. We would like for him to present his error budget changes and to participate as we begin to develop GPS/Loran-C hybrid-system standards.

Your support of Bob's participation in the Symposium will be much appreciated. Thank you for your help.

Sincerely,

Robert W. Lilley, Ph.D.
President
(614) 593-1514

RWL:skc
JP0908

Board: FYI I write several of these each year, to highlight the need for particular people to attend!

Wild Goose Association

The International Loran Radionavigation Forum

COPY

July 25, 1993

Mr. John M. Beukers
East Ridge Longborough, nr.
Moreton-in-Marsh
Glos. GL 56 0QL ENGLAND

Dear John:

The WGA Executive Committee asked that I write to you with our thanks and appreciation for the excellent report on your Moscow trip. The group shares your concern that the meeting needs careful planning and budgeting. Specific suggestions were made for someone like Erika Faust to help on site.

Dale Johnson, our President-elect, and I will be searching for a WGA U.S. representative to serve on the Steering Committee, and your suggestions are sought. We are working on the assumption that the 1995 meeting will be our Annual Technical Symposium. Is this also your feeling?

Once again, my personal thanks and those of the Executive Committee for your continuing dedication to the WGA and your excellent report.

Sincerely,

Robert W. Lilley, Ph.D.
President

RWL:skc
JB071593

xc: W. Dean, Secretary
D. Johnson, President-elect

Wild Goose Association, Inc.
P.O. Box 556, Bedford, MA 01730, USA

Wild Goose Association
The International *Loran* Navigation Forum
Facsimile Message

From:
Robert W. Lilley, President
Avionics Engineering Center
Ohio University
Athens, Ohio 45701
(voice) 614-593-1514
(fax) 614-593-1604

Date: Sept 10, 1993 Time: 3:10

This is page 1 of 2 pages.

To:

☒ Individuals: Mr. V. Denisov
011-7-095-132-08-2

☐ Group: Executive Committee
- ___ David Scull, ION, Executive Director
- ___ Walter Dean, WALDEAN, Secretary
- ___ Carl Andreas, RACAL MARINE, Treasurer
- ___ James Culbertson, COASTWATCH, Past Pres.

☐ Group: Board of Directors, 1992-93
- ___ James Alexander, AMT
- ___ David Amos, SYNETICS
- ___ John Beukers, BEUKERS TECHNOLOGIES
- ___ Frank Cassidy, DATA MARINE INTL'
- ___ Laura Charron, NAVAL OBSERVATORY
- ___ Bruce Hensel, B. F. GOODRICH
- ___ John Illgen, ILLGEN SIMULATION
- ___ Dale Johnsen, UPS/IL-MORROW
- ___ David Last, UNIVERSITY OF WALES
- ___ Mark Morganthaler, TRIMBLE
- ___ Mike Moroney, VNTSC
- ___ Ben Peterson, USCG ACADEMY

☐ Committee Chairs
- ___ David Olsen - USCG
- ___ William Brogdon - GAZETTE
- ___ James van Etten - AWARDS
- ___ Martin Shuey - RTCA

This will confirm that at their board meeting on April 22, 1993 and subsequent Executive Committee meeting on July 15, 1993, the Board of Directors of the Wild Goose Association approved of a Radionavigation convention to be organized jointly with the International Navigation Association and the InterNavigation Committee of Russia to be held in Moscow late May or early June of 1995. The exact date is to be determined by the host, the InterNavigation Committee.

No further authorization from the Wild Goose Association is necessary for the planning of this Convention to begin.

We look forward to working with you.

R Lilley

President

WGA International Loran-C Symposium
Santa Barbara, CA
October 19-21, 1993
Call John Illgen for Details, 805-968-8661

FAX TRANSMISSION: NUMBER OF PAGES INCLUDING THIS ONE (1)

Beukers Technologies
East Ridge, Longborough
Moreton-in-Marsh, Glos. GL 56 0QX U.K.

Tel: 0451-870777 Fax: 0451-870222
International Tel: +44 451-870777 Fax: +44 451-870222

	To:	Dr. Robert Lilley	Date:	September 2, 1993
SD*5	Fax No:	614 593 1604	Time:	12:29 PM
	From:	John Beukers	File:	0902Lill

Subject: Moscow and ION Annual Meeting

---

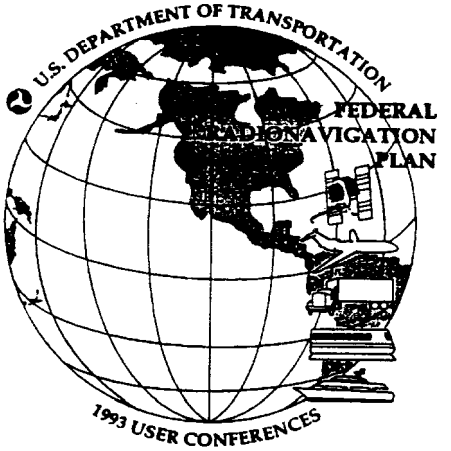
1. Moscow

It seems that the message still hasn't got through to Denisov.

Please will you send him a fax that says:

"This will confirm that at their board meeting on XXXX and subsequent Executive board meeting held on XXXX, the Board of Directors of the Wild Goose Association approved of a Radionavigation Convention to be organized jointly with the International Navigation Association and the Internavigation Committee of Russia to be held in Moscow late May or early June of 1995. The exact date to be determined by the host, the Internavigation Committee".

"No further authorization from the Wild Goose Association is necessary for the planning of this Convention to begin."



Dates/Locations:

November 9-10, 1993
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

November 30, 1993
Ohio Department of Transportation/Division of Aviation
2829 W. Dublin-Granville Road
Columbus, Ohio 43235

December 2, 1993
Seattle Hilton
Sixth and University Streets
Seattle, Washington 98101

Sponsors:

Research and Special Programs Administration (RSPA)
Federal Aviation Administration (FAA)
U.S. Coast Guard (USCG)
John A. Volpe National Transportation Systems Center (Volpe Center)

Conference Coordinator: John A. Volpe National Transportation Systems Center (Volpe Center)

CONFERENCE OVERVIEW

The U.S. Department of Transportation is sponsoring the 1993 Radionavigation User Conferences. These meetings serve as an open forum for aviation, marine, land, and space users of U.S. Government-provided radionavigation systems to review and comment on current and future operating plans and policies for these systems. This is an opportunity for users, manufacturers, and service providers to provide input for preparation of the next edition of the official Federal document on radionavigation systems policy, the Federal Radionavigation Plan.

This year, the conferences will be held in three locations to accommodate the user community: Washington, D.C.; Columbus, Ohio; and Seattle, Washington. The conference in Washington, D.C. will be two days in length. The first day will emphasize maritime and land users; the second day will emphasize aviation users. Brief overviews of all systems will be presented on both days.

The conferences in Columbus, Ohio and Seattle, Washington will each be one day in length. Again, brief overviews of all systems will be provided to leave ample time for questions and discussion.

ADVANCE PROGRAM

1993 Radionavigation User Conferences

November 9-10, 1993
Washington, D.C.

I. *MARINE/LAND USERS SESSION* (11-9-93)

7:30 AM	REGISTRATION
8:30 AM	WELCOME/INTRODUCTION
8:45 AM	DEPARTMENT OF TRANSPORTATION OVERVIEW (RSPA)
9:00 AM	DEPARTMENT OF DEFENSE (DOD)
	- GPS, Transit
9:15 AM	FEDERAL AVIATION ADMINISTRATION (FAA)
	- VOR/DME, ILS, MLS, Loran-C, Omega, Radiobeacons, GPS, DGPS
9:45 AM	U. S. COAST GUARD (USCG)
	- Loran-C, Omega, Radiobeacons, GPS (GPSIC), DGPS
10:45 AM	BREAK
11:00 AM	LAND MODE APPLICATIONS (Federal Highway Administration)
11:30 AM	QUESTION AND OPEN DISCUSSION PERIOD
12:00 PM	LUNCH
1:00 PM	QUESTION AND OPEN DISCUSSION PERIOD
2:45 PM	BREAK
3:00 PM	QUESTION AND OPEN DISCUSSION PERIOD
4:30 PM	SUMMARY (RSPA)

ADVANCE PROGRAM

1993 Radionavigation User Conferences

November 30, 1993, Columbus, Ohio
December 2, 1993, Seattle, Washington

7:30 AM	REGISTRATION
8:30 AM	WELCOME/INTRODUCTION
8:45 AM	DEPARTMENT OF TRANSPORTATION OVERVIEW (RSPA)
9:00 AM	DEPARTMENT OF DEFENSE (DOD)
	- GPS, Transit
9:15 AM	FEDERAL AVIATION ADMINISTRATION (FAA)
	- VOR/DME, ILS, MLS, Loran-C, Omega, Radiobeacons, GPS, DGPS
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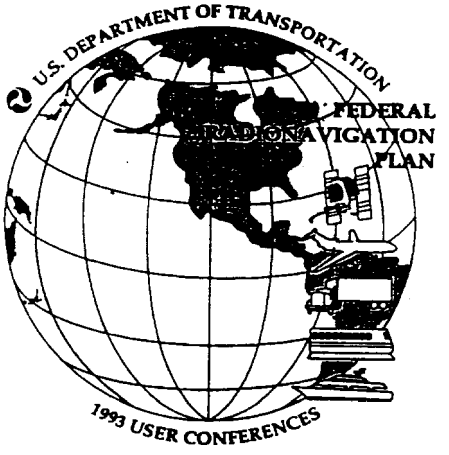


1993 Radionavigation User Conference Registration Form

Please return this form to the
Volpe Center Conference Office by October 15, 1993

Name _____
Last First Middle Initial

Name to Appear on Badge _____

Professional Title _____

Organizational Affiliation _____

Mailing Address _____

City _____ State/Prov. _____ Postal Code _____

Country _____

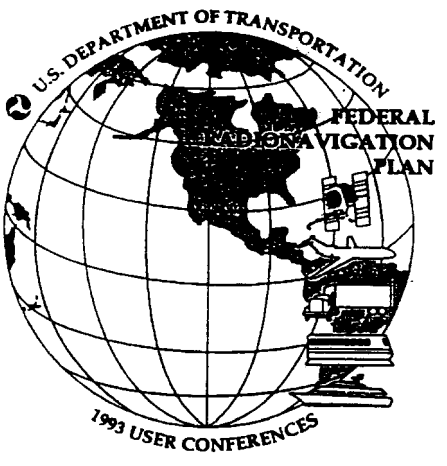
Business Telephone (_____) _____ Fax (_____) _____

Please check the meeting(s) you plan to attend:

- ☐ I WILL attend the November 9-10 meeting in Washington, D.C.
- ☐ I WILL attend the November 30 meeting in Columbus, OH
- ☐ I WILL attend the December 2 meeting in Seattle, WA
- ☐ I CANNOT attend any of the meetings

Return this registration form by October 15, 1993 to:

Carol Scanlon, DTS-930
Conference Office
Volpe National
Transportation Systems Center
Cambridge, MA 02142
Telephone (617) 494-2307 Fax (617) 494-2569



General Conference Information

November 9-10, 1993: Washington, D.C.

The November 9-10 conference will be held at the Federal Aviation Administration auditorium, 800 Independence Avenue, S.W., Washington, D.C. 20591. Non-Federal employees are reminded that they must sign in (with photo identification) with Security on the first floor of the building.

Attendees are urged to arrive early as seating is limited.

The Federal Aviation Administration building can be reached from Washington National Airport via Metro (Yellow Line, L'Enfant Plaza station) or taxi. To the hotels below, fares range between $10-$15, one way.

Following is a list of hotels in the area:

Holiday Inn - Capitol
550 C Street, S.W.
Washington, D.C.
(202) 479-4000
Approx. 3 blocks to FAA

Loews L'Enfant Plaza
480 L'Enfant Plaza, S.W.
Washington, D.C.
(202) 484-1000
Approx. 3 blocks to FAA

Holiday Inn - Central
1501 Rhode Island Ave., N.W.
Washington, D.C.
(202) 483-2000
15-20 minute walk to FAA
On Metro

December 2, 1993: Seattle, Washington

The December 2 conference will be held at the Seattle Hilton, Sixth and University Streets, Seattle, Washington 98101, (206-624-0500). The hotel is located in downtown Seattle approximately 20 miles from SeaTac International Airport, and can be reached by taxi or Gray Line Airporter, which runs every half hour. The hotel is walking distance to Metro Bus and the Monorail.

A block of rooms will be held at the Seattle Hilton until November 10, 1993 at:

Single - $70 + taxes; Double - $80 + taxes

Please make your reservations directly with the hotel by the November 10th cutoff date.

Other hotels in the area include:

Sheraton Seattle
6th Ave. & Pike
Seattle, WA
(206) 621-9000
Approximately 1 1/2 blocks to Seattle Hilton

West Coast Roosevelt Hotel
7th Ave. & Pine
Seattle, WA
(206) 621-1200
Approximately 5 blocks to Seattle Hilton

Federal Policy and Plans for the Future Radionavigation Systems Mix 1992

Purpose: This statement sets forth the policy and plans for Federally provided radionavigation systems.

Objectives: The Federal Government operates radionavigation systems as one of the necessary elements to enable safe transportation and encourage commerce within the United States. It is a goal of the Government to provide this service in a cost-effective manner. In order to meet both civil and military radionavigation needs, the Government has established a series of radionavigation systems over a period of years. Each system utilizes the latest technology available at the time it was introduced to meet existing or unfulfilled needs. This statement addresses how and for what period each system should be part of the Federal radionavigation systems mix.

The Department of Defense is deploying a new high-technology radionavigation system, the Global Positioning System (GPS), which will have wide civil application on a global basis. This system has the potential to meet or better the accuracy and coverage capabilities of most other radionavigation systems. Consequently, if the full civil potential of GPS is realized, the Department of Transportation will consider phasing out some of the existing radionavigation systems.

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.

The DOD requirement for Omega will end December 31, 1994; however, limited use is expected as long as the system remains operational.

VOR/DME: VOR/DME provides users with the primary means of air navigation in the National Airspace System (NAS). VOR/DME, as the international standard for civil air navigation in controlled airspace, will remain a short-range aviation navigation system through the year 2010.

The DOD requirement for and use of VOR/DME will terminate when aircraft are properly integrated with GPS and when GPS is certified to meet RNP for national and international controlled airspace. The target date is the year 2000.

TACAN: TACAN is a short-range navigation system used primarily by military aircraft.

The DOD requirement for and use of land-based TACAN will terminate when aircraft are properly integrated with GPS and when GPS is certified to meet RNP in national and international controlled airspace. The target date is the year 2000. The requirement for shipboard TACAN will continue until a suitable replacement is operational.

ILS, MLS: ILS is the standard civil landing system in the U.S. and abroad, and is protected by ICAO (International Civil Aviation Organization) agreement to January 1, 1998. ICAO has selected the MLS as the international standard precision approach system, with implementation targeted for 1998. MLS is expected to gradually replace ILS in national and international civil aviation. The FAA and DOD plan to have MLS collocated with ILS to minimize the transition impact.

Transit: Transit is a satellite-based positioning system operated by DOD.

Transit will terminate and system operation will be discontinued in December 1996.

Radiobeacons: Maritime and aeronautical radiobeacons serve the civilian user community with low-cost navigation. Some maritime radiobeacons will be modified to carry differential GPS correction

become known. The Coast Guard and the FAA will notify civil users when the GPS is approved for navigation.

GPS will provide two levels of service - a Standard Positioning Service (SPS) and a Precise Positioning Service (PPS).

SPS Policy: SPS is a positioning and timing service which will be available to all GPS users on a continuous, worldwide basis with no direct charge. SPS will be provided on the GPS L1 frequency which contains a coarse acquisition (C/A) code and a navigation data message. SPS is planned to provide, on a daily basis, the capability to obtain horizontal positioning accuracy within 100 meters (2 drms, 95 percent probability) and 300 meters (99.99 percent probability), vertical positioning accuracy within 140 meters (95 percent probability), and timing accuracy within 340 ns (95 percent probability). The GPS L1 frequency also contains a precision (P) code that is reserved for military use and is not a part of the SPS. Although available during GPS constellation build-up, the P code will be altered without notice and will not be available to users that do not have valid cryptographic keys.

PPS Policy: PPS is a highly accurate military positioning, velocity, and timing service which will be available on a continuous, worldwide basis to users authorized by the DOD. PPS will be the data transmitted on GPS L1 and L2 frequencies. PPS was designed primarily for U.S. military use. It will be denied to unauthorized users by use of cryptography. PPS will be made available to U.S. Federal and Allied Government (civil and military) users through special agreements with the DOD. Limited, non-Federal Government, civil use of PPS, both domestic and foreign, will be considered upon request and authorized on a case-by-case basis, provided:

- It is in the U.S. national interest to do so.
- Specific GPS security requirements can be met by the applicant.
- A reasonable alternative to the use of PPS is not available.

Differential GPS:

Differential GPS (DGPS) is a system in which differences between observed and predicted GPS signals at a particular location are transmitted to users as a differential correction to upgrade the

THE WALL STREET JOURN

EASTERN EDITION THURSDAY, AUGUST 26, 1993 CHICOPEE, MASS

Poor Man's Cruise

Airliners Can Exploit U.S. Guidance System, But So Can Enemies

Global Positioning Satellites Could Be Used to Direct Cheap, Accurate Missiles

Defense Aide: It's a Quandary

By JOHN J. FIALKA
Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON—At the Pentagon, they call it "the poor man's cruise missile."

It is a low-flying guided missile or robot-driven aircraft that is relatively cheap to produce, but capable of hitting targets with a precision the U.S. once monopolized. Iraq, Iran and North Korea are among a dozen countries developing these missiles. The spread of such weapons would cut the U.S. technological edge and increase the danger American forces face in regional conflicts.

But the threat of these new missiles doesn't stem from a breakthrough in some Third World capital. The sophisticated satellite system to guide the missiles is being put into space by the Pentagon. And the ability to access the system inexpensively was developed by the Federal Aviation Administration for the commercial-airline industry.

By tapping into the Defense Department's $10 billion Global Positioning System, renegade states conceivably could guide their missiles to precise targets — including some in the U.S. — by firing low-flying missiles from submarines or merchant vessels. The missiles could carry chemical or biological weapons, or even nuclear warheads.

Hard to Protect

The GPS, using signals from 24 orbiting satellites to pinpoint locations on earth, is the most accurate navigation and targeting system ever devised, and could go on line late this summer. The fact that others are gearing up to use it underscores how difficult it is to protect military technology, particularly when it also has

Military officials already are worried about the potential danger of GPS-guided cruise missiles. "We really haven't faced a threat like that in the continental U.S.," says Rear Adm. Bruce B. Bremner, director of operations for the U.S. Space Command in Colorado Springs, Colo. "There is the potential that it could be used for terrorists or for enemy use and it could do a lot of damage."

No one has a plan for solving the problem. There are few effective defenses against cruise missiles, which travel at low altitudes and often are mistaken for birds on radar screens. Moreover, the world's airlines and other commercial users will soon be heavily dependent on GPS guidance. The GPS was designed so that a president could switch off the system in a military crisis, but Adm. Bremner doubts that safety could be preserved if, for example, the system were switched off as GPS-guided airliners try to land in bad weather.

'Dual Use' Technology

The airliners' enthusiasm for the military navigation system has taken the Pentagon by surprise. It threatens to start yet another battle over sales of so-called "dual use" technology, which can be employed for military or civilian purposes.

"This is an inherent quandary," admits Jules G. McNeff, the Pentagon's top expert on the GPS system of orbiting "Navstar" satellites. Originally, the navigation system used a coded signal to keep precision guidance out of the hands of a potential enemy. But during the mid-1980s, as the military's navigation system took shape in space, two other federal agencies — the Coast Guard and the FAA — began multimillion-dollar programs to expand the benefits of GPS for commercial users.

Through the use of computers and ground-based radio beacons, they invented "local differential GPS," which essentially breaks the military's code. Now GPS is accessible to anyone who can acquire the necessary receiver equipment.

Flying Through Doors

GPS was used by the U.S. during the Persian Gulf War, when B-52 bombers, F-16 fighters and Apache helicopters savaged Iraqi forces using ultraprecise guidance. The Navy's Standoff Land Attack Missiles, guided in part by GPS, amazed television viewers by flying in through doors and other openings to demolish highly fortified targets.

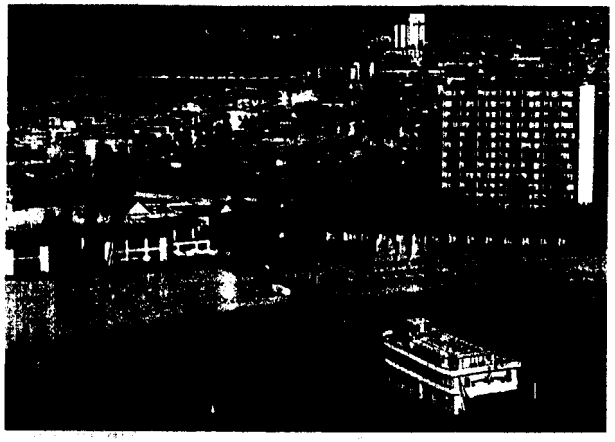
In comparison, Iraq's Scud missi had primitive guidance systems, usi coordinates from inaccurate maps, a often missed their assigned targets several miles. The sprawling U.S. amm nition dumps, bases and petroleum st age sites in Saudi Arabia were virtua immune. "I don't expect that to be t again anytime in the future," says J McNeff.

Indeed, the U.S. Tomahawk miss attack on Baghdad in June may be t of the last raids on an enemy who does shoot back. Enemies equipped with prec missiles "will have a high likelihood inflicting painful damage in a conflic predicts a U.S. official.

In addition to Iraq, Iran and No Korea, GPS-guided cruise missiles in the pipeline in India, Pakistan, Indo sia, Egypt, Israel, Taiwan and sev other countries, U.S. officials say. equipment is commercially available

Please Turn to Page A4, Column 4

The emphasis of this technical meeting is exploring modern navigation applications and new technologies for land, sea, air, and space. Papers simply presenting company products are discouraged, unless they provide innovative information about the product, or feature its role in an integrated system.



ABOUT SAN DIEGO

San Diego is California's oldest and second largest city. Splashed with spectacular sunny weather, its wealth of year-round outdoor activities, and its countless tourist and cultural attractions, such as the Zoo, Wild Animal Park, and Sea World, San Diego is justifiably another name for paradise.

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EXHIBIT INFORMATION

Table top exhibits will be available at a cost of $600, which includes one complimentary registration. For more information, please contact Lisa Beaty, phone: 703-683-7101 or fax: 703-683-7105.

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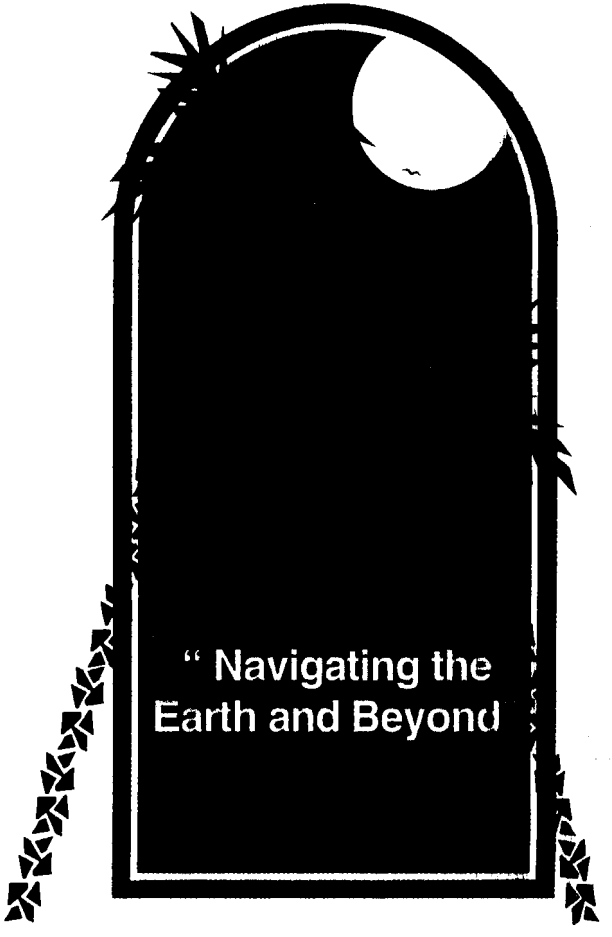

January 24 - 26, 1994
Catamaran Resort Hotel
San Diego, California

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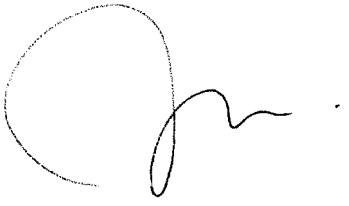
	To:	Dr. Robert Lilley	Date:	September 16, 1993
SD*5	Fax No:	614 593 1604	Time:	11:15 AM
	From:	John Beukers	File:	0916Lill
	Subject:	Material for Board Mtg		

Bob,

Attached as promised in our phone conversation of last evening. Sorry for it being a bit late.

Sounds as though I have lots of catching up to do next month. It will be good to have all the troops together to get some action on a number of items. Maybe we can push the NW Europe effort a bit as well.



Wild Goose Association

The International Loran Radionavigation Forum

Report for the 105th Board Meeting

submitted by John M. Beukers

1. WGA Radionavigation Journal. Directors will be disappointed and even annoyed that once again after a productive restart earlier in the year, activity on the Journal had to be displaced by other priorities. These were associated with GPS/GNSS and the future mix of worldwide radionavigation systems. The need for the Journal is greater now than ever before however the demands upon my time for written material, travel and presentations has not permitted the luxury to set aside a dedicated block of time sufficient to get the job completed. There is no lack of material or difficulty in getting contributor participation but there is very little industry support. International loran may change this situation. We want to get the Journal out, it is important to do so and it is long overdue. Recognizing this we will keep trying unless Directors have another avenue to use.

2. 1995 Convention in Moscow. Report on the site survey for the 1995 WGA/INA/IRN Convention in Moscow was circulated and a vote to proceed in 1995 was made. A subsequent meeting in June at the ION Annual Meeting selected a date at the end of May early June 1995. Since June there has been one way communication to Mr. Denisov to confirm a specific date, but, as of this writing, no date has been established. Dr. Andrew Stratton is the focal point for INA and I have been in regular communication with him. Since Mr. Denisov is scheduled to be at the WGA Convention in October (time of the Board meeting for which this is being written), establishing a firm date should be possible.

3. NW Europe Loran-C System (NELS). NELS is progressing but needs help from manufacturers and the user community. In addition the Coordinating Authority (CAO) needs support from those with loran expertise but has to set up an organization to accept this. I am involved in a Loran Awareness Program and am attempting to coordinate promotional activities. One example is the draft pamphlet attached to this report. Anyone is invited to comment or complain and all contributions will be well received. **Since the credit includes the WGA, Board approval is needed.** This pamphlet is, in addition to a more comprehensive technical document being prepared by the CAO, for distribution by the group member countries. Perhaps an invitation to the CAO by the WGA to submit its material for review might be in order.

4. ION National Technical Meeting Jan. 1994. There is to be session on GPS and Ground Based Radio Navigation Technology at the ION Technical Meeting to be held in San Diego, January 24-26. This is an opportunity for loran or loran/GPS type papers. I am chairing this session and would like to see terrestrial systems receive proportional representation. Please contact me.

5. Congress Aviation Subcommittee Hearing. Some already know that I was one of 15 witnesses at the House Aviation Subcommittee Hearing on the future use of satellite technology in Aviation. There was substantial press activity prior to and following the event. I submitted a comprehensive report to the ION for publication in the Winter edition of the ION Newsletter. The hearing took place close on the heels of the hearings before the commission set up to probe the needs to provide for a competitive airline industry. Both hearings endorsed GPS as a means of saving airlines money and some witnesses expressed exasperation with the FAA for moving too slowly and ICAO for being in the way. I was recognized by one leading aviation daily as being the "only sour note"!. Ask me about it!

6. IAIN GNSS Initiative. The International Association of the Institutes of Navigation are to hold a meeting on October 15 in Paris to decide on whether or not to set up a GNSS office in Europe. All member associations were asked to make nominations for attendance. Invitations are going out to 200 and it is anticipated that 100 will attend. By the time of the Board meeting the Paris meeting will have taken place, and since I will have been in attendance a report will be contained in my presentation in the Policy session on the first day of the Santa Barbara WGA Convention.

7. The Radionavigation FAX Network. Over the past year a totally informal and more or less underground network of individuals are sharing the "latest" on what is going on around the world with radionavigation, particularly with GPS and, to a lesser extent, GLONASS. The vast spectrum of opinions, initiatives and actions within governments and institutions is startling, defies comprehension and logical reasoning. The WGA has work to do in getting loran back where it belongs. I urge directors to take this comment seriously and be prepared to contribute to new initiatives.

Respectfully submitted,

John M. Beukers
September 16, 1993

Understanding Accuracy

We are accustomed to finding our way by the use of charts, and the identification of landmarks. This physical evi- provides us with confidence as to where we are and where re going. But when we employ radio signals to fix our on or as an aid to navigating we lose this direct physical onship and add a degree of uncertainty. This is because the t of our electronic instruments has to be related in some to our present location and planned destination. We fore have to consider the *accuracy* of the information ed from the radio signals as it relates to our actual position, ner it be on land, sea or in the air.

The difference between electronically derived informa- nd physical location is loosely defined as accuracy, a term s often misused resulting in false or misleading claims of rmance in literature promoting navigation equipment. This s confusion within the user community.

Until very recently all charting and mapping was done by al survey using landmarks referenced to a "datum" for a ic area. There are several unrelated datums in use through- e world that do not necessarily overlay. For example, a rotruding from the sea, a wreck beneath the sea or the end nway, measured to one datum, might be 10's or even 100's ters off from the location described by another datum.

To determine the radio description of a location it is nec- to visit that location or reference it to a nearby radio ined "landmark". Once the electronic output has been ed either in coordinates to an electromagnetic grid or in rted form to latitude and longitude, we are able to define rious meanings of accuracy.

Absolute accuracy - the ability of the radio positioning to define a location without prior survey or corrections. erm needs to be used in conjunction with the survey cy of maps and charts. The benefit of knowing one's radio n to a high degree of accuracy can only be realized if the nship to charted objects is known to the same precision.

Repeatable accuracy - the ability to revisit a radio deter- location at any time, night and day, all year round, using put previously obtained from the receiving equipment. the most important number since it defines the error to be ed in retracing one's steps to a harbor channel, a favourite spot, a rock, a wreck, the end of a runway or a site on land.

Relative accuracy - the ability to determine one's location to another who is using the same radiopositioning sys- his is of importance in a rendezvous such as would occur arch and rescue mission. The relative position of two rs may be known to a high degree of accuracy but the phic location will be defined no closer than the absolute y supported by the system.

Loran-C Facts and Figures

- **Internationally Accepted**
  Loran-C is the most widely accepted precision navigation aid in the world. It is nationally owned, and in some areas the system is covered by multi-lateral agreements between states for funding and operation.
- **Mature and Proven System**
  Loran-C was developed by the United States Department of Defense for military purposes but in 1974 the system's funding, control and operation was transferred in its entirety to the Department of Transportation, a civil agency of the United States government. Since that time the system has matured on a commercial basis throughout the world. After 1994 United States-owned Loran-C assets overseas will be tranferred to host states who will take over financial and operational responsibility.
- **Universal Use**
  Loran-C is employed on land, on the sea and in the air with well over a million users. In the United States alone, operators of over 130,000 aircraft navigate on a regular basis with certified Loran-C equipment.
- **Uninterrupted Service**
  Loran-C is a civil system operated by civilian agencies with an availability of better than 99.7%. Notice of system status is provided by system operators.
- **Error Free Night Operation**
  Loran-C's daytime precision accuracy is maintained at night. Loran-C is specifically designed to avoid nighttime skywave effects that introduce errors into Decca receivers.
- **High Repeatable Accuracy**
  Loran-C repeatable accuracy of 30 to 50 meters is considerably better than the civil service provided by the United States Global Positioning System.
- **Long Range**
  The Loran-C service area is significantly greater than that provided by the Decca system and extends to well over 1000 km from a chain of transmitting stations.
- **Complementary to Satellite Systems**
  Most importantly, Loran-C is a complement to satellite systems and is not a competitor. By operating on the same time standard, Loran-C transmissions can be employed in conjunction with satellites to improve navigation signal integrity and availability.

For further information, please contact:

DRAFT REVISION C 93091

Coming to Northwest Europe in 1994/5

An Expanded Precision Radionavigation Aid Wholly Owned, Operated and Funded by European Countries for Use in Europe and Surrounding Areas

The Civil Northwest European Loran-C System

Coverage over Northwest Europe

An all-European Initiative

Published in cooperation with the Northwest Europe Loran-C Program Office, The International Association of Lighthouse Authorities (IALA) and the Wild Goose Association, (the International Loran-C Radionavigation Forum).

Navigator's Dream

It has been long said that the prudent navigator does not pon a single source of data for position location and ation. Northwest Europe is soon to get two all weather, 24 radionavigation services fulfilling the navigator's dream. 4 the area is to get the full coverage of precision terrestrial -C supplemented by the United States-owned satellite Positioning System. But why ***both*** a terrestrial system e in space? And what becomes of the current Decca that has been used for decades in this area? What choice equipment will there be and what should be bought? This eet provides some background on radionavigation sys- nd provides answers to some often asked questions.

ating by Satellite

n the 1993/4 time frame the United States Global Posi- System (GPS) is to be declared operational for civil use der the control of the U.S. Department of Defense and with opean involvement. The former Soviet Union's Global tion Satellite System (GLONASS) continues to be devel- vith defence funds for civil operation sometime in the For general worldwide use, civil acceptance of both of ystems has yet to be achieved. In addition, and in keeping ie U.S. strategy for national security, the U.S. GPS 's accuracy is purposely degraded. To overcome these cks the international community is actively working on provide a worldwide satellite navigation system specifi- esigned for civilian use.

n the meantime while the full potential of satellite logy is being assessed and the issues surrounding hip and control are being resolved, coverage of the on Loran-C radionavigation system is being extended ide.

trial Loran-C

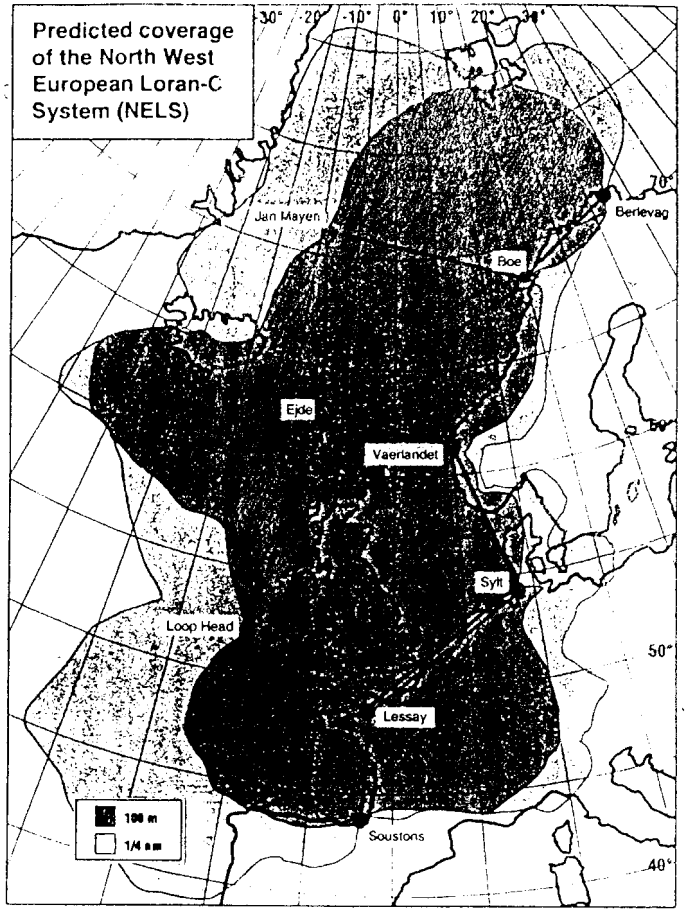
eveloped by the United States Department of Defense ployed by that agency for almost 20 years before being ver to civil use in 1974, Loran-C is now the world's most ely used system of radionavigation. During 1994, the States overseas Loran-C transmitting facilities will be red to host countries, an action that is causing unprece- upgrading and expansion of Loran-C throughout the Adding to these existing facilities, new stations are being l by other nations either as an individual initiative or in uch as the Northwest Europe consortium consisting of rk, France, Germany, Ireland, Norway and herlands.

onwealth of Independent States (CIS)

tending from Europe to the East into the CIS, Loran-C coupled with a look-alike system known as Chayka. The taking place from the West Coast of the United States CIS. The CIS has plans for total land coverage and to he Chayka system with the Loran-C chains in the anean, the Baltic and the Barents sea area.

Northwest Europe, North Sea and North Atlantic Loran-C System

Under the agreement signed on August 6, 1992 by Denmark, France, Germany, Ireland, Norway and The Netherlands, the existing U.S. Loran-C transmitters being transferred to host countries will be joined with two from France and three new stations, one in Ireland and two in Norway. The nine stations will be operated in four chains. While part of the system is currently operational, full operation with the new stations is not expected before mid-1995.



Countries Involved in Loran-C Operations.
Belarus, Canada, China, Denmark, Dubai, Egypt, France, Germany, India, Ireland, Italy, Japan, Korea, The Netherlands, Norway, Russia, Spain, Saudi Arabia, Turkey, Ukraine, and the United States of America.

Complementary Systems

Loran-C and satellite systems are often portrayed as be competitive when, in fact, they are uniquely complementary t the user. Both systems have exceptional performance characteristics but also have their weaknesses. But because the signals and transmission paths are totally different the advantages of one system overcome the deficiencies of the other. Repeatable accuracy, signal availability, system integrity and redundancy are significantly improved to the point where the combination of the two systems satisfies the most stringent performance requirements without resorting to expensive augmentations and monitoring.

Decca and Loran-C

Decca has well served the marine community in many parts of the world for half a century but today the system's use is in decline. Loran-C provides significantly better performance with fewer transmitters than Decca. While both Decca and Loran-C operate in a similar part of the frequency spectrum, they are fundamentally different in signal format and use. The short range Decca system was designed for marine use. Loran-C signals reach 1000Km or more and are employed on land, at sea and in the air. The signal characteristics of Decca cannot discriminate against the effects of nighttime propagation whereas Loran-C is designed specifically to eliminate this source of error. And important to the service provider, the cost per square kilometer of coverage is significantly less when using Loran-C.

GPS and Selective Availability (SA)

Two levels of service are provided by GPS; Precision and Standard. The precision service is restricted to the military while the standard service has been offered to the world for civil use at no charge. As part of the U.S. national security strategy, errors are purposely introduced into the standard service signals (SA) that can produce errors in position of 300 meters or more depending upon satellite geometry. This is the repeatable accuracy of GPS unless a continuous stream of corrections are sent to a user during operation. This should be compared with a repeatable accuracy of Loran-C of 30-50 meters.

User Equipment Choices

Position fixing and navigating with Loran-C or satellites is based upon relating received transmissions to precise time. Since all Loran-C transmitter and all satellite clocks have a common time reference, receivers that are appropriately designed can use both terrestrial Loran-C signals and satellite signals to compute position. A receiver so designed increases the number of signal sources available (4 satellites and 3 Loran-C stations, for example) and provides a significant improvement in performance. Receiving equipment that processes both Loran-C and GPS transmissions is becoming available. The alternative is to employ either a stand alone Loran-C unit or GPS unit or, if the pocket book can afford it, both units. But remember the repeatable accuracy of Loran-C is considerably better than GPS employed without supplemental communications for correction of errors.