

MEMORANDUM OF AGREEMENT  
BETWEEN THE  
DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS  
AND THE  
DEPARTMENT OF TRANSPORTATION  
UNITED STATES COAST GUARD  
OFFICE OF NAVIGATION SAFETY AND WATERWAY SERVICES  
FOR THE ESTABLISHMENT OF DGPS SERVICE

*Feb 94*

I. Purpose

This Memorandum of Agreement (MOA), and such supplements as may be agreed to, provides the basis for cooperative efforts in the establishment and utilization of the Differential Global Positioning System (DGPS) radionavigation service between the Department of the Army, U.S. Army Corps of Engineers (USACE), and the Department of Transportation, United States Coast Guard (USCG), Office of Navigation Safety and Waterway Services.

Specifically, this agreement establishes the overall policies and relationships guiding inter-agency activities for the funding, installation and operation of DGPS sites. This agreement provides for the maximum use of existing infrastructure and resources within each agency to the mutual benefit of both agencies. As a result, USACE surveying, positioning, dredging, revetment maintenance and other navigation related activities will be more efficient and the USCG will be able to provide improved safety of navigation on our nation's waterways.

II. References and Authorities

- A. The Federal Radionavigation Plan published biennially by Department of Transportation and Department of Defense
- B. 14 U.S.C. 81
- C. 49 CFR 1.45(a)(6)
- D. USACE Test Results of USCG DGPS Site at English Turn, LA

## E. USCG DGPS Broadcast Standard, COMDTINST M16577.1

### III. Background

The USCG is establishing a nationwide DGPS network to meet the requirements of harbor and harbor approach navigation as defined in reference (A). The system operates on long-established USCG marine radiobeacon frequencies (285-325 KHz). Some 50 sites are proposed for coastal coverage of the continental U.S., Great Lakes and selected areas of Hawaii and Alaska. Eight prototype DGPS sites are operating at this time. Most significant (to USACE) is that no funding is available for Coast Guard DGPS stations on the Western/Inland Rivers. In December 1992 a joint USACE/USCG test of the USCG system was initiated at English Turn, New Orleans, LA. The purpose of the test was to determine if the USCG DGPS radionavigation system was capable of providing meter-level accuracies. Results from tests performed in June 1993 indicate the USCG system can yield position accuracies of less than 1.5 meters 2drms at distances of upwards of 125 miles from the radiobeacon. This level of accuracy falls well within recognized positional tolerances required for most USACE marine surveying and construction activities. The Coast Guard recognizes that DGPS service on the nation's waterways will significantly enhance the safety of navigation and intends to request future funding to expand and support DGPS service on select waterways. In addition, the Coast Guard and USACE may have opportunities for further joint efforts on other waterways of the U.S. To this end, the USACE and the USCG would continue their cooperative efforts as outlined below.

### IV. Execution

The responsibility of each party in the execution of this MOA will be detailed in this document and follow on supplements to this agreement. Additional supplements will be prepared as necessary and will be approved by the Radionavigation Division, Office of Navigation Safety and Waterway Services, USCG Headquarters and the appropriate USACE field office.

### V. Implementation and Funding

Implementation of this MOA will be performed by the appropriate operational elements of USACE and USCG. For the USACE that is the individual field offices in coordination with their chain of command. For the USCG that is the Radionavigation Division, Office of Navigation Safety and Waterway Services, USCG Headquarters.

Funds transfers should be accomplished using a Military Interdepartmental Purchase Request (MIPR).

VI. Review and Termination

This MOA will be reviewed as deemed necessary by either agency. It is subject to amendment at any time upon joint written approval of the parties. This agreement may be terminated by either agency upon written notice to the other party 180 days prior to the desired termination.

VII. Other Provisions

Any activity under this MOA by USACE or USCG is subject to the availability of appropriated funds and proper authorization.

Nothing herein is intended to conflict with current USACE or USCG directives. If the terms of this MOA are inconsistent with existing directives of either of the parties entering into the MOA, then those portions of the MOA which are determined to be inconsistent shall be invalid; but the remaining terms and conditions not affected by inconsistency shall remain in full force and effect. At the first opportunity for review of the MOA, such changes as deemed necessary will be accomplished by either an amendment to this MOA or by entering into a new agreement, whichever is deemed expedient to the interest of both parties.

VIII. Effective Date

The effective date of this agreement shall be the later date affixed below.

APPROVED:

APPROVED:



William J. Ecker  
Rear Admiral, USCG  
Chief, Office of Navigation  
Safety and Waterway Services



Stanley G. Genega  
Major General, USA  
Director of Civil Works  
U.S. Army Corps of Engineers

Date 4 FEB 1994

Date 23 Feb 94



DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
WASHINGTON, D.C. 20314-1000

REPLY TO  
ATTENTION OF:

CECW-EP-S

11 August 1993

FACT SHEET

**SUBJECT:** Corps-wide Implementation of the U.S. Coast Guard (USCG) Differential GPS Navigation Service for USACE Dredge and Survey Support Positioning

1. **PURPOSE:** To provide technical information on proposed Corps-wide implementation and use of a nationwide USCG Differential GPS network.
2. **RECOMMENDED USE:** To provide background for Command decision on whether to implement and mandate use of the USCG Differential GPS Navigation Service throughout USACE.
3. **BACKGROUND SUMMARY:** The USCG Differential GPS (DGPS) Navigation Service was developed to provide a nationwide, all-weather, real-time, radio navigation service in support of commercial and recreational maritime interests. Its accuracy was originally designed to fulfill an 8-20 meter maritime navigation accuracy requirement. The system operates on long-established USCG marine radio beacon frequencies (285-325 KHZ). Each radio beacon has an effective range of 150 to 250 nautical miles at a 99.9% signal availability level. The USCG has installed approximately 8 DGPS radio beacons to date. Some 50 sites are proposed for complete coastal, Great Lakes, and Alaska coverage by FY96. Most significant (to USACE) is that no DGPS stations were programmed for the MR&T area. It is fully expected that the USCG system, once completed, will be the primary marine navigation device used by commercial and recreational vessels requiring meter-level accuracies. Tab 1 contains a detailed system description and projected USCG implementation plan. The USACE DGPS system under development at CETEC provides accuracies at the 0.1-meter level. Due to data link requirements of this system, it cannot broadcast differential correctors over the USCG marine radio beacon frequencies. HQUSACE IM is processing a request for frequency allocations for this system. Once obtained, it is envisioned that many districts requiring decimeter accuracies, especially for the vertical component to correct for tidal actions, will be establishing rover base-stations on a temporary basis. If and where possible these stations would be co-located with the USCG base stations.
4. **JOINT USACE/USCG COORDINATION ACTIONS:** Last December, in response to OMB inquiries regarding potential DGPS system redundancies between USCG and USACE, a joint USACE/USCG test of the USCG system was initiated at English

ENCLOSURE 2

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Turn, New Orleans, LA. (See Tab 2). The purpose of the test was to determine if the USCG DGPS navigation system was capable of providing meter-level accuracies through use of recently improved GPS receiver and communication technology. Organizations involved with the test included: HQUSACE, HQUSCG, New Orleans District, LMVD, U.S. Army Topographic Engineering Center, NOAA Coast & Geodetic Survey, and Trimble Navigation, Inc. Results from tests performed in early June indicate the reconfigured version of the USCG system will now yield 2DRMS (i.e., 95% confidence level) positional accuracies of less than 1.5 meters (5 feet); and at distances upwards of 125 miles from the reference beacon. This level of accuracy was far better than anticipated and falls well within recognized positional tolerances required for most USACE dredge control or related marine surveying and construction measurement activities (i.e., 6 meters 2DRMS). See Executive Summary of test results at Tab 3.

5. IMPACTS: Given the enhanced positional accuracies demonstrated in the New Orleans test, the USCG DGPS Navigation System is fully capable of serving meter-level USACE dredge control and marine surveying needs.

a. Corps-wide implementation and use of USCG system will eliminate need for maintaining existing USACE-operated microwave positioning systems and will significantly reduce or eliminate USACE requirements to develop independent UHF/VHF DGPS networks for meter-level vessel navigation & positioning. Actual and avoided cost savings are significant.

b. The system has unlimited potential for supporting other non-marine (i.e., inland) activities such as: master planning, engineering, mapping, operations, land/floating plant tracking, and various GIS development activities where meter-level accuracy is sufficient (typically for depicting features at map scales of 1 inch = 400 feet or smaller).

c. The Coast & Geodetic Survey (NOAA) has decided to use the USCG system as the primary positioning mode for all their offshore survey activities. Thus, all the major Federal agencies involved with marine support activities are leaning towards use of the USCG system. Having Federal agencies responsible for marine navigation, construction, and charting on the same navigation (i.e., geodetic) reference system is a decided safety benefit; especially considering that users will also be using the same navigation reference system.

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d. Other DGPS positioning techniques and systems will probably be developed over the next 3 to 5 years that could exceed the accuracies of this USCG system. Various DGPS/GPS network concepts are being considered by commercial firms and public agencies (e.g. FAA).

6. LMVD/MR&T DGPS NETWORK IMPLEMENTATION. The original USCG DGPS Navigation Service implementation plan (see Tab 1) did not include the "Western Rivers" (i.e., MR&T Project). Tab 4 outlines a Commander, Second Coast Guard District (St. Louis) request to the Commandant, USCG that the Western Rivers sector be programmed into the coastal and Great Lakes DGPS network. USCG funding for this add-on cannot be programmed until the FY96-97 time frame. With USACE funding support to the USCG, meter-level DGPS stations in the MR&T area could be installed and activated in FY94. In anticipation of such a cooperative cost-sharing effort with USACE, the USCG has requested FY94 DPA from GSA to procure such equipment as necessary to implement a Western Rivers DGPS Navigation Service network. To obtain full coverage in LMVD, three more reference stations will be required in addition to the English Turn DGPS station/beacon. To implement this network in LMVD by FY94, the USACE cost share is estimated not to exceed \$750,000.

7. POTENTIAL COST SAVINGS: The estimated cost to establish a Corps-operated VHF/UHF DGPS network in LMVD is \$2.25M. This exceeds the \$750K estimate to develop the USCG meter-level system on a cost-share basis. Since coastal and Great Lakes areas are already programmed (funded) by the USCG, USACE stands to save an estimated \$10M to \$15M through use of the USCG system; as opposed to developing and installing its own UHF/VHF DGPS network in these areas. In a Corps-wide system, annual O&M and integrity monitoring costs are estimated at \$3M to \$5M, or \$15 to \$25M over a 5-year projected life. Since the USCG will install, operate, maintain, and perform 24-hour integrity monitoring of the entire DGPS network, there will be no subsequent system O&M cost to USACE. Overall Corps-wide cost savings could approach \$25-40M through use of the USCG system.

8. RECOMMENDED ACTIONS:

a. Continue ongoing coordination with HQUSCG to complete LMVD DGPS radio beacon network coverage in FY94 - 3 additional stations required with USACE cost sharing support. Coordination meeting tentatively scheduled for early September 1993 in LMVD. Action: MAJ Frank Jordano (USACE Liaison Officer to HQUSCG), Bill Bergen (CECW-EP), and Max Lamb (CELMV-ED).

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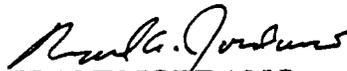
- b. Coordinate potential for FY94 network extension and cost-sharing support up the Missouri, Ohio, and Upper Mississippi Rivers: MRD (1 site), ORD (1 or 2 sites), and NCD (2 sites) respectively. Action: MAJ Frank Jordano and Bill Bergen.
- c. Consider establishing Corps-wide policy mandating use of the USCG DGPS network for dredge control and survey vessel positioning; provided that (1) USCG commits to upgrading entire DGPS network to 1.5 meter 2DRMS accuracy and (2) USCG system configuration is technically compatible with USACE applications for 0.1 meter (i.e., "4-inch") DGPS control requirements. Action: TBA.

9. COORDINATION: This fact sheet has been coordinated through CECW-E and CECW-O.

10. SUBMITTED BY:



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(TABS WITHDRAWN)

DGPS BROADCAST SITES							
NAME	LAT.	LONG.	RANGE	NAME	LAT.	LONG.	RANGE
GREAT LAKES REGION				ATLANTIC AND GULF COASTS (Continued)			
DULUTH, MN	46 46.8	92 05.3	40mi	FORT MACON, NC	34 41.5	76 41.0	130mi
EAGLE HARBOR, MI	47 27.7	88 09.5	160mi	CAPE HENRY, VA	36 55.8	76 00.5	130mi
WHITEFISH PT., MI	46 46.3	84 57.5	70mi	CAPE HENLOPEN, DE	38 46.6	75 05.3	180mi
LOOKOUT 4, MI	48 17.1	84 12.7	40mi	SANDY HOOK, NJ	TBD	TBD	100mi
SEUL CHOIX PT. MI	45 55.3	85 54.7	120mi	MONTAUK PT., NY	41 04.0	71 51.8	130mi
STURGEON BAY, WI	47 47.7	87 18.8	60mi	BOSTON, MA	42 02.4	70 03.7	60mi
MILWAUKEE, WI	43 01.6	87 52.9	140mi	PORTSMOUTH, NH	43 04.3	70 42.5	100mi
PRESQUE ISLE LT. MI	45 21.4	83 29.5	100mi	BASS HARBOR, ME	TBD	TBD	140mi
SAGINAW BAY, MI	TBD	TBD	60mi	PACIFIC COAST, ALASKA, & HAWAII			
FORT GRATIOT, MI	43 00.3	82 52.4	140mi	BARBERS POINT, HI	21 18.0	156 06.5	170mi
BELLE IS., MI	42 20.4	82 57.8	70mi	UPOLO POINT, HI	20 14.8	155 53.2	170mi
SANDUSKY, OH	41 30.0	82 40.5	130mi	POINT LOMA, CA	32 40.0	117 14.6	150mi
BUFFALO, NY	42 52.2	78 54.2	140mi	POINT ARGUELLO, CA	34 34.7	120 38.6	190mi
ROCHESTER, NY	43 15.4	77 36.2	100mi	PT. BLUNT, CA	37 51.2	122 25.2	60mi
TIBBETS PT., NY	44 08.1	76 22.2	70mi	POINT ARENA, CA	38 57.3	123 48.6	130mi
ATLANTIC AND GULF COASTS				CAPE BLANCO, OR	42 50.3	124 33.8	130mi
ARANSAS PASS, TX	27 50.0	97 03.5	180mi	GRAYS HARBOR, WA	46 54.2	124 07.8	150mi
GALVESTON, TX	29 19.7	94 44.3	180mi	EDIZ HOOK, WA	48 08.4	123 24.1	70mi
MOBILE PT. AL	30 13.6	88 01.4	170mi	ROBINSON POINT, WA	47 23.3	122 22.4	60mi
ENGLISH TURN, LA	29 52.7	89 56.6	190mi	GUARD ISLAND, AK	55 26.8	131 52.8	200mi
EGMONT KEY, FL	27 36.0	82 45.7	210mi	CAPE SPENCER, AK	58 12.0	136 38.3	260mi
KEY WEST, FL	TBD	TBD	150mi	C.HINCHENBROOK, AK	60 14.3	146 38.8	120mi
PUERTO RICO	TBD	TBD	200mi	POTATO POINT, AK	61 03.	146 42.	100mi
MIAMI, FL	25 44.0	80 09.7	120mi	COOK INLET, AK	TBD	TBD	200mi
CAPE CANAVERAL, FL	28 27.6	80 32.6	250mi	KODIAK, AK	59 00.	156 30.	200mi
CHARLESTON, SC	32 45.5	79 50.8	150mi	COLD BAY, AK	TBD	TBD	200mi

Table 3 - DGPS BROADCAST SITES

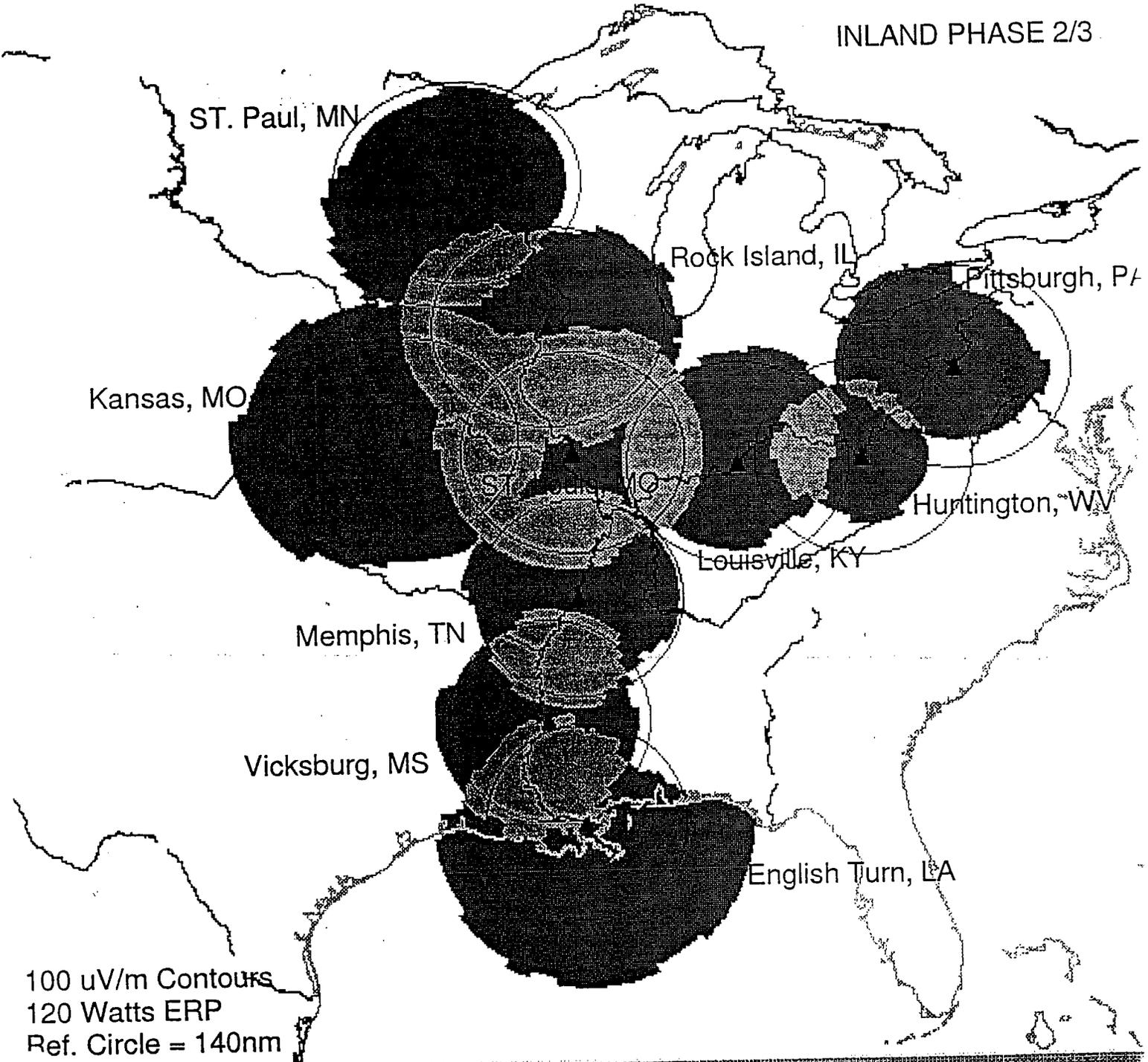
ENCLOSURE 3

# USCG DIFFERENTIAL GPS NAVIGATION SERVICE 1992-1996

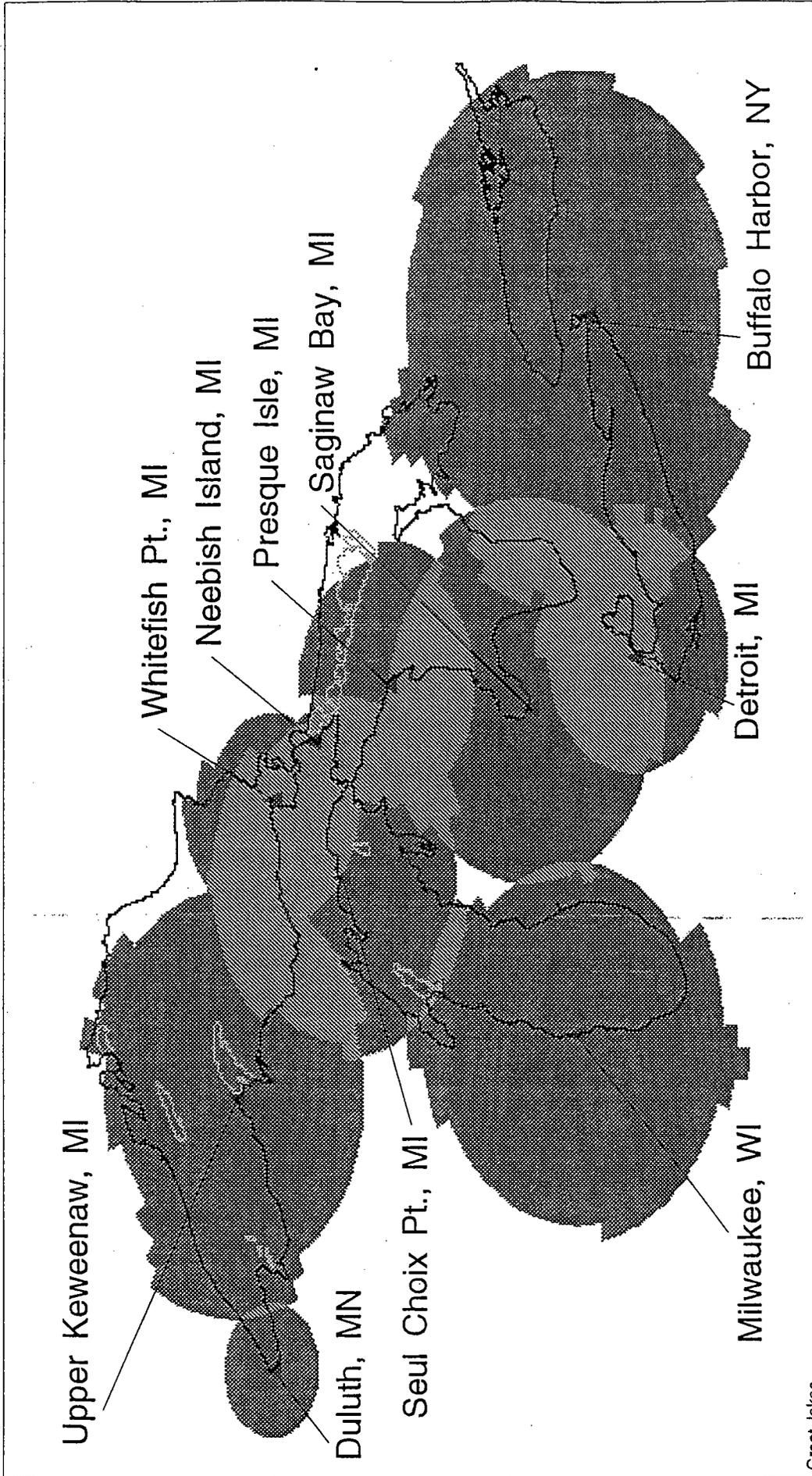
50 Station Coastal and Great Lakes Network



INLAND PHASE 2/3



Lat 38:17:53, Lon -90:27:15



Great Lakes

**Proposed Meter-Level Real-Time DGPS Radiobeacon Coverage  
and Transmitter Sites In US Great Lakes  
Detroit District Providing Transmitter Sites In Cooperation with US Coast Guard  
Network Expected to be Operational in Late 1994 or Early 1995**