PART 6

LORAN-C NAVIGATION SYSTEM

TABLES

FIGURES

A. Loran-C Chain Coverage

Figure 1 shows the North American coverage of Loran-C while Figures 2 and 3 show the Loran-C coverage existing on the East Coast of Canada and on the Great Lakes (respectively). They show the recommended Loran-C chains, and the station pairs within a particular chain, to be used within the various coverage areas. The following note pertains to Figure 2 and 3.

Note: The dividing lines between the Loran-C rates do not necessarily mean there are no other suitable Loran-C stations/chains which could be used to safely navigate in an area. Example Figure 2, while it is recommended to use 5930XY (Caribou - Nantucket - Cape Race on rate 5930) off Halifax, coverage also exists there for 9960WZ and 5930XZ. It is simply estimated that 5930XY provides better coverage in this area. Example Figure 3, while it is recommended to use 9960YZ (i.e., Seneca – Carolina Beach – Dana on rate 9960) in Lake Erie, coverage also exists there for 9960WZ and 8970XY. It is simply estimated that 9960YZ provides better coverage in Lake Erie.

The individual coverage patterns shown in Figures 4, 5 & 7 are provided by the Newfoundland East Coast, Canadian East Coast and Northeast U.S. Loran-C chains respectively. Those patterns provided by the Great Lakes coverage are shown in Figure 6.

B. Chain Details

Technical details of chains that provide coverage in waters off Eastern Canada are shown in Tables 1&2 and coverage in the Great Lakes is shown in Table 3. Table 4 shows the Northeast U.S. chains which cover the Great Lakes and East Coast.

C. Loran-C Coordinate Converters

Listing of vectors from the Loran-C coordinate converter position to the true position.

D. Loran-C Receiver Latitude/Longitude Corrections

Today's Loran-C receivers are equipped with microprocessors which are designed to internally compute the latitude and longitude coordinates of the receiver, based on the Time Difference (TD) readings, and directly display these values. This reduces the need to possess to Loran-C charts, though it is still recommended that they be procured.

The latitude/longitude computation may be based upon a pure seawater path. This leads to errors if the Loran-C signals from the various stations involve appreciable overland paths since the speed of the signal will decrease by varying amounts, depending on the nature of the earth's surface over which it is passing. Loran-C operates by measuring the difference in arrival times of the signals from the different stations in the Loran-C chain, and thus any unforeseen variation in the speed of a signal will result in an error in the latitude/longitude reading. Note that when the receiver is being used in the time difference mode (time difference readings being used to manually plot lines of position on a Loran-C chart), these errors are minimal and the system should be accurate to within $^1/_4$ nautical mile. This is because the Loran-C lattice on a nautical chart has already been adjusted to allow for the signal variation as it travels over land.

It is recommended that mariners using the latitude/longitude feature of their receiver check the manufacturer's operating manual to determine if corrections are necessary and how they may be applied to compensate for overland paths in order to obtain a greater fix accuracy. The correction can be applied in either of two forms: (i) insertion of a correction when the vessel is at a known location, or (ii) the insertion of a correction factor that is determined from a table or chartlet. The latter is called an Additional Secondary Phase Factor (ASF) correction, and the chartlets in Figures 8 & 9 can be used to ascertain the numeric value to apply. These corrections will normally be valid only within 50 to 100 miles of the location at which the correction was inserted because of the changing effects of land mass on the Loran signals in the different areas.

E. Waypoint Navigation Cautionary Note

Mariners are cautioned that an error can exist between the waypoint navigation information provided by their Locan-C receiver and the desired straight-line track plotted on a chart. A straight line course plotted between two waypoints on a mercator chart is a rhumb line, defined as a line on the earth's surface cutting the meridians of longitude at the same angle. The course and distance displayed by a microprocessor-based Loran-C receiver, used in the waypoint mode, are normally computed for a great circle track, not a rhumb line. In the northern hemisphere, a great circle track between two normal waypoints lies to the north of a rhumb line joining those same waypoints.

This offset distance, or error, is a maximum when sailing East-West at a latitude of approximately 45 degrees, decreasing to zero at the equator and at the North and South Poles. It also decreases to zero as your track becomes North-South, regardless of the latitude. As an example of the offset error possible, a journey from St. John's, Newfoundland, to the Lands End area, England, a distance of roughly 1850 nm, would have a maximum offset of approximately 140 nm when comparing a rhumb line and a great circle track between the two places. The rhumb line versus great circle path offset becomes a danger only if the mariner has not laid off a great circle course on a Gnomonic chart, ensuring the vessel will pass clear of all navigation dangers.

F. Loran-C Skywave Interference

It has been found that the skywave effects are minimal if the receiver is properly installed and operated. Special attention should be given to receiver grounding, placement of the antenna and the elimination of shipboard interference.

G. Loran-C System Status Information

Up-to-date Loran-C status information is available by telephoning:

Loran-C Chain/Rate	Phone Number/Location	
Newfoundland East Coast Chain 7270	(709) 454-3129	Control/Monitor, St. Anthony, Nfld.
Canadian East Coast/5930	(709) 454-3129	Control/Monitor, St. Anthony, Nfld.
Northeast U.S./9960	(703) 313-5900	USCG NAVCEN, Alexandria, Va
Great Lakes/8970	(703) 313-5900	USCG NAVCEN, Alexandria, Va

H. Loran-C NOTSHIPs

Loran-C Notices to Shipping (NOTSHIPs) concerning the status of Loran-C signals in eastern Canadian waters and in the Great Lakes, the immediate proximity are broadcast from the following Marine Communications and Traffic Services Centres (MCTS) and their respective remotely-controlled facilities:

St. Anthony	Labrador	Saint John	Quebec	Sarnia
St. John's	Halifax	Rivière-au-Renard	Montreal	Thunder Bay
Port-aux-Basques	Sydney	Les Escoumins	Prescott	

Note that these broadcasts may only be made from those MCTS Centres located in the general area where the Loran-C signal normally exists.

TABLE 1
NEWFOUNDLAND EAST COAST LORAN-C CHAIN GRI 7270

STATION	LOCATION (NAD83)	FUNCTION	EMISSION DELAY	THEORETICAL BASELINE TRAVEL TIME (1)	RADIATED PEAK POWER
COMFORT COVE, Newfoundland	49 19'53.57"N 54 51'42.57"W	MASTER	_____	_____	185 kW
CAPE RACE, Newfoundland	46 46'32.29"N 53 10'27.61 W	WHISKEY SECONDARY	12037.49 μs	1037.49 μs	500 kW
FOX HARBOUR, Labrador	52 22'35.25"N 55 42'27.86 W	XRAY SECONDARY	26148.01 μs	1148.01 μs	800 kW

(1) Theoretical baseline travel time is based on all-seawater transmission path between master and secondary.
(2) Vessels passing in the immediate vicinity of the Fox Harbour station may experience interference on their communication receivers. Reception of weak communication signals may not be possible on vessels that are within 10 miles of Fox Harbour.

TABLE 2
CANADIAN EAST COAST LORAN-C CHAIN GRI 5930

STATION	LOCATION (NAD 83)	THEORETICAL FUNCTION	EMISSION DELAY	THEORETICAL BASELINE TRAVEL TIME (1)	RADIATED PEAK POWER
CARIBOU, Maine (2)	46 48'27.31"N 67 55'37.16"W	MASTER	_____	_____	800 kW
NANTUCKET, Massachusetts (2)	41 15'12.05"N 69 58'38.54"W	X SECONDARY	13131.88 μs	2131.88 μs	375 kW
CAPE RACE, Newfoundland	46 46'32.29"N 53 10'27.61"W	Y SECONDARY	28755.02 μs	3755.02 μs	500 kW
FOX HARBOUR, Labrador (3)	52 22'35.25"N 55 42'27.86"W	Z SECONDARY	41594.59 μs	3594.59 μs	800 kW

(1) Theoretical baseline travel time is based on all-seawater transmission path between master and secondary.
(2) This station operated by United States of America.
(3) Vessels passing in the immediate vicinity of the Fox Harbour station may experience interference on their communication receivers. Reception of weak communication signals may not be possible on vessels that are within 10 miles of Fox Harbour.

TABLE 3
GREAT LAKES LORAN-C CHAIN GRI 8970

STATION	LOCATION (1)	FUNCTION	EMISSION DELAY	THEORETICAL BASELINE TRAVEL TIME (2)	RADIATED PEAK POWER
DANA, Indiana (3)	39 51'07.66"N 87 29'11.59"W	MASTER	_____	_____	400 kW
MALONE, Florida (3)	30 59'38.87"N 85 10'08.75"W	W SECONDARY	14355.11 μs	3355.11 μs	800 kW
SENECA, New York (3)	42 42'50.72"N 76 49'33.31"W	X SECONDARY	31162.06 μs	3162.06 μs	800 kW
BAUDETTE, Minnesota (3)	48 36'49.95"N 94 33'17.92"W	Y SECONDARY	47753.74 μs	3753.74 μs	800 kW
BOISE CITY, Oklahoma (3)	36 30'20.78"N 102 53'59.49"W	Z SECONDARY	63669.46 μs	4669.46 μs	800 kW

(1) Based on WGS 84 (coordinate system for charting)
(2) Theoretical baseline travel time is based on all-seawater transmission path between master and secondary
(3) This station is operated by the United States of America

TABLE 4
NORTHEAST U.S. LORAN-C CHAIN GRI 9960

STATION	LOCATION (NAD 83)	FUNCTION	EMISSION DELAY	THEORETICAL BASELINE (2) TRAVEL TIME	RADIATED PEAK POWER
SENECA, New York (3)	42 42'50.72"N 76 49'33.31"W	MASTER	_____	_____	800 kW
CARIBOU, Maine (3)	46 48'27.31"N 67 55'37.16"W	W SECONDARY	13797.20 μ s	2797.20 μ s	800 Kw
NANTUCKET, Massachusetts (3)	41 15'12.05"N 69 58'38.54"W	X SECONDARY	26969.93 μ s	1969.93 μ s	375 kW
CAROLINA BEACH North Carolina (3)	34 03'46.21"N 77 54'46.10"W	Y SECONDARY	42221.65 μ s	3221.65 μ s	800 kW
DANA, Indiana (3)	39 51'07.66"N 87 29'11.59"W	Z SECONDARY	57162.06 μ s	3162.06 μ s	400 kW

(1) Based on WGS 84 (Coordinated system for charting)
(2) Theoretical baseline travel time is based on all-seawater transmission path between master and secondary
(3) This station operated by United States of America.

Loran-C Coordinate Converters

Many of the Loran-C Coordinate Converters on the market do not compensate for the overland propagation errors caused by radio waves travelling more slowly over land than they do over seawater. These converters assume that the radio waves are travelling over an all seawater path from the transmitters to the ship. Because the amount of the time delay in each pattern varies with location, as does the width for 1 microsecond in each pattern, and the angle of cut between patterns, and which two patterns are being used for the position determination, there can be no over-all simple error statement.

It is important to note that a Loran-C coordinate converter that does not incorporate the overland propagation corrections (Additional Secondary Factor, or ASF) within its computations will produce a systematic geographic position error. This error is often in the dangerous direction; namely, it will compute a position that is farther offshore. If you are transiting along a coast, thinking that you are safely outside the dangerous shoals, you may find yourself closer to shore than you think you are.

The Canadian Hydrographic Service (CHS) has determined the overland propagation (ASF) errors through actual observations. The overland propagation corrections were incorporated into the lattices that were/are on CHS nautical charts. These maps have been published showing the corrections to observed Time Differences (TD's) necessary to make them theoretical TD's that can be used with algorithms using just the seawater velocity to compute the geographic position.

Manufacturers have their own methods to compute geographic positions, which may incorporate some approximations. The receivers may or may not tell the mariner which TD's it is using to compute the position – hopefully the pair with the best repeatable geometry. Some receivers use more than two TD's to compute positions.

Some manufacturers have incorporated the overland propagation corrections into their algorithms and those receivers should perform more accurately than those that do not. The industry self-imposed standard set by the Radio Technical Commission on Marine Services - Special Committee 75 on Minimum Performance Standards for Loran-C Coordinate Converters (1980) is a ¼ mile positioning accuracy.

The following tables give the vectors from the Loran-C coordinate converter position to the true position. These will give some guide as to the possible errors. It is suggested, however, that mariners **NOT** correct their positions by the stated amounts, but to use the listed information as an advisory. Your coordinate converter may behave differently.

5930 – Canadian East Coast Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	5930XY	5930XZ	5930YZ
Gulf of Maine					
Georges Bank	41 00'N	66 00'W	**0.4 nm @ 000°T**		
Georges Bank	42 00'N	67 00'W	**0.3 nm @ 350°T**		
Bay of Fundy					
Machias Seal I	44 30'N	67 00'W	**0.2 nm @ 035°T**		
Saint John	45 00'N	66 00'W	**0.3 nm @ 020°T**		
Cape d'Or	45 15'N	64 45'W	**0.3 nm @ 005°T**		
Digby	44 45'N	65 45'W	**0.3 nm @ 040°T**		
Brier Island	44 15'N	66 30'W	**0.3 nm @ 050°T**		
Western Nova Scotia					
Yarmouth	43 30'N	66 20'W	**0.1 nm @ 030°T**		
Seal Island	43 20'N	66 20'W	**0.2 nm @ 000°T**		
South Shore, Nova Scotia					
Shelburne	43 40'N	65 00'W	**0.4 nm @ 345°T**		
Mahone Bay	44 00'N	64 00'W	**0.4 nm @ 345°T**		
Mahone Bay	44 20'N	64 10'W	**0.3 nm @ 335°T**		
Sambro Island	44 20'N	66 30'W	**0.4 nm @ 335°T**		

5930 – Canadian East Coast Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	5930XY	5930XZ	5930YZ
Eastern Shore, Nova Scotia					
Sheet Harbour	44 40'N	62 30'W	**0.6 nm @ 345°T**		
Country Harbour	44 50'N	62 00'W	**0.7 nm @ 345°T**		
Canso	45 10'N	61 00'W	**0.8 nm @ 345°T**		
Pt Michaud	45 30'N	60 45'W	**0.5 nm @ 345°T**		
Sable Island					
West end	44 00'N	60 30'W	**0.6 nm @ 345°T**	0.7 nm @ 340°T	0.6 nm @ 340°T
East end	44 00'N	59 30'W	**0.7 nm @ 340°T**	0.8 nm @ 335°T	0.5 nm @ 335°T
Cape Breton Island					
Scaterie Island	45 50'N	59 45'W	**0.7 nm @ 345°T**	0.8 nm @ 330°T	0.4 nm @ 335°T
Sydney	46 20'N	60 00'W	0.2 nm @ 300°T	0.1 nm @ 005°T	**0.4 nm @ 340°T**
Cape Egmont	47 00'N	60 00'W	0.0 nm	0.0 nm	**0.1 nm @ 330°T**
Gulf of St. Lawrence, southern part					
Cheticamp	46 45'N	61 15'W	0.1 nm @ 350°T	0.2 nm @ 305°T	**0.1 nm @ 190°T**
Cape George	46 00'N	62 00'W	**0.1 nm @ 335°T**	0.2 nm @ 300°T	0.2 nm @ 205°T
S of Magdalen Is.	47 00'N	62 00'W	0.2 nm @ 350°T	0.2 nm @ 320°T	**0.0 nm**
North Cape, PEI	47 10'N	64 00'W	0.3 nm @ 345°T	0.3 nm @ 325°T	**0.0 nm**
Cape Egmont	46 20'N	64 15'W	**0.3 nm @ 350°T**	0.3 nm @ 325°T	0.1 nm @ 215°T
Gulf of St. Lawrence, western part					
Miscou Island	48 00'N	64 00'W	0.4 nm @ 340°T	0.4 nm @ 325°T	**0.2 nm @ 325°T**
Baie des Chaleurs	48 00'N	65 00'W		0.1 nm @ 070°T	**0.3 nm @ 340°T**
Gaspe	48 45'N	64 00'W		0.4 nm @ 330°T	**0.2 nm @ 335°T**
Grande-Vallee	49 20'N	65 00'W		0.1 nm @ 000°T	**0.2 nm @ 330°T**
Marsoui	49 20'N	66 00'W			**0.0 nm**
River St. Lawrence					
Pte des Monts	49 15'N	67 00'W			**0.2 nm @ 105°T**
Baie Comeau	49 10'N	68 00'W			**0.3 nm @ 100°T**
Pte Mitis	48 50'N	68 00'W		0.6 nm @ 310°T	**0.4 nm @ 105°T**
Les Escoumins	48 15'N	69 15'W	0.5 nm @ 325°T	**0.3 nm @ 310°T**	0.3 nm @ 070°T
Malbaie	47 36'N	70 00'W	0.7 nm @ 325°T	**0.5 nm @ 320°T**	0.6 nm @ 050°T
Ile aux Coudres	47 20'N	70 27'W	1.2 nm @ 320°T	**0.6 nm @ 315°T**	1.5 nm @ 065°T
Ile aux Ruaux	47 00'N	70 45'W			
Gulf of St. Lawrence, northern part					
Sept Iles	50 00'N	66 00'W			**0.2 nm @ 085°T**
Sheldrake	50 00'N	65 00'W			**0.2 nm @ 115°T**
Mingan	50 00'N	64 00'W			**0.1 nm @ 020°T**
Natashquan	50 00'N	62 00'W			**0.1 nm @ 025°T**
Pointe Heath	49 00'N	61 30'W	0.6 nm @ 005°T	0.5 nm @ 325°T	**0.2 nm @ 150°T**
R aux Oiseaux	48 00'N	61 00'W	0.5 nm @ 000°T	0.5 nm @ 325°T	**0.1 nm @ 175°T**
Cap Whittle	50 00'N	60 00'W			**0.2 nm @ 150°T**
B de St. Augustin	51 00'N	58 30'W			**0.2 nm @ 165°T**
Greely Island	51 15'N	57 00'W			**0.2 nm @ 145°T**

5930 – Canadian East Coast Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	5930XY	5930XZ	5930YZ
Gulf of St. Lawrence, eastern part					
Pte Riche	50 45’N	57 40’W			**0.3 nm @ 145°T**
Bay of Islands	49 15’N	58 40’W	0.9 nm @ 015°T	0.6 nm @ 315°T	**0.3 nm @ 155°T**
C St George	48 30’N	59 30’W	0.5 nm @ 015°T	0.4 nm @ 315°T	**0.2 nm @ 160°T**
C Anguille	48 00’N	59 45’W	0.2 nm @ 025°T	0.2 nm @ 310°T	**0.2 nm @ 155°T**
South Coast of Newfoundland					
Cape Ray	47 30’N	59 00’W	0.0 nm	0.2 nm @ 075°T	**0.4 nm @ 000°T**
Ramea	47 30’N	57 30’W	0.0 nm	0.2 nm @ 085°T	**0.3 nm @ 005°T**
Pass Island	47 30’N	56 15’W	0.1 nm @ 010°T	0.1 nm @ 045°T	**0.2 nm @ 010°T**
St Pierre	46 30’N	56 00’W	0.8 nm @ 355°T	1.0 nm @ 320°T	**0.2 nm @ 330°T**
off Placentia Bay	46 30’N	55 00’W	0.8 nm @ 350°T	1.0 nm @ 315°T	**0.1 nm @ 315°T**
Argentia	47 15’N	54 30’W	0.9 nm @ 015°T	1.0 nm @ 310°T	**0.0 nm**
C St Mary's	46 30’N	54 00’W	0.9 nm @ 345°T	1.1 nm @ 310°T	**0.1 nm @ 285°T**
Cape Race	46 30’N	53 00’W	1.6 nm @ 300°T	**1.2 nm @ 310°T**	5.7 nm @ 130°T
East Coast of Newfoundland					
Virgin Rocks	46 30’N	51 00’W		2.0 nm @ 295°T	
Ferryland Head	47 00’N	52 30’W			0.9 nm @ 295°T
St John's	47 30’N	52 30’W			0.5 nm @ 270°T
Baccalieu Island	48 15’N	52 30’W			0.7 nm @ 255°T
Bonavista	48 45’N	53 00’W			0.5 nm @ 250°T
Cape Freels	49 15’N	53 15’W			0.5 nm @ 245°T
Funk Island	49 45’N	53 10’W			0.4 nm @ 240°T
North Coast of Newfoundland					
Fogo Island	50 00’N	54 00’W			0.3 nm @ 220°T
Gull Island	50 00’N	55 20’W			**0.3 nm @ 210°T**
Grey Islands	51 00’N	55 00’W			**0.2 nm @ 200°T**
Quirpon	51 45’N	55 00’W			**0.2 nm @ 200°T**
St Lewis Sound	52 30’N	55 00’W			**6.0 nm @ 205°T**
Strait of Belle Isle	51 45’N	56 00’W			**0.2 nm @ 170°T**
Offshore, near 200 nm Limit					
	41 00’N	64 00’W	**0.5 nm @ 350°T**		
	40 30’N	60 00’W	**0.8 nm @ 345°T**		
	43 30’N	56 00’W	**1.2 nm @ 330°T**	1.4 nm @ 320°T	0.4 nm @ 300°T
	43 30’N	52 00’W	**1.8 nm @ 310°T**	1.7 nm @ 315°T	Parallel LOP's
	44 30’N	49 30’W	4.4 nm @ 290°T	**2.6 nm @ 300°T**	1.4 nm @ 145°T
	48 00’N	48 00’W			3.3 nm @ 280°T
	50 00’N	48 00’W			1.9 nm @ 260°T
	53 00’N	50 00’W			2.6 nm @ 225°T

7270 - East Newfoundland Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	7270WX
East Coast of Newfoundland			
Virgin Rocks	46 30’N	51 00’W	**2.2 nm @ 305°T**
Ferryland Head	47 00’N	52 30’W	**1.1 nm @ 295°T**

7270 - East Newfoundland Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	7270WX
St John's	47 30'N	52 30'W	**0.7 nm @ 270°T**
Baccalieu Island	48 15'N	52 30'W	**0.4 nm @ 250°T**
Bonavista	48 45'N	53 00'W	**0.2 nm @ 225°T**
Cape Freels	49 15'N	53 15'W	**0.2 nm @ 200°T**
Funk Island	49 45'N	53 10'W	**0.2 nm @ 125°T**
North Coast of Newfoundland			
Fogo Island	50 00'N	54 00'W	**0.4 nm @ 105°T**
Gull Island	50 00'N	55 20'W	Baseline ext.
Grey Islands	51 00'N	55 00'W	Baseline ext.
Quirpon	51 45'N	55 00'W	Baseline ext.
St Lewis Sound	52 30'N	55 00'W	Baseline ext.
Strait of Belle Isle	51 45'N	56 00'W	Baseline ext.
Offshore, near 200 nm Limit			
	44 30'N	49 30'W	Baseline ext.
	48 00'N	48 00'W	**0.8 nm @ 275°T**
	50 00'N	48 00'W	**0.2 nm @ 225°T**
	53 00'N	50 00'W	**0.9 nm @ 065°T**

9960 – North East United States Chain

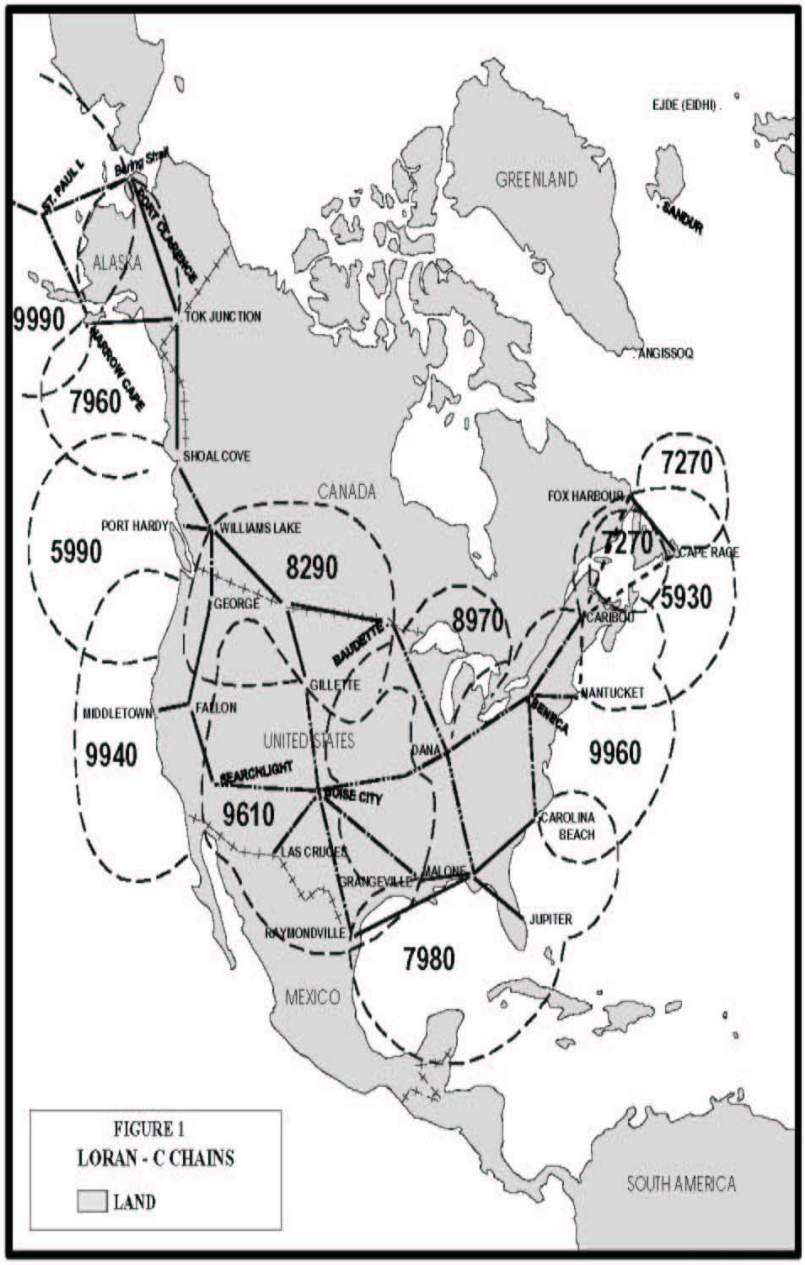
Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	9960WX	9960WY
Gulf of Maine				
Georges Bank	41 00'N	66 00'W	Baseline ext.	0.8 nm @ 300°T
Georges Bank	42 00'N	67 00'W	1.5 nm @ 310°T	0.6 nm @ 300°T
Bay of Fundy				
Machias Seal I	44 30'N	67 00'W	1.0 nm @ 290°T	0.9 nm @ 285°T
Saint John	45 00'N	66 00'W	1.5 nm @ 280°T	
Cape d'Or	45 15'N	64 45'W		
Digby	44 45'N	65 45'W	1.5 nm @ 280°T	
Brier Island	44 15'N	66 30'W	1.0 nm @ 290°T	0.8 nm @ 285°T
Western Nova Scotia				
Yarmouth	43 30'N	66 20'W	1.0 nm @ 295°T	0.8 nm @ 290°T
Seal Island	43 20'N	66 20'W	1.2 nm @ 295°T	0.8 nm @ 290°T
River St. Lawrence				
Baie Comeau	49 10'N	68 00'W	1.7 nm @ 215°T	
Pte Mitis	48 50'N	68 00'W	2.3 nm @ 210°T	
Les Escoumins	48 15'N	69 15'W	0.4 nm @ 235°T	
Malbaie	47 36'N	70 00'W	0.2 nm @ 275°T	
Île aux Coudres	47 20'N	70 27'W	0.2 nm @ 285°T	
Île aux Ruaux	47 00'N	70 45'W	**0.2 nm @ 285°T**	

8970 – Great Lakes Chain

Information in **Bold** is for the TD pair that gives the best repeatability.

Vicinity of:	Latitude	Longitude	9960WZ	9960YZ	8970XY
Lake Ontario					
Kingston	44 00’N	76 30’W	**0.3 nm @ 000°T**		
Cobourg	43 45’N	78 00’W	**0.3 nm @ 350°T**	1.7 nm @ 195°T	
Hamilton	43 20’N	79 25’W	**0.4 nm @ 350°T**	0.8 nm @ 180°T	
Lake Erie					
Port Colborne	42 45’N	79 15’W		**0.7 nm @ 170°T**	0.5 nm @ 345°T
Long Point	42 25’N	80 00’W		**0.6 nm @ 165°T**	0.5 nm @ 345°T
Rondeau	42 00’N	82 00’W		**0.5 nm @ 155°T**	0.4 nm @ 345°T
Amherstburg	42 00’N	83 07’W		**0.5 nm @ 155°T**	0.4 nm @ 350°T
Lake St. Clair					
mid-lake	42 20’N	82 45’W		0.6 nm @ 160°T	**0.4 nm @ 345°T**
Lake Huron					
Sarnia	43 10’N	82 20’W			**0.3 nm @ 340°T**
Point Clark	44 00’N	82 00’W			**0.3 nm @ 340°T**
Cape Hurd	45 00’N	82 00’W			**0.2 nm @ 340°T**
Great Duck Island	45 30’N	83 00’W			**0.1 nm @ 300°T**
Detour Passage	45 45’N	84 00’W			**0.1 nm @ 245°T**
North Channel, Lake Huron					
Thessalon	46 10’N	83 30’W			**0.1 nm @ 245°T**
Gore Bay	46 00’N	82 30’W			**0.1 nm @ 295°T**
Georgian Bay					
Squaw Island	45 50’N	81 30’W			**0.2 nm @ 335°T**
Cabot Head	45 15’N	81 10’W			**0.2 nm @ 335°T**
Collingwood	44 35’N	80 15’W			**0.2 nm @ 325°T**
Parry Sound	45 15’N	80 30’W			**0.2 nm @ 340°T**
French River	45 50’N	80 50’W			**0.2 nm @ 350°T**
Lake Superior					
Île Parisienne	46 35’N	84 50’W			**0.1 nm @ 205°T**
Caribou Island	47 20’N	86 00’W			**0.1 nm @ 050°T**
Brule Point	47 50’N	85 45’W			**0.1 nm @ 065°T**
Superior Shoal	48 00’N	87 00’W			**0.1 nm @ 060°T**
Marathon	48 40’N	86 30’W			**0.2 nm @ 055°T**
Passage Island	48 20’N	88 20’W			**0.1 nm @ 105°T**
Thunder Bay	48 25’N	89 00’W			**0.1 nm @ 140°T**


EJDE (EIDHI)
GREENLAND
SANDUR
ANGISSOQ
ALASKA
ST. PAUL I
BARING STR
POINT CLARENCE
9990
TOK JUNCTION
NARROW CAPE
7960
SHOAL COVE
CANADA
7270
FOX HARBOUR
PORT HARDY
WILLIAMS LAKE
5990
8290
7270
CAPE RAGE
5930
GEORGE
8970
CARIBOU
BAUDETTE
GILLETTE
NANTUCKET
MIDDLETOWN
FALLON
SENECA
UNITED STATES
9940
DANA
9960
SEARCHLIGHT
BOISE CITY
9610
CAROLINA BEACH
LAS CRUCES
GRANGEVILLE
MALONE
JUPITER
RAYMONDVILLE
7980
MEXICO
FIGURE 1
LORAN - C CHAINS
LAND
SOUTH AMERICA

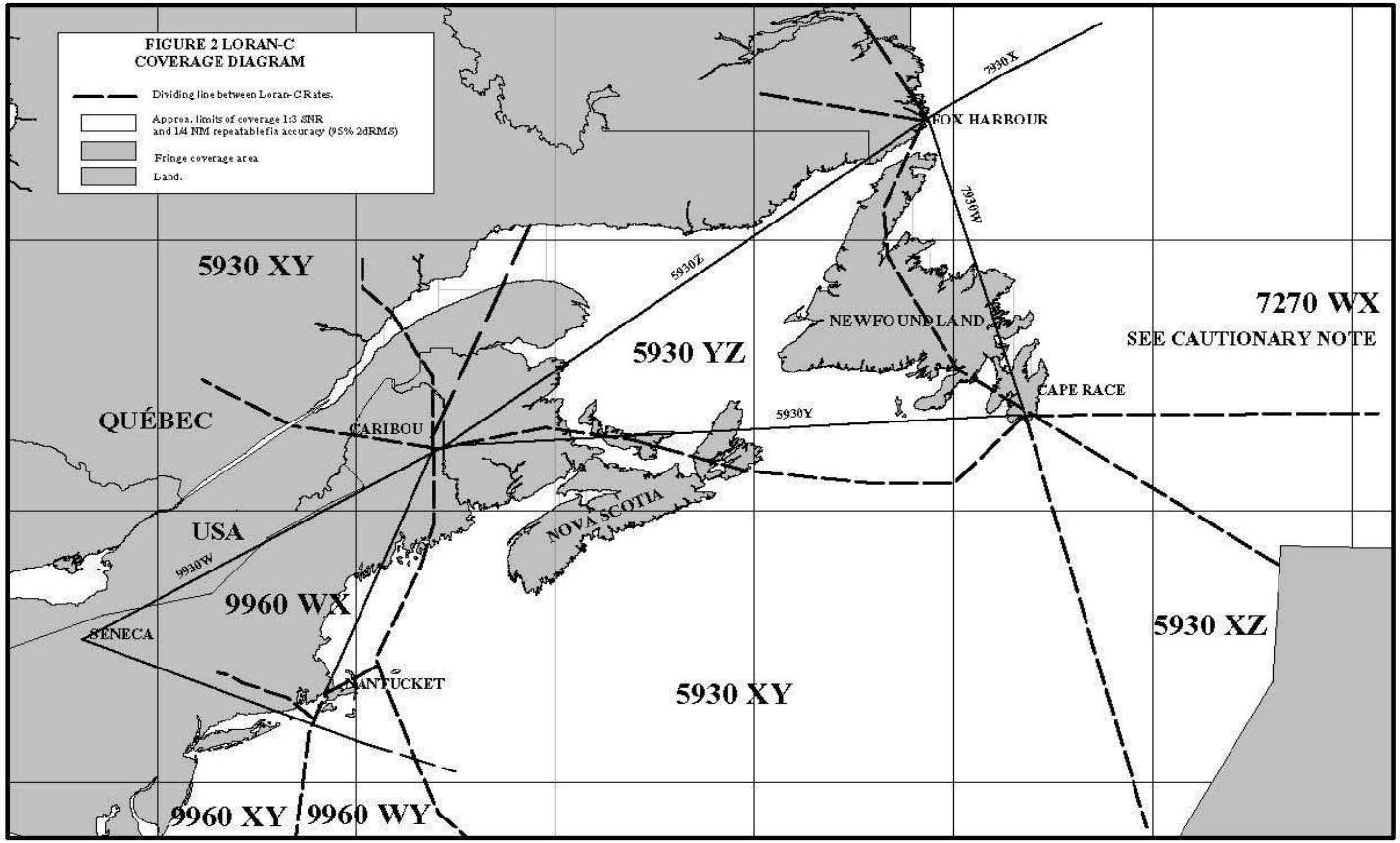


FIGURE 2 LORAN-C
COVERAGE DIAGRAM
Dividing line between Loran-C Rates.
Approx. limits of coverage 1/3 SNR
and 1/4 NM repeatable/fix accuracy (95% 2dRMS)
Fringe coverage area
Land.
5930 XY
5930 YZ
7270 WX
SEE CAUTIONARY NOTE
QUÉBEC
CARIBOU
USA
9960 WX
SENECA
NANTUCKET
5930 XY
5930 XZ
9960 XY
9960 WY
NOVA SCOTIA
NEWFOUNDLAND
FOX HARBOUR
CAPE RACE
7930X
7930W
5930Z
5930Y
9930W

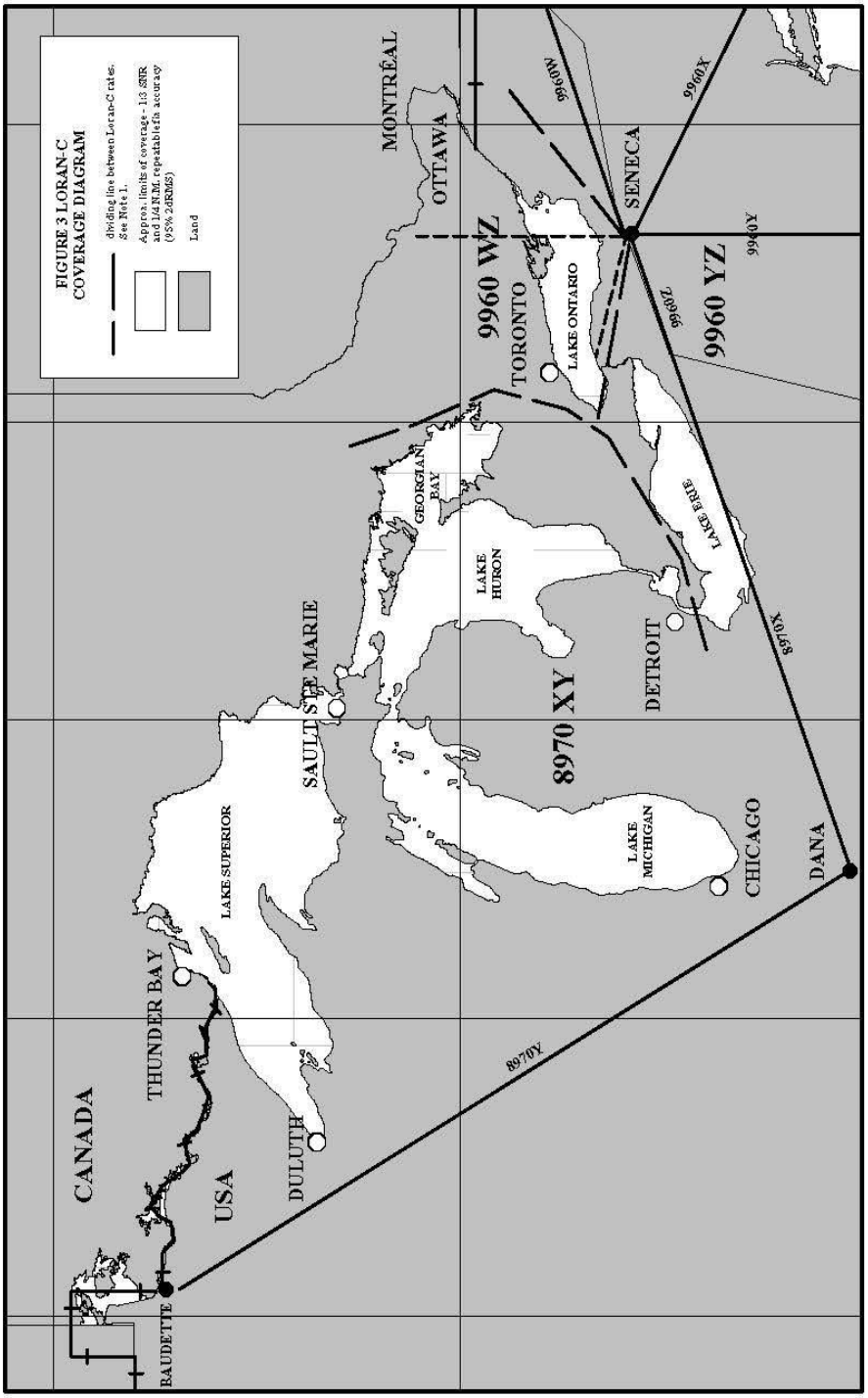


FIGURE 3 LORAN-C
COVERAGE DIAGRAM
dividing line between Loran-C rates.
See Note 1.
Approx. limits of coverage - 1/3 SNR
and 1/4 RMS repeatable to accuracy
(95% 2DRMS)
Land
CANADA
USA
THUNDER BAY
DULUTH
SAULT STE MARIE
LAKE SUPERIOR
GEORGIAN BAY
LAKE HURON
LAKE MICHIGAN
LAKE ERIE
LAKE ONTARIO
MONTRÉAL
OTTAWA
TORONTO
DETROIT
CHICAGO
SENECA
DANA
BAUDETTE
9960 WZ
9960 YZ
8970 XY
9960W
9960X
9960Y
9940Y
8970X
8970Y

6-12

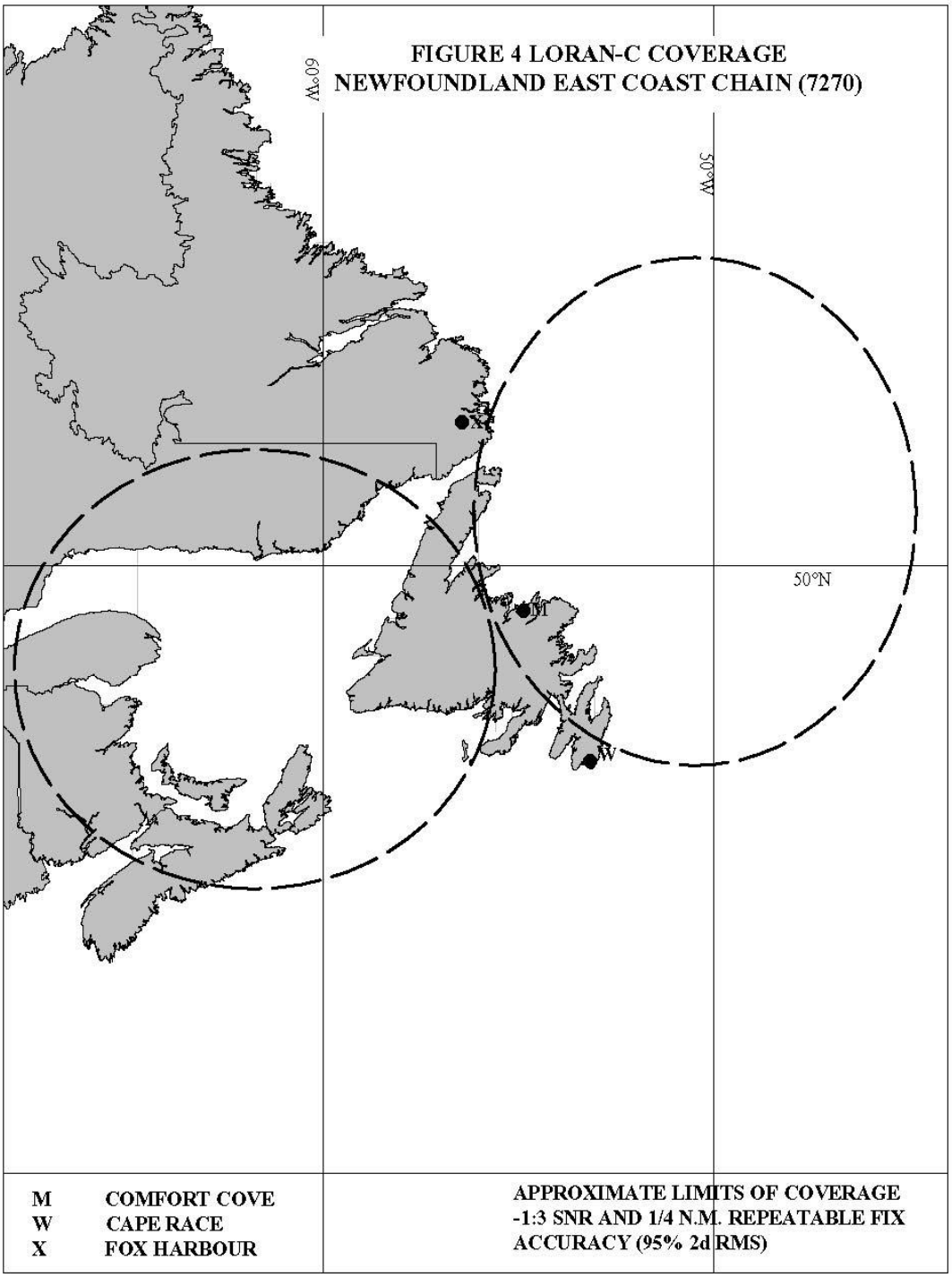


FIGURE 4 LORAN-C COVERAGE
NEWFOUNDLAND EAST COAST CHAIN (7270)
60°W
50°W
50°N
M
W
X
M COMFORT COVE
W CAPE RACE
X FOX HARBOUR
APPROXIMATE LIMITS OF COVERAGE
-1:3 SNR AND 1/4 N.M. REPEATABLE FIX
ACCURACY (95% 2d RMS)

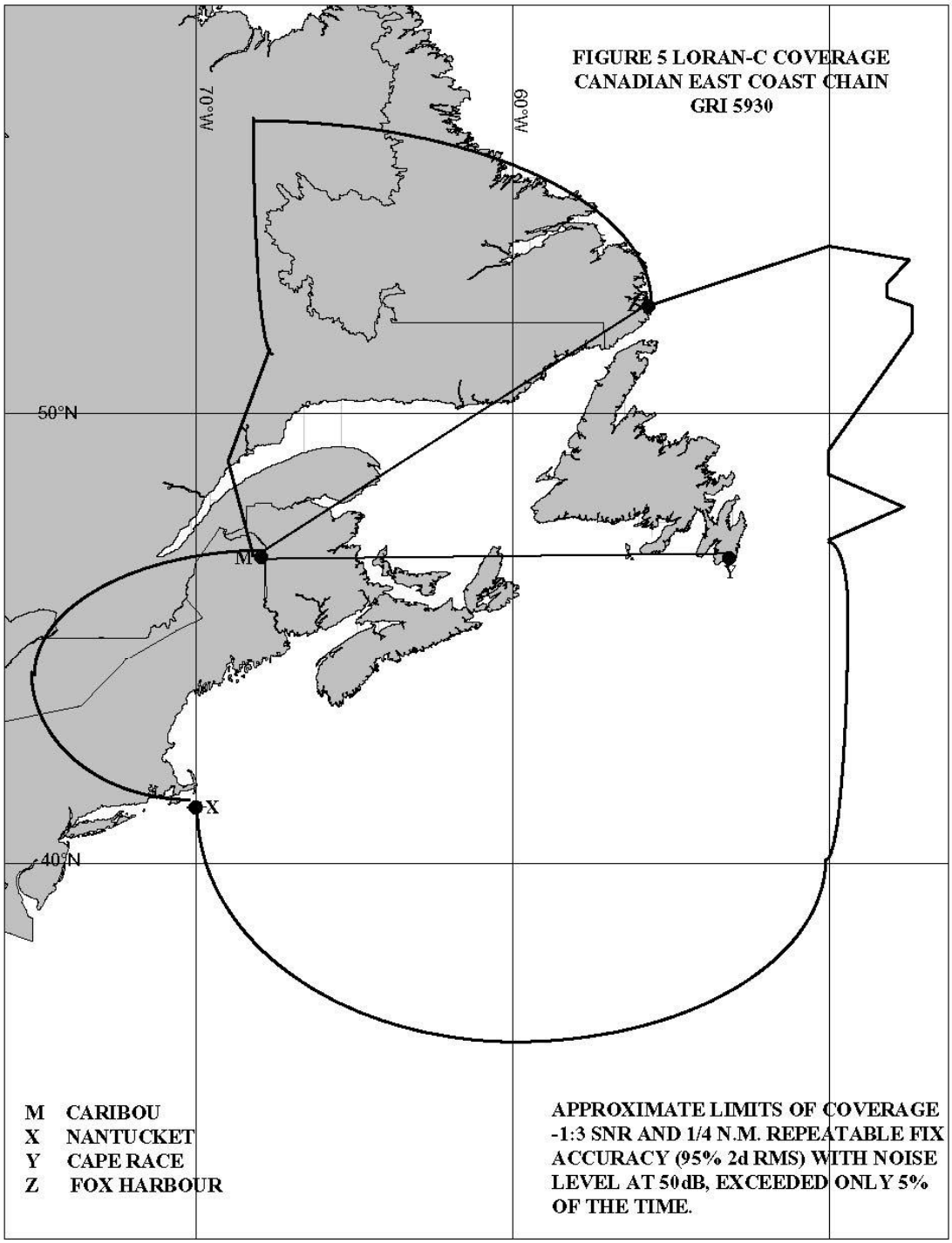


FIGURE 5 LORAN-C COVERAGE
CANADIAN EAST COAST CHAIN
GRI 5930
70°W
60°W
50°N
40°N
M
X
Y
Z
M CARIBOU
X NANTUCKET
Y CAPE RACE
Z FOX HARBOUR
APPROXIMATE LIMITS OF COVERAGE -1:3 SNR AND 1/4 N.M. REPEATABLE FIX ACCURACY (95% 2d RMS) WITH NOISE LEVEL AT 50dB, EXCEEDED ONLY 5% OF THE TIME.

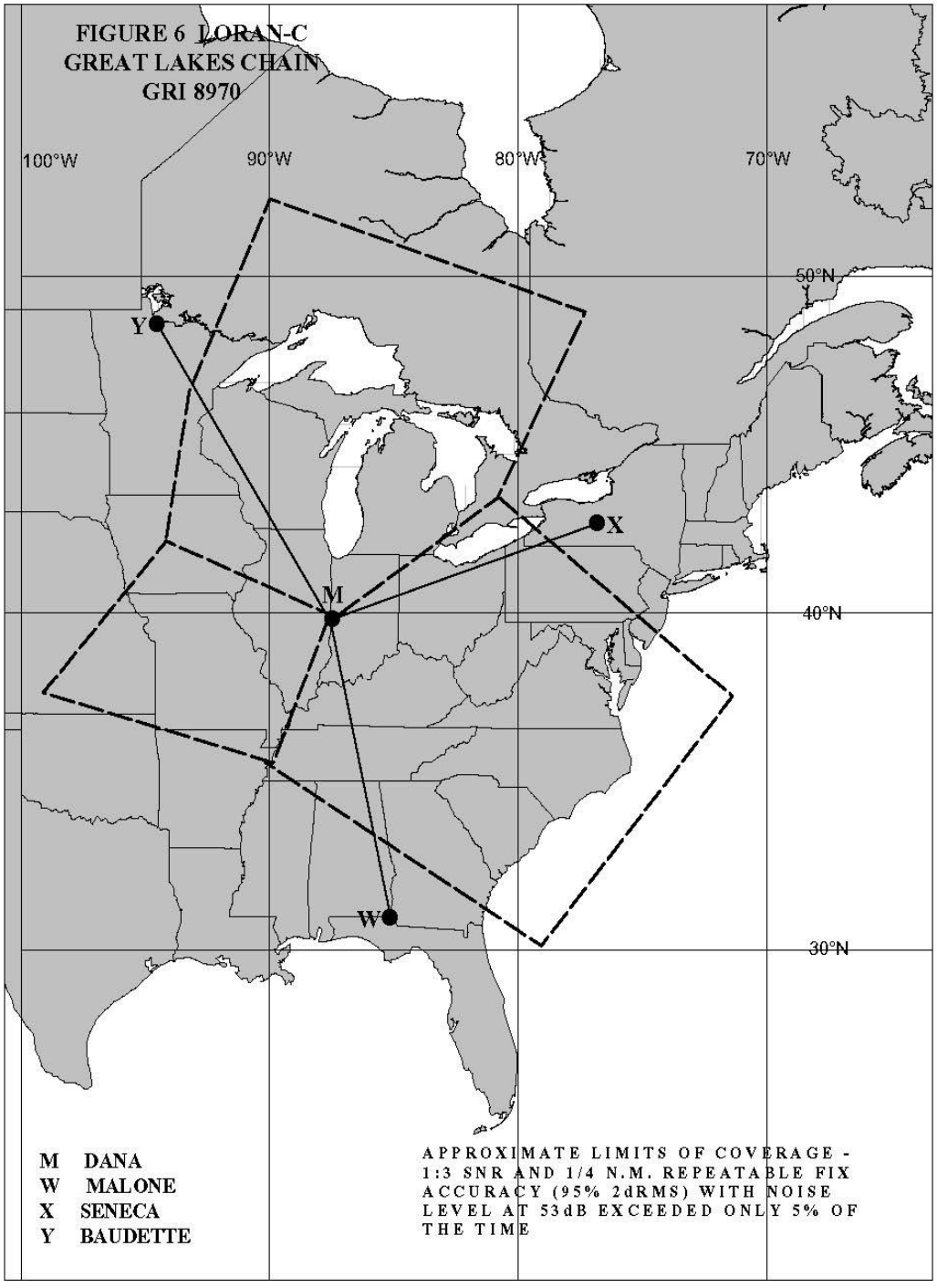


FIGURE 6 LORAN-C
GREAT LAKES CHAIN
GRI 8970
100°W
90°W
80°W
70°W
50°N
40°N
30°N
Y
X
M
W
M DANA
W MALONE
X SENECA
Y BAUDETTE
APPROXIMATE LIMITS OF COVERAGE - 1:3 SNR AND 1/4 N.M. REPEATABLE FIX ACCURACY (95% 2dRMS) WITH NOISE LEVEL AT 53dB EXCEEDED ONLY 5% OF THE TIME

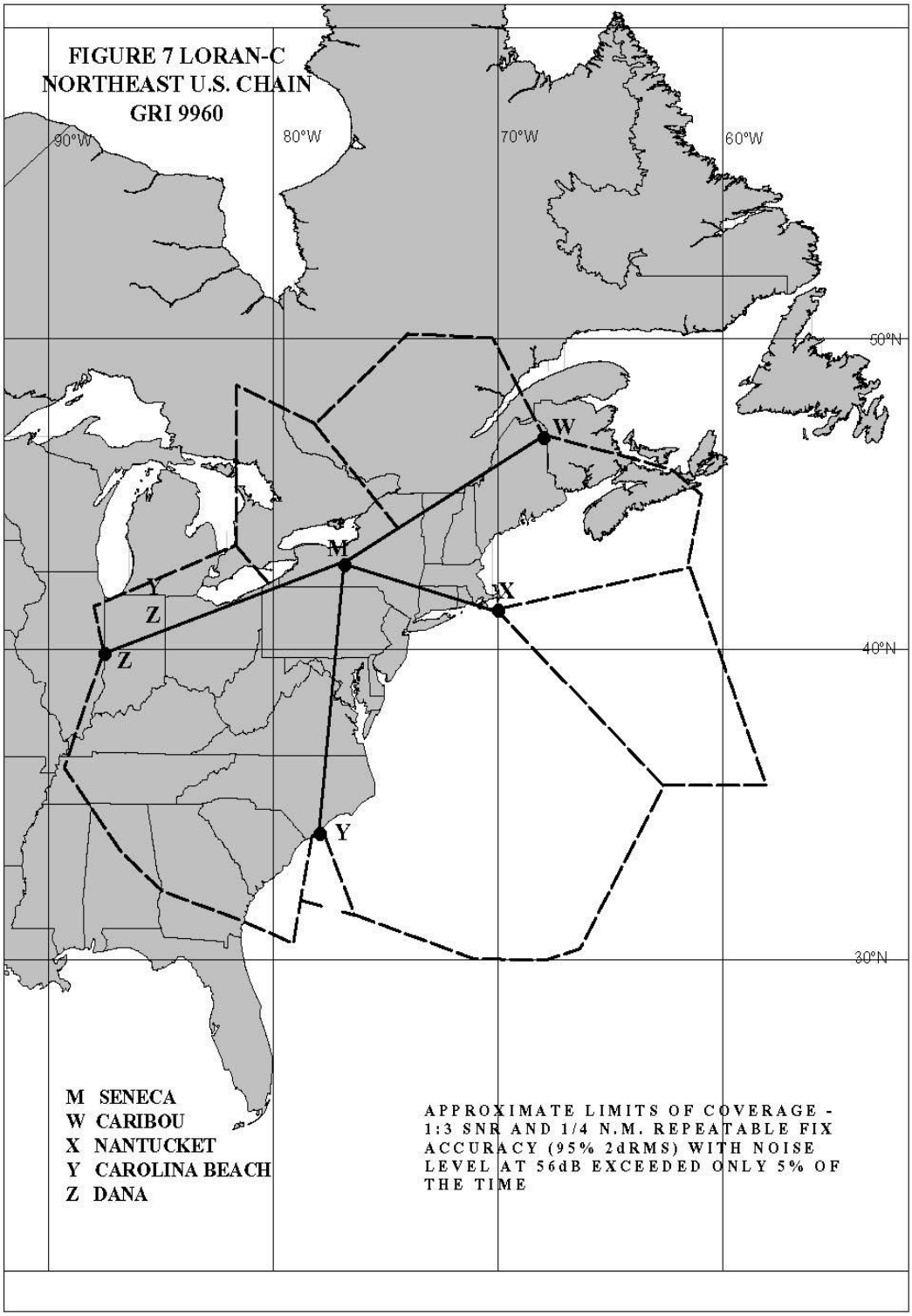


FIGURE 7 LORAN-C
NORTHEAST U.S. CHAIN
GRI 9960
90°W
80°W
70°W
60°W
50°N
40°N
30°N
W
M
X
Z
Z
Y
M SENECA
W CARIBOU
X NANTUCKET
Y CAROLINA BEACH
Z DANA
APPROXIMATE LIMITS OF COVERAGE - 1:3 SNR AND 1/4 N.M. REPEATABLE FIX ACCURACY (95% 2dRMS) WITH NOISE LEVEL AT 56dB EXCEEDED ONLY 5% OF THE TIME

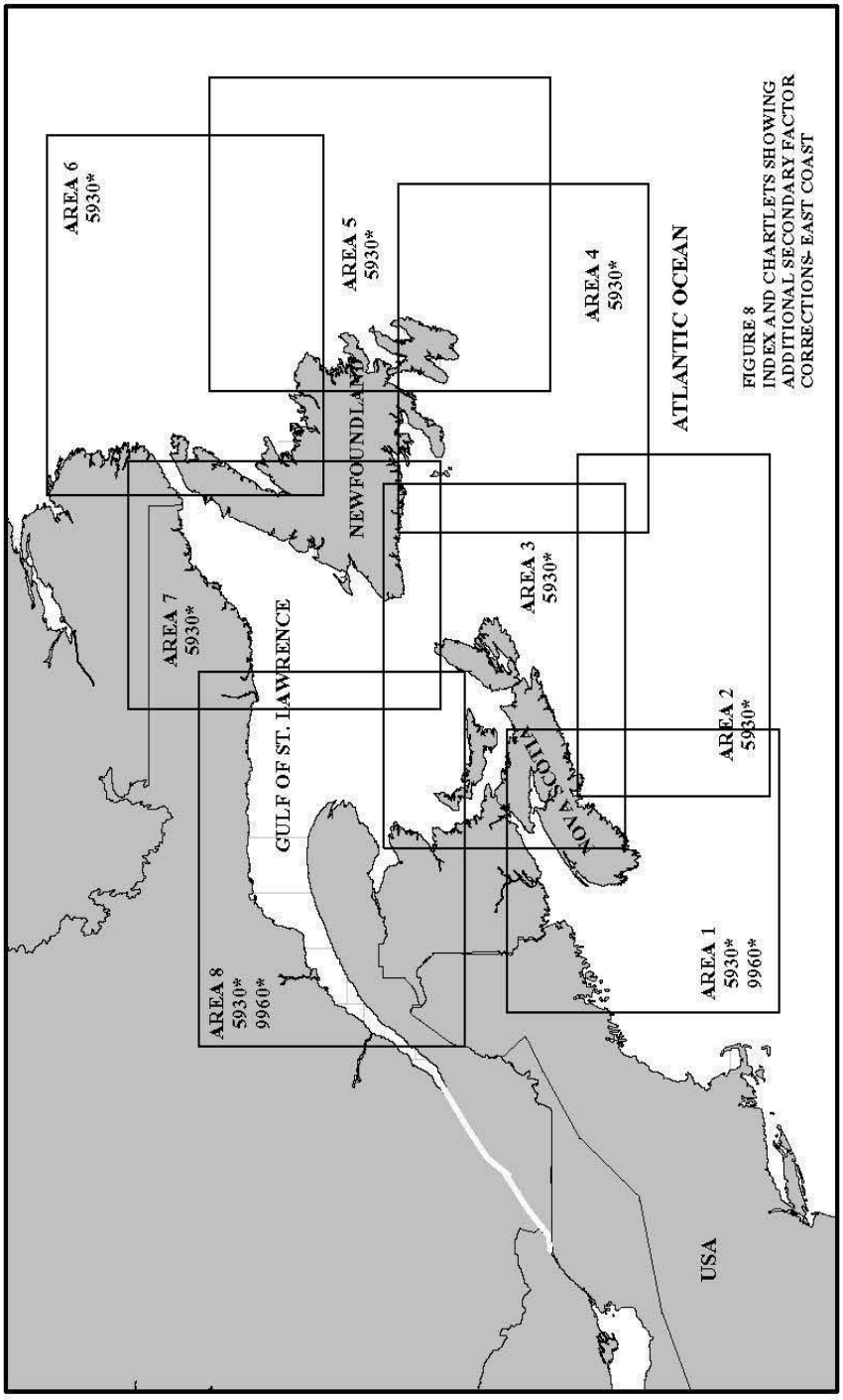


FIGURE 8
INDEX AND CHARTLETS SHOWING
ADDITIONAL SECONDARY FACTOR
CORRECTIONS- EAST COAST

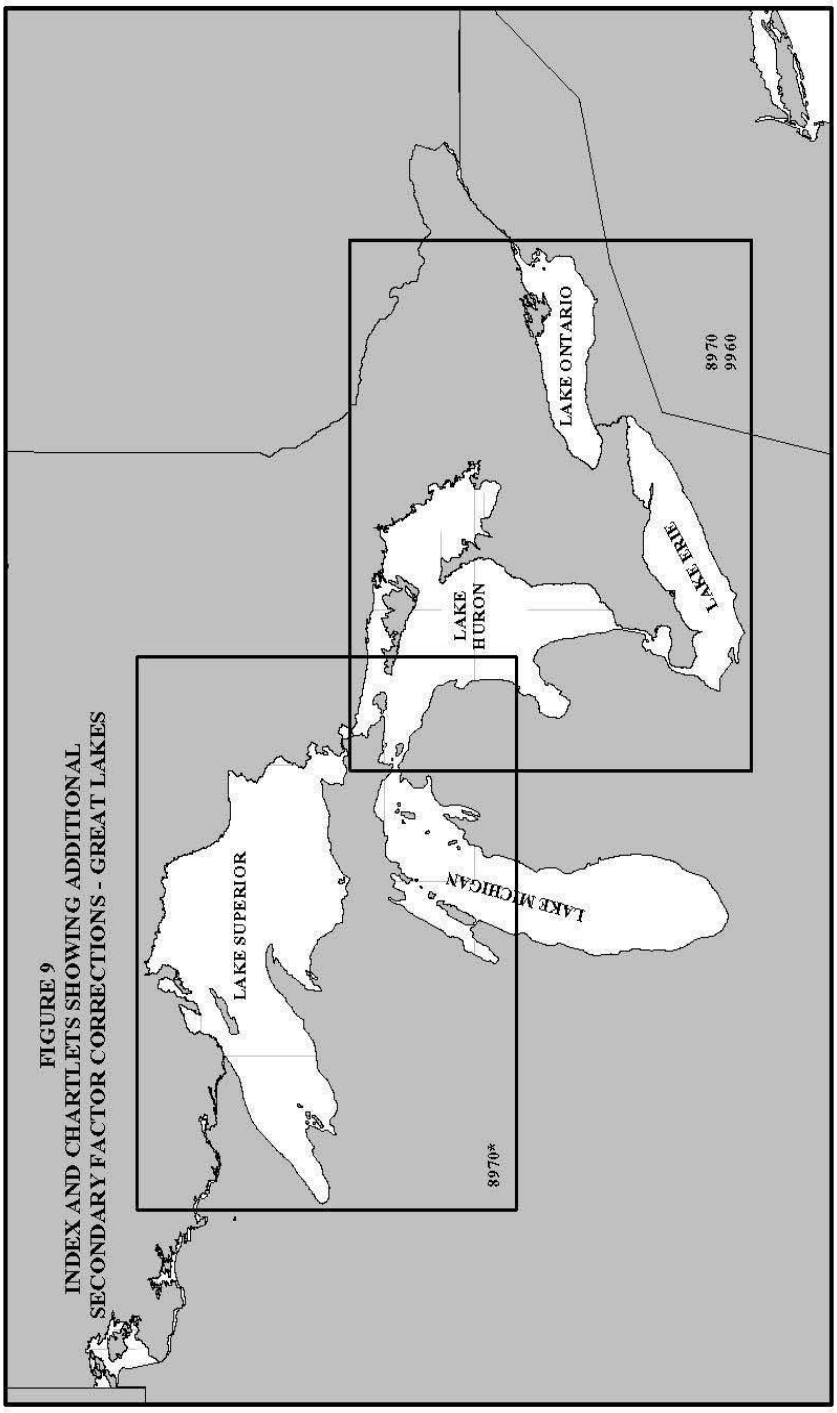


FIGURE 9
INDEX AND CHARTLETS SHOWING ADDITIONAL SECONDARY FACTOR CORRECTIONS - GREAT LAKES