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# A Survey of State-of-the-Art LORAN-C Receivers

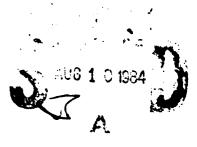


Franklin D. MacKenzie

Transportation Systems Center Cambridge MA 02142

June 1964 Final Report

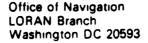
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U.S. Department of Transportation United States Coast Guard



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#### PREFACE

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This report is a summary of the state-of-the-art in LORAN-C receiver design (April 1984). The data sources were manufacturers, designers, and trade shows. Every effort was made to depict the status of receiver design activity accurately, in the midst of a volatile LORAN-C receiver market. New receiver models are being introduced monthly. Existing models are being modified in response to requests from the expanding user community. The work was sponsored by the U.S. Department of Transportation, United States Coast Guard, Office of Navigation. The data collection activity was performed by Cambridge Engineering under contract to the Transportation Systems Center, Office of Operations Engineering, System Evaluation Division, Maurice J. Moroney, Jr., Chief. Technical direction was provided by Franklin D. MacKenzie of the System Evaluation Division.

The work reported here was performed under the sponsorship of the Radionavigation Division, CAPT Douglas G. Currier, Chief. Technical support for the program was given by the LORAN Branch, LCDR William Thrall, Chief. The author wishes to thank the manufacturers for their contributions to the program included on the data sheets in the Appendix.

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#### 1. INTRODUCTION

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During the Vermont LORAN-C flight evaluation program (1979-1981) only one commercial manufacturer was building aircraft LORAN-C receivers. In 1982, eight manufacturers were either selling or designing new airborne LORAN-C receivers for the commercial and general aviation market. Today twenty-seven LORAN-C receiver manufacturers/distributors selling 85 current models for Aviation (21), Marine (57), Survey (4), Timing (2), and Land (1) (See Table 1) can be identified.

In order to provide the growing number of LORAN-C receiver users with accurate and reliable LORAN-C service and enable them to employ the state-ofthe-art features of these new receivers, the impact of present chain control procedures and stated coverage limitations must be examined. The ability of a receiver to operate in the cross-chain mode, for example, would permit areas which presently are not serviced by LORAN-C signals, such as the U.S. midcontinent, the Caribbean and Alaska, to be satisfactorily serviced by adding one or two transmitters. Realizing the potential system benefits which can be derived from the new state-of-the-art receiver designs, the U.S. Coast Guard has initiated a program with the Department of Transportation's Transportation Systems Center (TSC) to track the development and state-of-the-art of LORAN-C receiver designs.

This report contains information on LORAN-C receiver designs, equipment availability, comparative performance, comparative costs, and a forecast of the future direction of LORAN-C receiver designs. Special attention is given to changes in the algorithms developed for receiver control and for position location determination. The effect which these changes have had on improving the LORAN-C system effectiveness is evaluated. The U.S. Coast Guard will assess the impact of these receivers on present plans for the LORAN-C system, and also on future Department of Transportation and U.S. Coast Guard radionavigation plans.

The information contained in this report was developed from a variety of sources:

a. An existing TSC LORAN-C data base, which was created for two previous Project Memorandums (contact TSC Systems Evaluation

## TABLE 1. LIST OF LORAN-C RECEIVER MANUFACTURERS/DISTRIBUTORS

MANUPACTURIN	NODEL.	Marine	Aviation	Survey/	Time	Laad
Advanced Navigation, Inc.	ANI 7000 Engle	x	I			
Arsav, lac.	AVA-1000	-	X			
·	ARMAY 50 Armay 60		X			
Austron, Inc.	ARNAV 20 2100-F		X		x	
-	2100				X	
Datamarine International Digital Marinn Riectronice	4000 Navigator   Northstar 6000	1				
	Northetar 7000 Northetar 800	X				
Epeco Marine	C-PLOT RE	x				
	C-HAV XL C-HAV Sx	I				
Poster Airdata Purveo USA	LIIS 616 LC-70	I	I			
	LC-80	X				
II Morrow, Inc.	LC-200 Apoilo 1	X	X			
• • • • •	Aveger 511 Aveger 5018	X X				
	Avesger 512	x				
International Avionics	Aveger 5028R LC 300	X				
	LC-403 LC-404			X		
	LC-408			î		
	LC-300 LC-730	X				
	LC-1900		X			
International Marine Inst. King Marine Radio	CombiLoran 860 EING 8001	X				
Negapulse, Inc. Nicrologic	Accefiz 500 5000-Portable	x		I		
	5000A-Portable		X			
	4L-230 HL-330	I				
	HL-3000 HL-4000	I	I			
	WL-2000W	1	-			
	ML-30008 ML-4100	I	I			
Meice (LSA Scientific)	HL-5000 Basic C-MASTER X	I				
	C-MARTER LY	I.				
	C-MASTER V C-MASTER IV L/L	I				
Notorols, isc. Neutical Electropics	MAVL-1 Autofix 911	I				X
WERFICET STARFLORTER	Autofix 921	•	X			
	Autofix 911-A Autofix 900	I	I			
Navidyne Corp.	E32-7000/W	Ĩ				
Offshore Mavigatica, Iss.	282-7000 CN1-7000	•	X			
Racal-Decca Aviosics	ADL-81 ADL-82		X			
Radar Devices, Isc.	ROL-XXEX RAYNAY 7000	X X	-			
Raytheon Marine Co.	RATHAV 750	X				
Si-Tex	RAYNAV 6000 81-Tex/Edden 70					
	S1-Tex/Loden 78 S1-Tex/Loden 78	7 X	x			
	81-Tex/Roden 71	7 X	-			
Simrad, Inc.	tl- <b>638</b> TL- <b>656</b>	I I				
SR9 Labe	CLX-96 L-847 25	X	I			
	HLX .	X				
Teledyse Systems Company Texas Instruments	TL-711A T1- <b>990</b> 0	x	X			
· · · · · · · ·	TI-59000	X				
	TI-9000A	I				
	TI-90000 TI-90008	X				
	TI-9100		I			
	TI-99006P TI-99006PN	X X				
	11-91 880000-17	x	X			
Trimble Navigation	Trimble 100A	X				
	Trimble 200	X				
28_NAMUTACTURERS	SS. RECELVERS	<u>57</u>	<u>21</u>	4	2	1

. La la contra a contra contra contra de la contra Division for availability of documents) entitled "A Review of State-ofthe-Art LORAN-C Aviation Receiver Designs," and "A Review of Stateof-the-Art-LORAN-C Receivers for the Bureau of the Census".

- b. Data sheets obtained from manufacturers. A mailing requesting technical data was sent to all known distributors/manufacturers of LORAN-C receivers. This list was updated as additional manufacturers entered the field.
- c. Direct contact with LORAN-C receiver engineering and/or marketing personnel. Telephone conversations and personal contact with LORAN-C receiver designers provided information not normally included in data sheets (e.g., ASF correction techniques).
- d. Observations and contacts made at shows and expositions. As a part of the data collection effort, the Northeast Boat Show (Boston MA), the Wild Goose Association Convention (Washington D.C.) and FISH EXPO 83 (Seattle WA) were attended.

#### 2. TECHNICAL DEVELOPMENTS

This section includes background information on technical developments and design techniques employed in LORAN-C receivers. New technology and receiver design are highlighted.

#### 2.1 LATITUDE AND LONGITUDE COMPUTATION

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One of the major developments in low-cost, general-purpose LORAN-C receivers has been the incorporation of the computation necessary to display latitude and longitude coordinates, as opposed to time difference (TD) values. While latitude and longitude displays were formerly an expensive option on receivers, they are presently available in several receivers at a total cost of less than 1,000 (Sitex/Koden 787 & MLX). To convert LORAN-C TD values, measured at a specific location, into latitude and longitude coordinates, it is necessary to compensate for propagation delays as LORAN-C signals cross land masses of different conductivity values and pass through areas of varying meteorological conditions. The correction required to produce a true latitude and longitude coordinate from measured TD values is referred to as the additional secondary phase factor (ASF) or land mass correction. Coordinate conversion models were grouped, as follows, in accordance with the classification of ASF techniques presented in a paper by L.M. DePalma<sup>1</sup>:

- a. Baseline Model This model assumes a standard atmosphere in which the effect of the earth's presence is ignored. LORAN-C signals are assumed to propagate at a constant velocity.
- b. Seawater Model This model assumes that signals propagate over an all seawater path on a curved earth with a conductivity value of 5 mho/meter. This model requires a small positive ASF to be added as a function of distance, for distances under 400 miles.
- c. Land Model This model assumes a land path with an average conductivity value of approximately 0.003 mho/meter. For both the land and sea models the ASF correction is a non-linear function of range. The non-linearity effect with range is more pronounced as the conductivity value of the earth's surface decreases. In general, the ASF as a function of range can be represented by low order polynomials.

d. Mixed Path Model - This model assumes that the path from the transmitter to the user consists of segments which are either seawater or land with an average conductivity value. Millington's method is used to compute a total, or integrated, value of ASF.

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e. DMA Model - This model is the most complex and the conductivity of each path segment is defined using a five-level conductivity map. Values are calculated by using Millington's method.

The receiver manufacturers contacted to date can be divided into two categories:

- a. Those who provide for some form of ASF correction as part of the latitude and longitude computation process.
- b. Those who choose to ignore the need for such corrections and, therefore, do not provide them.

All manufacturers contacted were aware of the need to correct latitude and longitude values computed by their receivers to agree with the true latitude and longitude coordinates of known locations. In some designs, this requirement is ignored, and the operator is not provided with the means to enter corrections. However, most receiver designs permit the operator to calibrate the receiver by entering corrections either in the form of ASF from tables, or by entering the true latitude and longitude coordinates at a known location. The receivers which can be calibrated are divided into two groups:

- a. Those which treat the entered calibration value as the only correction required. They compute further latitude and longitude values using the baseline standard atmospheric model with a constant bias value (e.g., MLX).
- b. Many marine receivers commonly use the calibration at a dock as a way of removing the effect of land mass on the signals traveling to the coast, and then use the all-seawater model to compensate for the additional ASF obtained as the boat moves away from the coast (e.g., Internav LC300).

Several receivers employ more sophisticated ASF correction techniques such as storing TD correction maps or conductivity maps in the computer memory. The raw data from the conductivity maps is used to calculate ASF. Receivers which have stored correction maps in computer memory include the Micrologic 5000, the

AVA-1000, and the Northstar 7000. Receivers which have stored conductivity maps and ASF calculations are the ANI (ONI) 7000 and the Trimble 100/200 receivers. During 1983 there was a trend towards designs that included automatic ASF corrections through the use of correction maps or tables (e.g., ARNAV 20, 50, 60, King 8001, Micrologic 6000).

2.2 MULTI-STATION SOLUTIONS

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Traditional LORAN-C position location determination has been accomplished using the TD values produced between the master transmitter and two selected secondaries. In locations where signals are available from more than two secondaries, it is possible to produce position locations from TD values between the master and all stations in the chain. In general, the inclusion of data based on additional stations will produce a more accurate position location fix and the ability to provide continuous latitude and longitude outputs without switching between stations. Proprietary information is not available on the specific computational techniques used in receivers designed for multi-station solutions. However, the following levels of sophistication are identifiable:

- a. In the simplest case, a TD value may be treated as an independent measure of a line of position which can be used with another TD value to determine a position location.
- b. More sophisticated models incorporate the relative quality of each TD value into the solution, causing stations with a stronger signal at the receiver to be weighted more heavily in the solution than those stations with weaker signals.
- c. The most complete multi-station solution will recognize that the signal quality associated with each TD value contains a common element (the master station), and thus the TD values are statistically correlated. This permits the weighting of the various TD values according to their true quality.

A properly performed multi-station solution is inherently master independent (ignoring the problems of receiver lockup without a master station).<sup>2</sup> To sustain this master independence quality, however, it is necessary to recognize that:

- a. The covariance matrix has non-zero cross-correlation terms.
- b. The precision of mathematics required will be greatly increased if a station of very low quality is selected as the common station.

Receivers using the multi-station solutions include the ANI (ONI) 7000, which is capable of employing the signals from as many as eight different transmitters (from as many as four different chains, see cross-chain below) and the AVA-1000, which is capable of tracking and producing a simultaneous solution using signals from all secondaries in a given chain.

The Trimble receivers employ a multi-station solution in a limited way. Only two TD values are used to compute latitude and longitude coordinates, with a third time TD value (where available) used to resolve the inherent ambiguity present in hyperbolic systems. In particular, Trimble cites a case where identical time difference readings are obtained in California and in Nevada. Although, in this case, the difference in position location should be obvious to the user and hence correctable, the Trimble corrects the readings automatically.

The first low-cost marine receiver employing a multi-station solution is the C-MASTER X from Mieco. This receiver also provides for automatic switching as the user transitions between chains.

#### 2.3 NOTCH FILTERS

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Notch filters are included in LORAN-C receiver designs to remove the effects of interfering signals. The frequency band from 90 to 110 kHz is recognized by the International Telecommunications Union as a protected radio navigation band in Region II. However, this band was allocated in terms of radiated transmitter power and not in terms of the bandwidth necessary for a receiver to receive and process LORAN-C signals. In general, LORAN-C receivers are designed with a bandwidth that varies over the range 20 to 40 kHz. For this reason, notch filters are necessary to block interfering signals present in the portion of the frequency spectrum outside of 90 to 110 kHz. Further, in the European regions, (Regions I and III), notch or band-stop filters are required to remove FSK signals which are transmitted in the 90 to 110 kHz band (i.e., 106, 110 kHz).

The number of notch filters added to a receiver depends on the quality of the receiver, its anticipated application, and the geographic area of usage. In general, fewer notch filters are found in low cost receivers. Even in low-cost receivers,

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however, the option of procuring a third or fourth notch filter is available to the customer (e.g., the Sitex/Koden 787 has two notch filters with an optional third). The majority of medium-priced and higher performance receivers incorporate between four and six notch filters. The number of notch filters also varies both with anticipated use and area of usage of the receiver. Aircraft receivers typically require more notches than marine receivers because the large operational area of an aircraft platform will make receivers susceptible to many interfering signals. For example, the AVA-1000 includes nine fixed-notch filters, while the ANI (ONI) receiver uses four computer-tuned notch filters and up to four additional fixed-notch filters.

At the beginning of 1983, the C-MASTER X, C-MASTER IX, Northstar 7000 and the Trimble marine receivers were designed with automatic computer-tuned notch filters. At the present time, the use of automatic computer-tuned notch filters in a receiver design is commonplace.

#### 2.4 CROSS-CHAIN OPERATION

Each transmitter in the LORAN-C Navigation System is capable of providing a measure of range from the transmitter to the user provided that the user has a satisfactory time reference against which to measure the time of arrival of the LORAN-C pulse. In theory, it is possible to obtain a LORAN-C position fix using three geometrically dispersed stations which are members of three different chains. In practice, this is not the case for two reasons:

- a. The cross-chain repetition interval between chains varies in time. A non-ambiguous measure of TD between two stations from different chains is possible only if the user has some idea of time epoch.
- b. The U.S. Coast Guard controls the TD values within a given chain. The emission times between chains is controlled by the U.S. Naval Observatory (USNO) by virtue of the synchronization of each LORAN-C chain with the USNO Master Clock. Interchain time is specified to an accuracy of  $\pm 2.5 \mu$  sec with respect to USNO. While microsecond synchronization times are impressive in terms of absolute time dissemination, they represent large position errors when they are considered as TD errors.

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These considerations require the user of cross-chain signal receivers to track at least two stations from each chain, thus providing at least one line of position. The major advantage of using cross-chain operation occurs in areas of marginal coverage such as the mid-continent U.S. and parts of Canada.

Several receivers have cross-chain navigation capability. These are the ANI (ONI) 7000 receiver, which can track up to four chains, and the new receivers available from International Aviation (Internav), the LC-720, the LC-1200 and the LC-480, which can track two chains. Two older airborne receivers, the ADL-81 and the ADL-82, provide cross-chain operation, as each station is tracked by an independent oscillator.

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Table 2-1 summarizes the technical developments in LORAN-C Receiver design.

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## TABLE 2-1. SUMMARY OF LORAN-C RECEIVER TECHNICAL DEVELOPMENTS

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MANUFACTURER	NODEL	NANUAL NOTCILES	AUTOMATIC NOTCILES	STATIONS TRACKED, MASTER PLUS	CROSS - <u>CILA IN</u>	ASF TECHNIQUE	LAT/ LONG
Advanced Navigation, Inc.	ANI 7000	opt	3	8-MS	4	Mode 1	Yes
Arnav, Inc.	Eagle	8	No	A11 A11-MS	No No	No SCM	No Yes
	AVA-1000 ARNAV 50	9 9	No No	A11-WS	No	SCM	Yes
	ARNAV 60	9	No	A11-MS	No	SCM	Yes
•	ARNAV 20 2100- <b>F</b>	9 opt	No No	A11-MS 1	No N/A	SCM N/A	Yes N/A
Austron, Inc.	2100-7	opt	No	i	N/A	N/A	N/A
Datamarine International	4000 Navigator LC	4	No	A11	No	Man SCM	Yes Yes
Digital Marine Riectronics	Northstar 6000 Northstar 7000	4 #	No 4	A11 A11-A	No No	SCM	Yes
	Northstar 800	8	No	A11-A	No	SCM	Yes
Epsco Marine	C-PLOT Rx	4	No	A11 A11	No Nu	Man Kan	Үев Үзб
	C-NAV XL C-NAV SX	4	No No	A11	No	Man	Yes
Foster Airdata	LNS 616	2	No	A11	No	n*	Yes
Furueo USA	LC-70 LC-80	4	No No	? 5	No No	Man Man	Yca No
	LC-200	4	No	5	No	Maa	No
II Morrow, Inc.	Apollo I	8	No	A11	No	<b>ม</b> ีลภ	Yes
	Avenger 511 Avenger 501B	8 8	No No	A11 A11	No No	No No	No No
	Avenger 512	8	No	ALL	No	No	No
	Avenger 502BR	8	No	A11	No	Man	Yes Yes
International Avionics	LC300 LC403	4	No No	A11 4	No No	Man N/A	No
	LC-404	4	No	4	No	N/A	No
	LC-408	4	No	4+4	2	N/A	No
	LC-360 1.C-720	4 opt	No No	A]] 4+4	No 2	Man Man	Yes Yes
	IC-1200	2	2	4+4	2	Man	Yes
International Marine Inst.	CombiLoran 860	2 opt	4	A11	No	Man	Yes
King Marine Radio	KING 8001 Accufix 500	2 2+opt	4 No	ALI 4	No No	SCM N/A	Yes No
Negapulse, Inc. Nicrologic	5000-Portable	6	No	5	No	SCM	Yes
	5000A-Portable	6	No	5	No	SCN	Yes
	NL-220 Nl-320	777	No No	5 5	No No	No No	No Yes
	ML-3000	6	No	5	No	SCN	Yes
	ML-4000	6	No	5	No	SCM	Yes
	ML-2000N ML-2000R	6 6	No No	A11 A11	No No	Nan No	Yes No
	ML-4100	6	No	A11	No	Man	Yes
	ML-5000 Basic	6	No	A11	No No	SCN Mag	Yes Yes
Meico (LSA Scientific)	C-MASTER X C-MASTER IV	2+opt 2+opt	4	A11 A11	No	Man	Yes
	C-MASTER V	?	?	?	?	?	?
	C-MASTER IV L/L	2+opt	4	A11 ?	No ?	Mea ?	Yes ?
Notorola, Inc. Nautical Hlectronics	MAVL-I Autofix 911	? 4	No	5	No	Man	Yes
	Autofix 921	?	?	?	?	?	?
	Autofix 911-A	4	No No	5 5	No No	Wan ?	Yes No
Navidyse Corp.	Autofix 900 BSZ-7000/N	4	NO	A11-A	No	?	Tes
waviejes corp.	BSZ-7000	4	No	A11	No	No	No
Offshore Navigation, Inc.	ON1-7000	opt	3 2	8 3	4 2	Node1 No	Yes No
Racal-Decca Avionics	ADL-81 ADL-82	opt	2	3	3	No	No
Radar Devices, Inc.	RD1-????	4	No	4	No	Wan	?
Raytheon Marine Co.	RAYNAV 7000 Raynav 750	No No	4 6	5 4	No No	? Nan	Yes Yes
	RAYNAV 6000	2	No	5	No	?	Yes
Si-Tex	Sitex/Koden 760	2	3	A11	No	Nan	Yes
	Si-Tex/Koden 787 Si-Tex/Koden 787C	2+opt 2+opt	No No	4 A11	No No	No Man	No Yes
	Si-Tex/Roden 717	1	4	AII	No	Man	Yes
Simrad, Inc.	TI-838	6	No	?	No	No	No
SRD Labs	TL-856 CLX-95	6 4	No No	2 4	No No	NO Man	No Yes
UTLY HADS	L-NAV 25	6	No	2	No	Man	Yes
	MLX	4	No	2	No	Man	Yes
Teledyne Systems Company	TL-711A TI-9900	2	No No	4 All	No No	Man Man	Yes Yes
Texas Instruments	TI-9000N	4	No	ALI	No	Man	Yes
	TI -5000	?	?	?	No	Man	Yes
	TI-9000A	4	No No	AT 1 Al 1	No No	Man Man	No No
	TI-9000N Ti-90008	4	No	A11	No	Man	No
	TI-9100	No	Yes	A11	No	Man	Yes
	T I -99008P	4	No	A11	No	Man	Yes
		A	¥-				
	TI-99008PN TI-91	4 No	No Yes	A11 A13	No No	Man Man	Yes Yes
Trimble Navigation	TI-99008PN						

KKY: A = automatic nelection NS = multi-station solution Man \* manual correction entry SCB = stored correction map used Model \* computes for path using propagation model All = all stations in chain are tracked n\* \* based on VORTAC position opt = optional

2-7/2-8

#### 3. LORAN-C MARKET CHANGES AND ADDITIONS

In producing the data base for LORAN-C receivers, an attempt was made to exclude receivers which are no longer available, or which cannot be considered state-of-the-art. This section describes several changes that took place in the LORAN-C market during the past year, namely, new manufacturers, new receivers, and changes in trade names. The following manufacturer changes have been noted:

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- a. MORROW, INC. (not to be confused with II Morrow, Inc.) has changed their company name to ARNAV. Their first aviation receiver is the AVA 1000. ARNAV introduced three additional receivers, the ARNAV 20, 50 and 60 in December 1983 and January 1984.
- b. INTERNAV (International Navigation, Inc.) has changed their corporate name to International Avionics but will continue to use the name INTERNAV on their LORAN-C receivers. They are introducing four new receivers which were either obtained through, or developed in concert with, their Canadian counterpart, Internav, Ltd. The new receivers are designated the LC-300, LC-720, LC-1200 and LC-480. The LC-300 is a low-cost version of the existing LC-360 receiver. The LC-720 is a dual-chain version of the LC-360. The LC-1200 is a receiver designed for airborne use, while the LC-480 is a dual-chain version of the LC-404 monitor/receiver.
- c. MICROLOGIC has introduced the ML-5000 receiver which does not contain either computer-tuned notch filters or full land mass correction. The ML-5000 receiver does have a map of LORAN-C land-mass corrections for the coastal area of North America from Nova Scotia to Alaska, and incorporates self-calibration for envelope to cycle distortion. An additional feature of the receiver is the optional battery pack and antenna, which converts the ML-5000 into a portable batteryoperated LORAN-C receiver. In January 1984, Micrologic produced the ML-6000, a low-cost (\$2795) aviation receiver.

3-1

- d. NAVIGATION SYSTEMS, INC., located in Silver Spring, MD, will change their name to RACAL-DECCA AVIONICS, INC. to reflect the purchase of DECCA company and several of its subsidiaries by the RACAL company of England.
- e. KING MARINE RADIO CORPORATION is a new company based in Clearwater, FL, which was formed as a wholly-owned subsidiary of King Radio of Orlath, KS. This marks the entry of King Radio into the LORAN-C business. The management staff establishing this division of King Radio came from Sitex/Koden and the engineering personnel came mainly from Bendix Avionics. Their design emphasis has been concentrated on a small unit which is user-friendly. The King 8000 has twenty discrete LEDS, which presumably will be used to cue the operator. The front panel dimensions of the receiver are the same dimensions as the TI-9100.

An estimate of the market share of various manufacturers of both air and marine LORAN-C receivers is shown in Tables 3-1 and 3-2. The market shares shown do not equal 100 percent because they are based on individual manufacturer's estimates (cross-checked with other manufacturers), and reflect different time frames (e.g., in the fall of 1983, ARNAV supplied less than 3 percent of the aviation market. However, they are now estimating a 10 to 15 percent share based on the popularity of their new low-cost ARNAV 20 receiver). The tables should provide a rough indication of the volume suppliers.

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#### TABLE 3-1. MARINE LORAN-C RECEIVERS

#### MANUFACTURER MARKET SHARE Datamarine \*\* Epsco \*\* Furuno 5% Micrologic 15% Meico \*\* Nelco \*\* **Digital Marine** 5% Raytheon 5% Sitex/Koden 30% SRD Labs 15% **Texas Instruments** 10% Internav ¥\* **II Morrow** 15% Trimble \*\*

#### TABLE 3-2. AIRCRAFT LORAN-C RECEIVERS

MANUFACTURER	TOTAL INSTALLED & WORKING (5000)	NEW INSTALLATIONS II QUARTER 1984
Arnav	8%	30%
ONI	8%	**
Micrologic	12-15%	20%
Teledyne	15%	**
Texas Instruments	25%	**
SRD Labs	10%	10%
II Morrow	20-25%	40%
Foster	196	**

**\*\*** indicates less than 5% Totals do not add to 100% due to uncorrelated nature of estimates.

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#### 4. SIGNIFICANT EVENTS

HACKED REPORT

This section contains information which is relevant to state-of-the-art receiver design.

Several manufacturers commented that they are under contract to provide LORAN-C receiver boards for vehicle tracking systems. The potential number of LORAN-C vehicle trackers is in excess of 10,000 units.

On 5 May 1983, Motorola formally introduced their automatic vehicle location receiver and system. This receiver is designed to operate in a fully automatic mode without operator intervention in vehicles, such as taxicabs, containing Motorola VHF communications systems. The receiver does not contain a display, but communicates directly with the vehicle's 2-way radio through a builtin data modem. This receiver was described in the state-of-the-art survey performed for the Census Bureau.

Many general aviation pilots are using low-priced (and in some cases, low quality) marine receivers to provide navigation information for use in VFR operation. It is estimated that 1000 to 2000 receivers of the marine type have been sold to general aviation pilots. The use of a non-approved receiver in the cockpit of an aircraft raises several questions:

- 1. Will the LORAN-C receiver and its associated microprocessor circuitry interfere with existing aircraft navigation systems?
- 2. Will unofficial reliance on LORAN-C navigation data produce hazardous operating conditions? For example, a receiver which provides high quality navigation data 90 percent of the time might be relied upon during periods of unflagged but degraded performance (such as could occur during periods of high precipitation static).

The general public knowlege of LORAN-C is growing because of the availability of low-cost receivers. As a result, there is increased pressure to provide complete continental U.S. coverage. An example of this is an inquiry received from the Department of Immigration and Naturalization for a study to explore the possibility of providing LORAN-C position data to immigration agents working along the Mexico/U.S. and Canada/U.S. borders.

An analysis of the receiver design characteristics supplied by various manufacturers indicates a trend towards aircraft versions of standard marine receivers. These receivers differ from their marine counterparts in two respects. First, their time constants have been adjusted to reflect the higher dynamics experienced during aircraft movements. Second, some of the navigation features have changed to reflect aircraft navigation procedures. Receivers in this class include the L-NAV 25 from SRD Labs, the ML-5000A from Micrologic, and the Apollo I from II Morrow, Inc.

New receivers show a decrease in power consumption. Two years ago, receivers typically used between 10 and 20 watts. The new receiver designs such as the SRD Labs receiver, the Meico receivers, the Micrologic 5000, the NELCO receiver, and the Si-Tex/Koden 787 series have power requirements between 5 and 10 watts. This reduction in power is directly attributed to the decrease in power requirements for microprocessors and associated components, and the increased use of low power consumption liquid crystal displays as opposed to LED-type displays.

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The general aviation community appears to be adapting very quickly to LORAN-C as a navigation system. The desire to use LORAN-C because it is an available, operationally proven system is evident beyond the general aviation community. For instance, the Norwegian government has decided to proceed with the installation of LORAN-C transmitters along their coastal areas. This decision appears to have been based on both the availability of LORAN-C technology and the control of navigational destiny which Norway would gain through the use of the LORAN-C system (as opposed to basing navigation needs on a global satellite system such as GPS which is being implemented by the U.S. DOD).

As LORAN-C receiver technology is better understood, receiver manufacturers seem to be expanding the capabilities of their receivers to make them more user-friendly. These improvements include: (1) The simplification of both keyboard and display designs to decrease operator training requirements and provide a high degree of user acceptance, and (2) the inclusion of more automatic test features to increase user confidence in the numbers displayed by the receiver.

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The ARNAV AVA-1000, the ARNAV 50 and the ARNAV 60 receivers extend coverage by adding the capability to either move their tracking point to the skywave signal or move it to initially acquire a skywave signal. Skywave tracking permits these receivers to work in areas which otherwise are not covered by LORAN-C. When the skywave of the signal is used, the receivers lose their ability to provide absolute position location information. Once initialized, they will compensate for the initial unknown cycle tracking. The receivers are expected to provide quality position location information sufficiently accurate for en route air navigation.

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#### 5. BIBLIOGRAPHY

Newcomers to the LORAN-C system often request a list of books or papers which describe the LORAN-C system. The following references are cited:

1. LORAN-C USER HANDBOOK. U.S. Department of Transportation, Coast Guard, COMDTINST M16562.3 (old CG-462), May 1980.

This publication contains an elementary description of the LORAN-C system and its use. It also includes the status of the various system chains.

2. <u>AUTOMATIC VEHICLE LOCATING SYSTEMS</u>. Edward N. Skomal, Van Nostrand Reinhold Company, 1981.

This book is a good starting point for anyone interested in vehicle location systems from either a technical (how to do it) or an operational research (what are the benefits) point of view. Chapter 5 includes a general description of the LORAN-C system.

3. "Current Developments in LORAN-C." Robert L. Frank, Proceedings of the IEEE, Vol. 71, No. 10, October 1983.

A survey of new LORAN-C developments. It includes a brief introduction to LORAN-C, a description of the operation of solid-state transmitters, propagation effects, receivers and hybrid applications. A 136 entry list of references is included.

 <u>NAVIGATION</u>. Journal of the Institute of Navigation, Volume 29, Number 1, Spring 1982.

This issue is perhaps the most complete and broad-based description of the LORAN-C system. This issue has been reprinted several times due to demand for copies.

Contents include:

History of LORAN-C

LORAN-C Present and Future

DMHATC Support to National Ocean Survey LORAN-C Charting Benefit/Cost Analysis Applied to LORAN-C Expansion

**LSAXAXA** 

The LORAN-C Receiver: A Functional Description Certification of an Airborne LORAN-C Navigation System Using LORAN-C for Automatic Vehicle Monitoring Evolution of LORAN-C Coverage

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### APPENDIX

## LORAN-C RECEIVER DATA BASE

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 ADVANCED NAVIGATION INC 621 LOFSTRAND LN. ROCKVILLE MD. 20850 HODEL # ANI 7000 301-424-8730 PHONE LIST PRICE (USD): 10/00/81 ADVERTISED PRICE (USD): 20950.00 05/07/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 7.62 W(inches): 7.5 D(inches): 12.6 VOLUME(cu.in.): 887 TEMP RANGE (deg F): -67,+170 WEIGHT (1b): 18.1 INPUT VOLTAGE: 18-32 POWER REQUIREMENT (Watts): 60 DISPLAY TYPE: FIBER OPTIC 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 7 + 12 POS ROTARY ANTENNA HEIGHT (inches): 6.25 \*\*\*\*ASF CORRECTION TECHNIQUE ASF BASED ON INTERNAL CONDUCTIVITY MAP. USA COVERED \*\*\*\*NOTCH FILTERS AUTOMATIC SOFTWARE TUNED HARDWARE NOTCHES. OPTIONAL FACTORY SET FIXED NOTCHES. \*\*\*\*MICRO-PROCESSOR TYPE(S) 2 6809 \*\*\*\*STATIONS TRACKED & HOW USED 8 MAX FROM UP TO FOUR CHAINS \*\*\*\*MULTI-CHAIN CAPABILITY UP TO FOUR CHAINS \*\*\*\*CERTIFICATIONS TSO, C-60A, STC FOR IFR, TOTAL NAS PRIMARY NAV. ENROUTE AND TERMINAL \*\*\*\*DYNAMIC RANGE 127 DB \*\*\*\*NOISE BANDWIDTH 35kHZ 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 10dB/1uV \*\*\*\*DYNAMIC RANGE 127 DB \*\*\*\*SNR FOR TRACK (MIN) -18dB \*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*\*N1 FULL INTERFACES TAS/NOG, WEATHER RADAR, HSI/RMI, RS-232/HPIL, ADD UP TO \$4500 \*\*\*\*\*N2 SENSOR VERSION \$13,500n

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ARNAV INC 4740 RIDGE DR. W.S. POB 7078 SALEM OR 97303-0012 HODEL # BAGLE PHONE \$03-393-2550 LIST PRICE (USD): 1095.00 09/00/81 ADVERTISED PRICE (USD): 1095.00 05/07/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/memitor, (T)iming, (L)and, (O)ther] H(inches): 3.5 W(inches): 8.8-D(inches): 12 VOLUME(cu.in.): 369 WEIGHT (1b): 6 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 9-12 INPUT VOLTAGE: 6.5-50 DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? N MENBER AND TYPE OF DATA KEYS: THB,6TCH PD,FNCT KEY ANTENNA HEIGHT (inches): 102 \*\*\*\* ASF CORRECTION TECHNIQUE N/A \*\*\*\*NOTCH FILTERS & PRE-TUNED \*\*\*\*STATIONS TRACKED & HOW USED ALL TRACKED; 2 USED AT A TIME \*\*\*\*WULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS NO \*\*\*\*DYNANIC RANGE 1043 \*\*\*\*NAX. GDOP FOR LAT-LONG N/A \*\*\*\*WOISE BANDWIDTH 20kHz \*\*\*\*SENSITIVITY ( u VOLTS) +30dB/uV/m \*\*\*\*SHR FOR ACQUISITION -1048 \*\*\*\*SHR FOR TRACK (MIN) -1543 \*\*\*\*SNR FOR POSITION DISPLAY -15dB \*\*\*\*MICRO-PROCESSOR TYPE(\$) 8085

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NODEL # AVA-1000 ARNAV INC 4740 RIDGE DR. N.E. POB 7078 SALEM OR 97303-0012 PHONE 503-393-2550 LIST PRICE (USD): 09/00/82 ADVERTISED PRICE (USD): 7995.00 05/05/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUME(cu.in.). W(incnes)+ D(inches). H(isches); WEIGHT (1b): 4.8 TEMP RANGE (deg F): -4,+130 POWER REQUIREMENT (Watts): INPUT VOLTAGE: 10-45 DISPLAY TYPE: A-N, LED, DOT MATRIX 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 20 PUSH-BUTTON ANTENNA HEIGHT (inches): 19 \*\*\*\*ASF CORRECTION TECHNIQUE NAP IN CONVERSION ALGORITHM \*\*\*\*NOTCH FILTERS 9 PRESET ALL STATIONS TRACKED & HOW USED ALL STATIONS TRACKED, ALL USED IN NAV SOLUTION \*\*\*\*HULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS TSO, IFR(STC) \*\*\*\*MAX. GDOP FOR LAT-LONG NOT DEFINED \*\*\*\*NOISE BANDWIDTH 20kHz \*\*\*\*SENSITIVITY ( u VOLTS) +30dB/uV/METER \*\*\*\*SHR FOR ACQUISITION -10dB \*\*\*\*SNR FOR TRACK (MIN) - 20dB \*\*\*\*SNR FOR POSITION DISPLAY 020dB (WARNING BELOW) \*\*\*\*DYNAMIC RANGE 100dB \*\*\*\*WICRO-PROCESSOR TYPE(S) TWO, Z-80A \*\*\*\*\*N1 EXTENDED RANGE OPTION AVAILABLE, USES SKY AND GROUND WAVE

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ARNAV INC 4740 RIDGE DR. N.E. POB 7076 SALEM OR 97303-0012 ARNAV 50 MODEL # 503-393-2550 PHONE ADVERTISED PRICE (USD): 7995.00 11/00/83 LIST PRICE (USD): DESIGNED FOR: A [(M)srime, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inchus): 3.25 H(inches): 6.25 D(inches): 10.7 VOLUME(cu.in.): 217.3 TEMP RANGE (deg F): -4, +131 WEIGHT (1b): 4.8 POWER REQUIREMENT (Watts): 19 INPUT VOLTAGE: 10-55 0-9 KEY PAD? Y DISPLAY TYPE: LED DOT MATRIX ANTENNA HEIGHT (inches): MUNDER AND TYPE OF DATA REYS: 16+11SEC, SEL SW \*\*\*\*ASF CORRECTION TECHNIQUE MAP \*\*\*\*STATIONS TRACKED & HOW USED NASTER + ALL SECONDARIES, ALL STATIONS USED FOR FIX \*\*\*\*NOTCH FILTERS 9 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 2, 2-80 \*\*\*\*MULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS PENDING TSO, IFR \*\*\*\*DYNAMIC RANGE 100 dB \*\*\*\*NAX. GDOP FOR LAT-LONG UK \*\*\*\*NOISE BANDWIDTH 20 kHz \*\*\*\*SENSITIVITY ( u VOLTS) 3 uV/M \*\*\*\*SNR FOR ACQUISITION -10 dB \*\*\*\*SMR FOR POSITION DISPLAY -20 43 \*\*\*\*SHR FOR TRACK (MIN) -20 dB \*\*\*\*N1 DESIGED FOR LINITED COVERAGE AREAS, USING SKYWAVE \*\*\*\*\*\*\* WAYPOINTS, 200 ALPHABETIZED, DATA ENTRY & DISPLAY

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ARNAV 60 ARNAV INC NODEL # 4740 RIDGE DR. N.E. POB 7078 SALEM OR 97303-0012 PHONE 503 393-2550 ADVERTISED PRICE (USD): 9495.00 11/00/83 LIST PRICE (USD): DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther} W(inches): 4.75 . D(inches): lū VOLUNE(cu.in.): H(inches): 7 WEIGHT (16): 5.5 TEMP RANGE (deg F): -67,+158 POWER REQUIREMENT (Watts): 19 INPUT VOLTAGE: 10-45 0-9 KEY PAD? Y DISPLAY TYPE: LED, DOT MATRIX ANTENNA HEIGHT (inches): NUMBER AND TYPE OF DATA KEYS: 16+11 SEC, SEL.SW. \*\*\*\*ASF CORRECTION TECHNIQUE MAP \*\*\*\*STATIONS TRACKED & HOW USED MASTER + ALL SECONDARIES, ALL STATIONS USED FOR FIX \*\*\*\*NOTCH FILTERS 9 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) Z-80 \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS PENDING TSO, IFR \*\*\*\*DYNAMIC RANGE 100dB \*\*\*\*MAX. GDOP FOR LAT-LONG UK \*\*\*\*NOISE BANDWIDTH 20 kHz \*\*\*\*SENSITIVITY ( u VOLTS) +3 uV/METER \*\*\*\*SNR FOR ACQUISITION -10 dB \*\*\*\*SNR FOR POSITION DISPLAY -20 dB \*\*\*\*SNR FOR TRACK (MIN) -20 dB \*\*\*\*\*N1 LOFF OPTION, \$1500 PREAMP RANGE -67,+158 \*\*\*\*\*N2 DESIGNED FOR LIMITED COVERAGE AREAS, USING SKYWAVE, SAYPOINTS ALPHABETIZED

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 ARNAY INC. 4740 RIDGE DR. N.E. POB 7078 SALEM OR 97303-0012 MODEL # ARNAV 20 PHONE 503-393-2550 LIST PRICE (USD): ADVERTISED PRICE (USD): 2795.00 11/00/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/momitor, (1)iming, (L)and, (0)therj M(inches): 3.25 VOLUME(cu.in.): W(inches): 6.25 D(inches): 10.7 WEIGHT (1b): 4.6 TEMP RANGE (deg F): -20,+55 IMPUT VOLTAGE: POWER REQUIREMENT (Watts): DISPLAY TYPE: 0-9 KEY PAD? NUMBER AND TYPE OF DATA KEYS: ANTENNA HEIGHT (inches): \*\*\*\* ASF CORRECTION TECHNIQUE NAP \*\*\*\* STATIONS TRACKED & HOW USED MASTER + ALL SECONDARIES, ALL STATIONS USED FOR FIX \*\*\*\*NOTCH FILTERS 9 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 2-80 \*\*\*\* MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS VFR, BEING TESTED TO TSO STANDARDS \*\*\*\* BYNAMIC RANGE 100Db \*\*\*\* MAX. GDOP FOR LAT-LONG UX \*\*\*\*NOISE BANDWIDTH 20 Khz \*\*\*\*SENSITIVITY ( u VOLTS) Su¥/Ma \*\*\*\*SWR FOR ACOUISITION -10 43 \*\*\*\*SHR FOR POSITION DISPLAY -28 48 \*\*\*\*SHR FOR TRACK (MIN) -20 dB seeseN1 WAYPOINTS : 200 ALPHABETIZED

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 HODEL # AUSTRON INC POB 14766 AUSTIN,TX 78761 2100-F PHONE 512-251-2341 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: T [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 14.5 D(inches): 19 H(inches): 3.5 VCLURE(cu.in.). 90-WEIGHT (1b): 20 TEMP RANGE (deg F): 32-122 INPUT VOLTAGE: 115VAC POWER REQUIREMENT (Watts): DISPLAY TYPE: LCD, & DIGITS 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: +11PBS ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE PROGRAMMED FOR USER BASED ON MEASUREMENTS \*\*\*\*STATIONS TRACKED & HOW USED SELECTS FIRST IN CHAIN THAT MEETS CRITERIA \*\*\*\* NOTCH FILTERS PROVIDED BY OPTIONAL FILTER BOX, MODEL 2088, 2082 OR 2084 \*\*\*\*MICRO-PROCESSOR TYPE(S) 6800 \*\*\*\*WULTI-CHAIN CAPABILITY NA \*\*\*\*CURTIFICATIONS MA \*\*\*\*DYNAMIC RANGE 127 db Software controlled attenuator \*\*\*\*MAX. GDOP FOR LAT-LONG NA \*\*\*\* NOISE BANEWIDTH 40 kliz .01#V INTO SO ONS -20dB \*\*\*\* SHR POR POSITION DISPLAY 11A \*\*\*\*\*<sub>W1</sub> THIS RECEIVER IS DESIGNED AS A FREQUENCY COMPARISON UNIT

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AUSTRON INC. POB 14766 AUSTIN, TX 78761 HODEL # 2100 PHONE 512-251-2341 ADVERTISED PRICE (USD): 10740.00 11/00/83 LIST PRICE (USD): DESIGNED FOR: T [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] Hinches). 3.5 Wilsches): 14.5 B(laches): 19 VOLUME(cu.is.): 964 WEIGHT (15): 20 TENP RANGE (deg P): 32-122 POWER REQUIREMENT (Watts): INPUT VOLTAGE: 115VAC DISPLAY TYPE: LCD, & DIGITS 0-9 KEY PADT Y HUNDER AND TYPE OF DATA KEYS: +15PBS ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE PROGRAMMED FOR USER BASED ON MEASUREMENTS \*\*\*\* STATIONS TRACKED & NOW USED TRACKS SINGLE STATION FOR TIME MEASUREMENT \*\*\*\* NOTCH FILTERS EXTERNAL MODEL 2080.2082,2084 \*\*\*\*WICEO-PROCESSOR TYPE(S) 6809 \*\*\*\* WILTI-CHAIN CAPABILITY HA \*\*\*\*CERTIFICATIONS MA \*\*\*\* BYNAMIC RANCE 12743 PROGRAMMABLE ATTENUATOR SASSMAX. GOOP POR LAT-LONG 4000 NOISE BANDWIDTH 400Hz -3dB, 40dB TRACK 40Hz \*\*\*\*SENSITIVITY ( u VOLTS) .01uV INTO 50 ONN \*\*\*\*SMR FOR ACQUISITION -28dB \*\*\*\*SNR FOR POSITION DISPLAY NA \*\*\*\*SHR FOR TRACK (HIN) >30d3 ATHOSPHERIC \*\*\*\*\*N1 TINING RECEIVER AUTOMATIC ACQUISITION \*\*\*\*\*N2

DATE 02/10/84

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NODEL / 4000 NAVIGATOR LC

#### DATAMARINE INTERNATIONAL INC 53 PORTSIDE DRIVE, POCASSET, NA 02559

PHONE 617-563-7151

LIST PRICE (USD): 2595.00 02/00/81 ADVERTISED PRICE (USD): 1995.00 05/07/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] M(inches): 4.25 W(inches): 10.5 D(inches): 12.7 VOLUME(cu.in.): 566 WEIGHT (1b): 7 TEMP RANGE (deg F): +32-+120 INPUT VOLTAGE: 10-16 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD7 Y NUMBER AND TYPE OF DATA KEYS: 10 ANTENNA HEIGHT (inches): 96

\*\*\*\*ASF CORRECTION TECHNIQUE KEYBOARD ENTRY

\*\*\*\*NOTCH FILTERS FOUR, 30db FILTERS, 2 FIXED, 2 EXTERNAL

\*\*\*\*MICRO-PROCESSOR TYPE(S) 8085

\*\*\*\*STATIONS TRACKED & HOW USED ALL WITHIN SELECTED CHAIN

\*\*\*\*MULTI-CHAIN CAPABILITY All Chains operational (No cross chain)

\*\*\*\*CERTIFICATIONS

\*\*\*\*DYNAMIC RANCE 804B PLUS 204B STEP ATTENUATION FOR STRONG STATION

NO LINIT

\*\*\*\*WOISE BANDWIDTH 20kHz - 3dB

\*\*\*\*SENSITIVITY ( & VOLTS) Sav

\*\*\*\*SNR POR ACQUISITION -2048

\*\*\*\*SHR FOR TRACK (MIN) GREATER THAN -2048

\*\*\*\*SWR FOR POSITION DISPLAY

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WAYPOINTS, & TRACK SPEED SO KTS

DATE 02/10/84

HODEL # NORTHSTAR 6000 DIGITAL MARINE ELECTRONICS CRP 30 SUDBURY RD. ACTON NA 01720 PHONE 617-897-6600 LIST PRICE (USD): ADVERTISED PRICE (USD): 2995.00 10/29/83 DESIGNED FOR: M {(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 9.5 W(inches): 16 Dignhagle 11 votmmm(cu.is.): 1672 WEIGHT (1b): 25 TEMP RANGE (deg F): 32-140 INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 50 DISPLAY TYPE: LED 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 6 ROTARY SW ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE TABLE LOOKUP GRI ALL STATIONS, LAT/LONG, MANUAL OVERRIDE \*\*\*\* NOTCH FILTERS 2 INTERNAL, 2 OPERATOR ADJUSTABLE \*\*\*\*NICRO-PROCESSOR TYPE(S) 2020 \*\*\*\* WULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS RTCM \*\*\*\*DYNANIC RANCE 120 dB \*\*\*\*MAX. GDOP FOR LAT-LONG 110 \*\*\*\*SENSITIVITY ( & VOLTS) 0.8 uV . \*\*\*\*SHR FOR POSITION DISPLAY -25 48 \*\*\*\*SHR FOR TRACK (MIN) -25 dB \*\*\*\*\*N1 WAYPOINTS, 120 \*\*\*\*\*N2 TRACK SPEED, 200 KTS

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 NODEL # DIGITAL MARINE ELECTRONICS CRP NORTHSTAR 7000 30 SUDBURY RD. ACTON NA 01720 PHONE 617-897-6600 LIST PRICE (USD): ADVERTISED PRICE (USD): 2995.00 10/28/83 DESIGNED FOR: M [(N)arinu, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (U)ther; W(inches): 12.7 D(inches): 12.5 VOLUME(cu.in.): 1151 H(inches): 7.25 WBIGHT (16): 24 TEMP RANGE (deg F): INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: 2xLOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 26 ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE AUTOMATIC CORRECTION TECHNIQUE, TABLE LOOKUP \*\*\*\*NOTCH FILTERS FOUR AUTOMATIC HIGH DYNAMIC RANGE \*\*\*\*WICRO-PROCESSOR TYPE(S) 2025 \*\*\*\*STATIONS TRACKED & HOW USED SINGLE GRI; TRACES ALL SECONDARIES, AUTO-SELECTS PREFERRED PAIR OF SECONDARIES \*\*\*\*MULTI-CHAIN CAPABILITY 10 \*\*\*\*CERTIFICATIONS DESIGNED TO RTCH MPS 70 \*\*\*\*DYNAMIC RANGE 120 dB \*\*\*\*MAX. GDOP FOR LAT-LONG PRODUCES MESSAGE WHICH STATES "LAT/LONG MAY BE POOR BASED ON JITTER EVAUATION OF FAR CORNERS OF RHOMBOID" \*\*\*\*NOISE BANDWIDTH UNENOWN \*\*\*\*SENSITIVITY ( u VOLTS) 0.6 uV \*\*\*\*SWR FOR ACQUISITION -25 dB \*\*\*\*SHR FOR TRACK (MIN) -25 dB \*\*\*\*SHR FOR POSITION DISPLAY -25 dB \*\*\*\*\*\*\*\*\* CDU #1 : H 4.5, W 7.25, D 8, CU IN 261, WEIGHT 4 COST \$895, POWER REQUIREMENT 1.5w \*\*\*\*\*W2 CDU #2 : H 7, W 14, D 3.75, CU IN 367.5), WEIGHT 7, POWER REQUIREMENT 7.5W

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 DIGITAL MARINE ELECTRONICS CRP 30 SUDBURY RD. ACTON, MA 01720 HODEL # NORTHSTAR 800 PHONE 617-897-6600 ADVERTISED PRICE (USD): 2395.00 10/29/83 LIST PRICE (USD): DESIGNED FOR: M ((M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther) H(inches): 4 W(inches): 9.5 WEIGHT (1b): <12 TEMP RANGE (deg F): 32-140 INPUT VOLTAGE: 12 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 26, PRESR.SNSTV.MBRN ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE TABLE LOOKUP \*\*\*\*STATIONS TRACKED & HOW USED ONE GRI ALL SLAVES, LORAN A CONVERSION, LAT/LONG CONVERSION, MANUAL OVERRIDE \*\*\*\*NOTCH FILTERS S FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 2025 \*\*\*\* WULTI-CHAIN CAPABILITY 10 \*\*\*\*CERTIFICATIONS RTCH \*\*\*\*DYNAMIC RANGE 120 dB \*\*\*\*MAX. GDOP POR LAT-LONG "LAT/LONG MAY BE POOR" MESSAGE \*\*\*\*NOISE BANDWIDTH \*\*\*\*SENSITIVITY ( u VOLTS) .6 uV \*\*\*\*SNR FOR ACQUISITION -25 dB \*\*\*\*SHR FOR POSITION DISPLAY -25 dB \*\*\*\*SNR POR TRACE (MIN) -25 dB

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DATE 02/10/84

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EPSCO MARINE 411 PROVIDENCE HWY, WESTWOOD MA. 02090 C-PLOT RX NODEL # PHONE 617-329-1500 LIST PRICE (USD). ADVERTISED PRICE (USD): 5995.00 10/29/83 DESIGNED FOR: N {(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther} VOLUME(cu.in.): MLINCHes): W(inches): D(inches): TEMP RANGE (dog F): WEIGHT (1b): SO INPUT VOLTAGE: \*\*\* POWER REQUIREMENT (Watts): 65 DISPLAY TYPE: LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 29, MEMBRANE ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL \*\*\*\*STATIONS TRACKED & HOW USED 1 GRI, ALL SECONDARIES \*\*\*\*NOTCH FILTERS 4 \*\*\*\*WICRO-PROCESSOR TYPE(S) 8085 \*\*\*\* MULTI-CHAIN CAPABILITY 80 \*\*\*\*CERTIFICATIONS NONE . \*\*\*\*DYNAMIC RANGE STEP AGC \*\*\*\*WAX. GDOP FOR LAT-LONG NO LIMIT \*\*\*\*NOISE BANDWIDTH 20 kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 5 uV \*\*\*\*SHR FOR ACQUISITION -20 dB \*\*\*\*SNR FOR POSITION DISPLAY -18 48 \*\*\*\*SHR FOR TRACE (MIN) -20 dB \*\*\*\*\*N1 NON-VOLATILE MEMORY ON TO DEST. AND CORR.

DATE 02/10/84 LORAN-C RECEIVER NANUFACTURERS EPSCO MARINE C-NAV XL HODEL # 411 PROVIDENCE HWY, WESTWORD MA. 02090 PHONE 617-329-1500 ANVERTISED PRICE (USD): 2995.00 11/00/85 LIST PRICE (USD): DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(isches): 4.25 W(inches): 10.5 D(inches): 12.7 VOLUME(cu.in.): 566 TEMP RANGE (deg P): +32-+120 WEIGHT (15): 7 POWER REQUIREMENT (Watts): 25 INPUT VOLTAGE: 10-40 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 0 +2 +12 ANTENNA HEIGHT (inches): 96 \*\*\*\* ASF CORRECTION TECHNIQUE KEYBAORD ENTRY \*\*\*\*NOTCH FILTERS FOUR, 30 dB FILTERS \*\*\*\*MICRO-PROCESSOR TYPE(S) RORS \*\*\*\* STATIONS TRACKED & HOW USED ALL WITHIN SELECTED CHAIN. AUTO SELECT 2 STRONGEST SECONDARIES. OPERATOR OVERRIDE \*\*\*\*MULTI-CHAIN CAPABILITY ALL CHAINS OPERATIONAL (NO CROSS-CHAIN) \*\*\*\*CERTIFICATIONS NORWEGIAN MARITIME DIRECTORATE \$51357-\$1 \*\*\*\*DYNAMIC RANGE SOME PLUS 2048 STEP ATTENUATION FOR STRONG CHAIN \*\*\*\*MAX. GDOP FOR LAT-LONG NO LIMIT \*\*\*\* NOISE BANDWIDTH 20 kHz, 343 \*\*\*\*SENSITIVITY ( u VOLTS) S uV \*\*\*\*SWR FOR ACQUISITION - 20dB \*\*\*\*SWR FOR TRACK (MIN) GREATER THAN -20 db \*\*\*\*SWR FOR POSITION DISPLAY APPROXIMATELY -18dB SNR LAMP WILL ILLUMINATE

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DATE 02/10/84

MODEL / C-NAV SX EPSCO MARINE 411 PROVIDENCE HWY, WESTWOOD NA. 02090 PIIONE 617-329-1500 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 4.25 W(inches): 10.5 VOLUME(cu.in.): 566 D(inches): 12.7 WEIGHT (1b): 7 TEMP RANGE (deg F): +32-+120 INPUT VOLTAGE: 10-16 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 10 ANTENNA HEIGHT (inches): 96 \*\*\*\* ASF CORRECTION TECHNIQUE KEYBOARD ENTRY \*\*\*\*NOTCH FILTERS FOUR, 30dB FILTERS \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\* STATIONS TRACKED & HOW USED ALL WITHIN SELECTED CHAIN \*\*\*\*WULTI-CHAIN CAPABILITY ALL CHAINS OPERATIONAL (NO CROSS CHAIN) \*\*\*\*CERTIFICATIONS NORWEGIAN MARITIME DIRECTORATE \$51357-81 \*\*\*\*DYNAMIC RANGE SOAD PLUS 204B STEP ATTENUATION FOR STRONG CHAIN \*\*\*\*MAX. GDOP FOR LAT-LONG NO LIMIT \*\*\*\*NOISE BANDWIDTH 20kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) SuV \*\*\*\*SWR FOR ACOUISITION - 20d3 \*\*\*\*SNR FOR TRACK (MIN) GREATER THAN -2048 \*\*\*\*SNR FOR POSITION DISPLAY APPROXIMATELY -18dB SNR LAMP WILL ILLUNINATE

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DATE 02/10/84

\* FOSTER AIRDATA SYSTEMS INC. 7020 HUNTLEY RD COLUMBUS OH 43229 MODEL # LNS 616 PHONE 614-888-9520 ADVERTISED PRICE (USD): LIST PRICE (USD): 12500.00 05/07/#3 DESIGNED FOR: A [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] P(inches) S.26 W(inches): 4.15 D(inches): 11.0 VOLUMB(cu.in.): 345 WEIGHT (1b): 9.25 TEMP RANGE (deg F): -67,+158 INPUT VOLTAGE: 18-32 POWER REQUIREMENT (Watts): 30 DISPLAY TYPE: LED 2-LOP 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 4 + 8 POS ROTARY ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE CALCULATED FROM VORTAC POSITION \*\*\*\*STATIONS TRACKED & HOW USED FIX BASED ON THREE. TRACKS ALL. \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*MICRO-PROCESSOR TYPE(S) \*\*\*\*CERTIFICATIONS \*\*\*\*DYNAMIC RANGE \*\*\*\*MAX. GDOP FOR LAT-LONG \*\*\*\*NOISE BANDWIDTH \*\*\*\*SENSITIVITY ( u VOLTS) \*\*\*\*SWR FOR ACQUISITION \*\*\*\*SHR FOR TRACK (MIN) \*\*\*\* SHR FOR POSITION DISPLAY \*\*\*\* NOTCH FILTERS

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FURUNO U.S.A., INC Pob 2343, 271 Harbor Way, S San Francisco ca 94080 NODEL # LC-70 PHONE 415 873-9393 LIST PRICE (USD): ADVERTISED PRICE (USD): 2795.00 10/29/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 5.1 W(inches): 9.9 D(inches): 11 YOLUME(cu.im.): 555 WEIGHT (15): 11 TEMP RANGE (deg F): 52,+122 INPUT VOLTAGE: 10-42 POWER REQUIREMENT (Watts): 35 DISPLAY TYPE: 2\_LOP LCD 0-9 ERY PAD? Y NUMBER AND TYPE OF DATA KEYS: 1 + 10 SEC FUNCT ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE NANUAL INPUT

\*\*\*\*NOTCH FILTERS 2 INTERNAL, 2 EXTERNAL

\*\*\*\*MICRO-PROCESSOR TYPE(S)

\*\*\*\* STATIONS TRACKED & HOW USED

\*\*\*\*WULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS

\*\*\*\*DYNAMIC RANGE 100 db

\*\*\*\*MAX. GDOP FOR LAT-LONG

\*\*\*\*NOISE BANDWIDTH

\*\*\*\*SENSITIVITY ( u VOLTS) >1uV/M

\*\*\*\*SNR FOR ACQUISITION

\*\*\*\*SHR FOR TRACK (MIN)

\*\*\*\* SNR FOR POSITION DISPLAY

\*\*\*\*\*N1

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AVAILABLE ONLY ON SPECIAL ORDER BASIS

\*\*\*\*\*N2

TRACE SPEED 40 KTS, WAYPOINTS, 32

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 FURUNO U.S.A., INC HODEL # LC-80 POB 2543, 271 HARBOR WAY, S SAN FRANCISCO CA 94080 PHONE 415 873-9393 LIST PRICE (USD): 1395.00 ADVERTISED PRICE (USD): DESIGNED FOR: N l(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther; H(inches): 4 W(inches): 10 D(inches): 11 VOLUME(cu.in.): 440 WEIGHT (1): 5 TENE RANGE (deg F): 32-+131 INPUT VOLTAGE: 10-42 POWER REQUIREMENT (Watts): 12 DISPLAY TYPE: 2\_LOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 17 ACTIVE KEYS ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL DELTA TDS \*\*\*\*NOTCH FILTERS MANUAL, TWO EXTERNAL, TWO INTERNAL, SØdB/NOTCH \*\*\*\*MICRO-PROCESSOR TYPE(S) JAPANESE \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS 5 SECONDARIES, MANUALLY SELECTED TD PAIRS \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS RTCH 12/78/D-100 \*\*\*\*DYNANIC RANGE 80d3 \*\*\*\*WAX. GDOP FOR LAT-LONG NO \*\*\*\*NOISE BANDWIDTH T10 \*\*\*\*SENSITIVITY ( . VOLTS) 10V/METER \*\*\*\*SHR FOR ACQUISITION "ABOUT 39" \*\*\*\*SHR FOR TRACK (MIN) "ABOUT 20" LOSE TK, 0-100 WARNING ON DISPLAY \*\*\*\*SNR FOR POSITION DISPLAY HANGS ON AS LONG AS TX \*\*\*\*\*N1 CONTINUES TO DISPLAY BUT WITH WARNING, AND CONTINUES TO OUTPUT TO PLOTTER/COMPUTER INTERFACE, BUT WARNS OF BAD DATA \*\*\*\*\*N2 TRACK SPEED 40 KTS, WAYPOINTS, 10

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DATE 02/10/84

FURUNO U.S.A., INC POB 2343, 271 HARBOR WAY, S SAN FRANCISCO CA 94080 MONUL A LC-200 PHONE 415 873-9393 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] Milnemesj. 4.25 W(IRCRes/: 13 D(inches): 13.3 VOLUME(cu.in.): 734 WEIGHT (1b): 12 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 20 INPUT VOLTAGE: 10-48 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD? N MUMBER AND TYPE OF DATA KEYS: 7 ROTARY SW'S + TOGG ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED \*\*\*\*NOTCH FILTERS 4 , TWO EXTERNAL, TWO INTERNAL \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED TRACKS ALL STATIONS, 2 LOP MANUALLY SELECTED \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS MEETS U.S.COAST GUARD SPECIFICATIONS FOR VESSELS OF 1600GT AND ABOVE \*\*\*\*DYNANIC RANGE UNKNOWN \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 24kHZ, 3dB (TRACKING) \*\*\*\*SENSITIVITY ( u VOLTS) UNKNOWN \*\*\*\*SNR FOR ACQUISITION UNKNOWN \*\*\*\*SHR FOR TRACK (NIN) UNKNOWN

UNKNOWN

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NOT CURRENTLY IN PRODUCTION

DATE 02/10/84

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II MORROW INC 2777 19th S.E. POB 13549, SALEM OREGON 97309 APOLLO I HODEL # PHONE 503-581-8101 ADVERTISED PRICE (USD): 1595.00 11/10/83 LIST PRICE (USD): 2495.00 05/07/83 DESIGNED FOR: % [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUME(cu.in.): 388 H(inches): 3.75 W(inches): 8.85 D(iaches): 11.7 TEN RANGE (deg F): -4,+158 WEIGHT (15): 3.5 INPUT VOLTAGE: 6.5-48 POWER REQUIREMENT (Watts): 8-12 0-9 KEY PAD? N DISPLAY TYPE: LED LAT/LONG OR 2LOP MUNBER AND TYPE OF DATA REYS: & PUSHETN, 1 ROTARY ANTENNA HEIGHT (inches): 21 \*\*\*\*ASF CORRECTION TECHNIQUE NANUAL CALIBRATION OF LAT/LONG \*\*\*\*NOTCH FILTERS 8 PRESET \*\*\*\* STATIONS TRACKED & HOW USED All Secondaries Tracked, User Defines Triad for Navigation \*\*\*\*MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS **TSO** \*\*\*\*DYNANIC RANGE 120d3 \*\*\*\*MAX. GDOP FOR LAT-LONG WARNING LIGHT, BAD BCDS \*\*\*\*NOISE BANDWIDTH Z3kHz AT RECEIVER OUTPUT, 13 AT -3, 25 OR LESS AT -40 SENSITIVITY ( & VOLTS) 1wV (ATMOSPHERIC MOISE LIMITED) \*\*\*\*SIR FOR ACQUISITION -124B \*\*\*\*SHR FOR TRACK (MIN) >-2048 AND CONTINUE TO GIVE POSITION \*\*\*\*SHR FOR POSITION DISPLAY WARNING LIGHT -104B

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HODEL # AVENGER 511 II NORROW INC 2777 19th S.E. POB 13549, SALEN OREGON 97309 PHONE 503-581-8101 LIST PRICE (USD): ADVERTISED PRICE (USD): 1095.00 11/10/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(INCAGS): 8.85 V(incaes). if.7 H(inches): 3./5 VOLUME(cu.in.): 388 WEIGHT (1b): 6.5 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 6.5-48 POWER REQUIREMENT (WAtts): 9 DISPLAY TYPE: 2-LOP LCD 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 9 PUSH BUTTON ANTENNA HEIGHT (inches): 96 \*\*\*\*CERTIFICATIONS NONE \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*DYNAMIC RANGE 110 dB \*\*\*\*NICRO-PROCESSOR TYPE(S) 8085 \*\*\*\*NAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 23kHz AT RECEIVER OUTPUT SENSITIVITY ( & VOLTS) 1 V (ATHOSPHERIC NOISE LIMITED) \*\*\*\*SHR FOR ACQUISITION -10 DB \*\*\*\* SHR FOR TRACE (HIN) -30dB \*\*\*\*STATIONS TRACKED & NOW USED All Secondaries tracked, user defines triad for navigation \*\*\*\*SIR FOR POSITION DISPLAY -30dB \*\*\*\*NOTCH FILTERS I PRESET \*\*\*\*WULTI-CHAIN CAPABILITY 100

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 II MORROW INC 2777 19th S.E. POB 13549, SALEM OREGON 97309 HODEL # AVENGER 5018 PHONE 503-581-8101 ADVERTISED PRICE (USD): 1095.00 11/10/83 LIST PRICE (USD): DESIGNED FOR: N [(N)ariae, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 8.85 Bfincherlt 11 7 . . Witing(en in ): 198 H(inches): 3.75 WEIGHT (16): 6.5 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 6.5-48 POWER REQUIREMENT (Watts): 12-15 DISPLAY TYPE: 2\_LOP LED 0-9 KRY PAD? M MUNBER AND TYPE OF DATA REYS: 5-THUNE, + 8-PUSHBUT ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*DYNANIC RANGE 11043 \*\*\*\*SHR POR ACQUISITION -1643 \*\*\*\*SHE FOR TRACK (MIN) -3848 \*\*\*\*HOISE MANNIDTH 23bits AT RECEIVER OUTPUT \*\*\*\*WOTCH FILTERS A PRESET \*\*\*\*HICRO-PROCESSOR TYPE(S) 8085 \*\*\*\*CERTIFICATIONS HONE \*\*\*\* SUMSITIVITY ( w VOLTS) 1w7 (ATMOSPHERIC MOISE LIMITED) ALL SECONDARIES TRACKED, USER DEFINES LOP FOR DISPLAY \*\*\*\* WELTI-CHAIN CAPABILITY 100 \*\*\*\*MAX. GDOP POR LAT-LONG N/A \*\*\*\*SHR FOR POSITION DISPLAY -JOdB

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II MORROW INC 2777 19th S.E. POB 13549, SALEN OREGON 97309 HODEL # AVENGER 512 PHONE 503-581-8101 LIST PRICE (USD): 1795.00 12/01/82 ADVERTISED PRICE (USD) - 1205.00 11/10/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther} D(inches). 11.7 VOLUMB(cu.in.): 388 H(Inches): 3.75 - P(ischis): 0.05 WEIGHT (1b): 6.5 **TEMP RANGE (deg F): 32,+122** INPUT VOLTAGE: 6.5-48 POWER REQUIREMENT (Watts): 11 DISPLAY TYPE: 2-LOP LCD 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 9 PUSH BUTTON ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL ENTRY \*\*\*\*NOTCH FILTERS 8 PRESET \*\*\*\*WICRO-PROCESSOR TYPE(S) TWO, 8085 \*\*\*\*STATIONS TRACKED & NOW USED ALL SECONDARIES TRACKED, USER DEFINES TRIAD FOR NAVIGATION \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS NONE \*\*\*\*DYNAMIC RANGE 110dB \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 23kHs AT RECEIVER OUTPUT \*\*\*\*SENSITIVITY ( u VOLTS) 1uV (ATMOSPHERIC NOISE LIMITED) \*\*\*\*SHR FOR ACQUISITION -10d3 \*\*\*\*SHR FOR TRACK (MIN) - 30d3

\*\*\*\*SNR FOR POSITION DISPLAY -30dB

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 II NORROW INC-2777 19th S.E. POB 13549, SALEN OREGON 97309 AVENGER SOZER HODEL # PHONE 503-581-8101 ADVERTISED PRICE (USD): 1295.00 11/10/83 LIST PRICE (USD): 1695.00 05/07/83 DESIGNED FOR: M [(M)arino. (A)ircraft. (S)urvey/monitor. (T)iming. (L)and. (O)ther] Hinnharls 3 75 W(inches): 8.85 D(Inches): 11.7 VOLUMb(cu.im.): 388 WEIGHT (1b): 6.5 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 12-15 INPUT VOLTAGE: 6.5-48 DISPLAY TYPE: 2\_LOP LED 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: S-THUNG, + S-PUSHBUT ANTENNA HEIGHT (inches): 96 \*\*\*\*ASP CORRECTION TECHNIQUE NAMUAL ENTRY \*\*\*\*NOTCH FILTERS 8 PRESET \*\*\*\*WICRO-PROCESSOR TYPE(S) THO, 8085 \*\*\*\*STATIONS TRACKED & NOW USED ALL SECONDARIES TRACKED, USER DEFINES TRIAD FOR NAVIGATION \*\*\*\* WILTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS NONE \*\*\*\*DYNAMIC RANGE 11043 \*\*\*\*MAX. GDOP POR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 23bHs AT RECEIVER OUTPUT \*\*\*\*SENSITIVITY ( = VOLTS) 1 uV (ATMOSPHERIC NOISE LIMITED) \*\*\*\*SWR POR ACQUISITION -1043 \*\*\*\*SHR FOR TRACK (MIN) -30dB \*\*\*\*SWR FOR POSITION DISPLAY -30dB

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DATE 02/10/84

INTERNATIONAL AVIONICS, INC. 6668 CUMMINGS PARE MORBURN MA 01801 MODEL / LC 300 617-935-3000 PHONE ADVERTISED PRICE (USD): 1895.00 10/28/83 LIST PRICE (USD): 1895.00 05/07/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(isches): 3.75 W(inches): 12 D(inches): 11 VOLUME(cu.in.): 495 TEMP RANGE (deg P): WEIGHT (1b): 10 INPUT VOLTAGE: 8-40 POWER REQUIREMENT (Watts): 20 DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? Y ANTENNA HEIGHT (inches): 96 NUMBER AND TYPE OF DATA KEYS: 6 KEY + 8 POS ROTARY \*\*\*\*ASF CORRECTION TECHNIQUE Manually Entered from Keyboard, delta 1D or known lat-long \*\*\*\*NOTCH FILTERS FOUR INTERNAL, OPTIONAL EXTERNAL AVAILABLE \*\*\*\*MICRO-PROCESSOR TYPE(S) TWO 8085 \*\*\*\*STATIONS TRACKED & HOW USED All Tracked, two lop manually selected \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS DOT CANADA \*\*\*\*DYNAMIC RANGE 95dB \*\*\*\*MAX. GDOP FOR LAT-LONG NOT CONSTRAINED \*\*\*\*NOISE BANDWIDTH 19kHz 34B , 40dB, 25kHz \*\*\*\*SENSITIVITY ( u VOLTS) 1uV/METER \*\*\*\*SHR FOR ACQUISITION -10d3 \*\*\*\*SHR FOR TRACK (MIN) -20 d3 \*\*\*\*SHR FOR POSITION DISPLAY -20 dB \*\*\*\*\*N1 OPTIONAL ANTISTATIC ANTENNA \*\*\*\*N2 OPTIONAL SEARCH PATTERNS FOR SAR

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DATE 02/10/84

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INTERNATIONAL AVIONICS, INC. 6668 CUMMINGS PARK WORBURN MA 01801 MODEL # LC 403 PHONE 617-935-3000 ADVERTISED PRICE (USD): 2800.00 10/28/83 LIST PRICE (USD): DESIGNED FOR: MT [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): VOLUME(cu.in.): H(inches): 2PCB D(inches): WEIGHT (1b): TEMP RANGE (deg F): 32,+140 INPUT VOLTAGE: 5 POWER REQUIREMENT (Watts): 8 0-9 KEY PAD? N DISPLAY TYPE: NONE NUMBER AND TYPE OF DATA KEYS: NONE RS-232 ONLY ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE TD ONLY \*\*\*\*NOTCH FILTERS TWO PRESET INTERNAL NOTCHES, TWO OPERATOR TUNEABLE NOTCHES OPTIONAL \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\*STATIONS TRACKED & HOW USED MASTER AND FOUR SECONDARIES, FOUR LOP PROVIDED \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS RTCH-MPS \*\*\*\*DYNAMIC RANGE 110d3 \*\*\*\* MAX. GDOP POR LAT-LONG N/A \*\*\*\* NOISE BANDWIDTH 241Hz, 34B 28kHz, 40dB \*\*\*\*SENSITIVITY ( u VOLTS) 1048 ABOVE 1uV/METER \*\*\*\*SHR POR ACQUISITION -1243 \*\*\*\*SHR POR TRACE (HIN) -20dB \*\*\*\*SHR FOR POSITION DISPLAY N/A \*\*\*\*\*N1 BARE BOARDS - CONN. INTERFACE REMOTELY CONTROLLABLE

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DATE 02/10/84

INTERNATIONAL AVIONICS, INC. 6668 CUMMINGS PARK WORBURN MA 01801 LC 404 MODEL # PHONE 617-935-3000 ADVERTISED PRICE (USD): 7000.00 10/28/83 LIST PRICE (USD): 10650.00 DESIGNED FOR: MT [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] D(inches): 13.2 VOLUME(cu.in.): 948 W(inches): 12.6 H(inches): 5.7 WBIGHT (1b): 17 TEMP RANGE (deg F): 32,+140 INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 4 ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE NO CORRECTION \*\*\*\*NOTCH FILTERS TWO PRESET INTERNAL, TWO OPERATOR TUNEABLE OPTIONAL \*\*\*\*MICRO-PROCESSOR TYPE(S) 2025 \*\*\*\* STATIONS TRACKED & HOW USED MASTER PLUS FOUR SECONDARIES, FOUR LOP PROVIDED \*\*\*\*WULTI-CHAIN CAPABILITY 10 \*\*\*\*CERTIFICATIONS RTCH-MPS \*\*\*\*DYNAMIC RANGE 110dB \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 28kHZ 40dB \*\*\*\*SENSITIVITY ( u VOLTS) 10de Above 1uV \*\*\*\*SWR POR ACQUISITION -15dB \*\*\*\*SHR FOR TRACE (MIN) - 20dB \*\*\*\*SWR FOR POSITION DISPLAY -20dB \*\*\*\*\*N1 HI ACCURACY. 10RMS, REMOTELY CONTROLLABLE

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 INTERNATIONAL AVIONICS, INC. 6668 CUBMINGS PARK WORBURN MA 01801 NODEL # LC 408 PIIONE 617-935-3000 ADVERTISED PRICE (USD): 13200.00 05/07/83 LIST PRICE (USD): DESIGNED FOR: NT [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] D(inches): 17 VOLUNCE(cu.in.): 1696 H(inches): 5.25 W(inches): 19 WEIGHT (15): 30 TEMP RANGE (deg F): 32-140 POWER REQUIREMENT (Watts): 25 INPUT VOLTAGE: \*\*\* DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6, 3 POS ROTARY SW ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE N/A \*\*\*\*NOTCH FILTERS FOUR INTERNAL, PRESET \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\* STATIONS TRACKED & HOW USED NSTR & 4 SEC. TRACKED FOR EACH CHAIN.COMPUTATION FROM TWO SELECTED LOP'S. TWO CHAINS, SIMULTANBOUS \*\*\*\*CERTIFICATIONS RTCH MPS \*\*\*\*DYNAMIC RANGE 110dB \*\*\*\* MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 28 kHz 40dB \*\*\*\*SENSITIVITY ( u VOLTS) 10dB ABOVE 1uV/METER \*\*\*\*SWR FOR ACQUISITION -12d3 \*\*\*\*SMR FOR TRACK (MIN) - 20dB \*\*\*\*SWR FOR POSITION DISPLAY - 20dB \*\*\*\*<sub>N1</sub> INPUT VOLTAGE 10-40 V/120VAC

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 NODEL # LC 360 INTERNATIONAL AVIONICS, INC. 6668 CUMMINGS PARK WORBURN MA 01801 PHONE · 617-935-3000 LIST PRICE (USD): 2995.00 05/00/83 ADVERTISED PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 5.06 W(inches): 12.4 D(inches): 11 VOLUME(cu.in.): 690 WEIGHT (16): 10 TEMP RANGE (deg F): INPUT VOLTAGE: 12 POWER REQUIREMENT (Watts): 30 DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6 KEY + 8 POS ROTARY ANTENNA HEIGHT (inches): 96 ASF CORRECTION TECHNIQUE MANUALLY ENTERED + ENOWN LAT/LONG \*\*\*\*NOTCH FILTERS FOUR INTERNAL; OPTIONAL, FOUR EXTERNAL \*\*\*\*MICRO-PROCESSOR TYPE(S) TWO 8085 ALL TRACKED & HOW USED ALL TRACKED, TWO LOP MANUALLY SELECTED \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS RTCH-MPS \*\*\*\*DYNAMIC RANGE 105d# \*\*\*\*MAX. GDOP FOR LAT-LONG NONE \*\*\*\*NOISE BANDWIDTH 19kHz 3dB, 40dB 25kHz \*\*\*\*SENSITIVITY ( u VOLTS) INV/METER FOR TRACK \*\*\*\*SMR FOR ACQUISITION -10d3 \*\*\*\*SHR FOR TRACK (HIN) - 20dB \*\*\*\*SHR FOR POSITION DISPLAY -20 dBN \*\*\*\*\*W1 WAYPOINTS, 40 TRACK SPEED 40 KTS

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 INTERNATIONAL AVIONICS, INC. 6668 CUMMINGS PARE WORBURN NA 01801 LC 720 MODEL # PHONE 617-935-3000 LIST PRICE (USD): 3995.00 05/07/83 ADVERTISED PRICE (USD): 3995.00 05/07/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): 5.06 W(inches): 12.4 D(inches): 11.1 VOLUME(cu.in.): 696 WEIGHT (1b): 15 TEMP RANGE (deg F): INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 25 DISPLAY TYPE: 2 LOP LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6, 8 POS ROTARY SW ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED \*\*\*\*NOTCH FILTERS EXTERNAL NOTCH FILTERS OPTIONAL \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\*STATIONS TRACKED & HOW USED MSTR & 4 SEC. FROM EACH CHAIN. POSITION FROM 2 SELECTED LOPS. \*\*\*\*MULTI-CHAIN CAPABILITY TWO CHAINS, SIMULTANEOUS \*\*\*\*CERTIFICATIONS UNKNOWN \*\*\*\*DYNAMIC RANGE 95dB \*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) 1uV/METER \*\*\*\*SHR FOR ACQUISITION UNKNOWN \*\*\*\*SHR FOR TRACK (MIN) -2043 \*\*\*\*SWR FOR POSITION DISPLAY UNKNOWN \*\*\*\*\*\*\* SAME AS LC360 BUT 2 CHAIN (4 LOPS ON EACH CHAIN) WITH CROSS-CHAIN CAPABILITY

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 INTERNATIONAL AVIONICS, INC. 6668 CUDMINGS PARK WORBURN MA 01801 HODEL # LC 1200 PHONE 617-935-3000 ADVERTISED PRICE (USD): 14000.00 10/28/83 LIST PRICE (USD): DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 3.75 D(inches): 12.8 VOLUNE(cu.is.): 375 H(inches): 7.85 WEIGHT (16): 5.5 TEMP RANGE (deg F): -67,+122 INPUT VOLTAGE: 8-40 POWER REQUIREMENT (Watts): 25 0-9 KEY PAD? DISPLAY TYPE: ALPHA-NUMERIC VAC. FLESCH Y MANBER AND TYPE OF DATA KEYS: 16+FNCTNS, ROTARY SH ANTENNA HEIGHT (inches): 6.25 sss#\*N1 DISPLAY UNIT 4.5(H), 6.75(W), 6.375(D). WEIGHT 3.3 LDS., ANTENNA 1.6 LBS \*\*\*\* ASF CORRECTION TECHNIQUE NANUALLY ENTERED FROM KEYBOARD, BELTA TO OR KNOWN LAT-LONG \*\*\*\*NOTCH FILTERS 2 PRESET 2 AUTOMATIC \*\*\*\*MICRO-PROCESSOR TYPE(S) TWO 8085 \*\*\*\*STATIONS TRACKED & HOW USED NASTER AND 4 SECONDARIES ON EACH SELECTED CHAIN. NASTER AND SECONDARY For Selected Lop Must be in Same Chain. Tho Manual \*\*\*\*MULTI-CHAIN CAPABILITY TWO CHAINS, SIMULTANEOUS \*\*\*\*CERTIFICATIONS WILL APPLY FOR TSO \*\*\*\* BYNANIC RANGE 95dB \*\*\*\*NAX. GDOP FOR LAT-LONG NO WARNING \*\*\*\*NOISE BANDWIDTH 1914: 348 4048 25 bHs \*\*\*\*SENSITIVITY ( u VOLTS) 1uV/METER \*\*\*\*SWR FOR ACQUISITION -104MW \*\*\*\*SHR FOR TRACK (MIN) - 2043 \*\*\*\* SWR FOR POSITION DISPLAY - 20d3

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DATE 02/10/84

INTERNATIONAL MARINE INSTRUMS 40 SIGNAL RD. STAMFORD CN 06902 MODEL # COMBI LORAN 860 PHONE 203-357-8455 LIST PRICE (USD): 2495.00 ADVERTISED PRICE (USD): 1996.10 05/07/83 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 3.62 . W(inches): 9.12 VOLUME(cu.in.): 363 D(inches): 11 WEIGHT (1b): 6 TEMP RANGE (deg F): 32+131 INPUT VOLTAGE: 11-45 POWER REQUIREMENT (Watts): 10 DISPLAY TYPE: 2-LOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 15 +10 SEC FUN ANTENNA HEIGHT (inches): 6.25 \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED \*\*\*\*NOTCH FILTERS FOUR, FULLY-AUTOMATIC COMPUTER TUNED PLUS TWO OPTIONAL PRESET NOTCHES

\*\*\*\*NICRO-PROCESSOR TYPE(S) UNKNOWN

\*\*\*\*STATIONS TRACKED & HOW USED

\*\*\*\*MULTI-CHAIN CAPABILITY NO

\*\*\*\*CERTIFICATIONS PART 2 RTCH MININUM PERFORMANCE SPECIFICATION

DYNAMIC RANGE 110dB

\*\*\*\*NAX. GDOP POR LAT-LONG UNKNOWN

\*\*\*\*NOISE BANDWIDTH WIDE

\*\*\*\*SENSITIVITY ( u VOLTS) 1uV

SEESSING FOR ACQUISITION LESS THAN 2 MINUTES AT 0dB

\*\*\*\*SMR FOR TRACK (MIN) -20dB

\*\*\*\*SWR FOR POSITION DISPLAY UNKNOWN

DATE 02/10/84 LORAN-C RECEIVER MANUFACTURERS KING MARINE RADIO CORP 5320 140 AVE N CLEARWATER, FL 33520 MODEL # KING 8001 PHONE 813-530-3411 LIST PRICE (USD): ADVERTISED PRICE (USD): 12/00/83 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 3.5 W(inches): 6.5 D(inches): 4.5 VOLUNE(cu.in.): 102.4 WEIGHT (16): 1.5 TEMP RANGE (deg P): 32-158 INPUT VOLTAGE: 11-40 POWER REQUIREMENT (Watts): 10 DISPLAY TYPE: LCD, 4 LINES, 7 DIG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 25 KEY MEMBRANE ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE AREA TABLE OR MANUALLY ENTERED, USA COAST, NORTHERN PACIFIC, JAPAN, MEDITER., ALASKA \*\*\*\*STATIONS TRACKED & HOW USED MASTER + 4 SECONDARIES, MASTER INDEPENDENCE \*\*\*\*NOTCH FILTERS 2 FIXED, 4 AUTOMATIC \*\*\*\*MICRO-PROCESSOR TYPE(S) 2025 \*\*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS RTCH MPS, CANADIAN DOT, FCC \*\*\*\*DYNANIC RANGE 100 dB \*\*\*\*MAX. GDOP FOR LAT-LONG NOT LIMITED

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\*\*\*\*HOISE BANDWIDTH

26 kHz, 3dB

\*\*\*\*SENSITIVITY ( u VOLTS) 5 uVOLTS

\*\*\*\*SHR FOR ACQUISITION -10 dB

\*\*\*\*SHR FOR POSITION DISPLAY -15 dB

\*\*\*\*SNR FOR TRACK (MIN) -15 dž

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TO BE INTRODUCED SPRING OF 1984, WILL INCLUDE SAUDI CHAIN

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MANUFACTURER CLAIMS EASE OF OPERATION IS A MAJOR FEATURE

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 MODW1. # ACCUFIX 500 MEGAPULSE, INC. & PRESTON COURT : BEDFORD, NA 01730 PHONE 617-275-2010 LIST PRICE (USD): 12/00/82 ADVERTISED PRICE (USD): DESIGNED FOR: SN {(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther} H(inches): 5.7 W(inches): 12.6 D(inches): 13.2 VOLUME(cu.in.): 948 WEIGHT (1b): 17 TEMP RANGE (deg F): 32,+140 INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 20 DISPLAY TYPE: 2LOP, LED 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6 + EXPNDEL SEC FACT ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE NOME \*\*\*\*NOTCH FILTERS 2 INTERNAL, PLUS OPTIONAL EXTERNAL NOTCHES AS REQUIRED FOR PARTICULAR APPLICATION \*\*\*\*MICRO-PROCESSOR TYPE(S) 2025 \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS & SECONDARIES, 2LOP DISPLAYED, ALL AVAILABLE FROM REMOTE DATA PORT \*\*\*\*MULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS RTCH-MPS \*\*\*\*DYNAMIC RANGE 114dB \*\*\*\*MAX. GDOF FOR LAT-LONG N/A \*\*\*\*WOISE BANDWIDTH 23 kHz \*\*\*\*SEMSITIVITY ( u VOLTS) 3uV \*\*\*\*SHR FOR ACQUISITION -1548 ATHOSPHERIC \*\*\*\*SHR FOR TRACK (NIN) -234B ATHOSPHERIC LOSS OF SIGNAL WARNING AT -2048 ATMOSPHERIC \*\*\*\*N1 ALL DATA OUTPUT THEU RS-232 PORT. FULL DUPLEX CONTROL/MONITORING THEU SECOND RS-232 PORT. \*\*\*\*\*\*\*\* UNIT WILL ACCEPT AND APPLY DIFFERENTIAL CORRECTIONS TO ALL TO OUTPUTS. \*\*\*\*\*<sub>83</sub>

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RECEIVER ERROR SPECIFIED LESS THAN 25 NEED OVER A WIDE RANGE OF OPERATING CONDITIONS.

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LORAN-C RECEIVER MANUFACTURERS	DATE 02/10/84	
MODEL # NL-5000 PORTABLE M	ICROLOGIC	
	20801 DEARBORN, CHATSWORTH, CA. 91311	
•	PHONE 213-998-1216	
LIST PRICE (USD): 1895.00 01/01/83	ADVERTISED PRICE (USD): 1860.00 05/07/83	
<b>DESIGNED FOR: WA {(W)arine, (A)ircraft,</b>	(\$)urvey/monitor, (T)iming, {L)and, (0)ther}	
H(inches): 8.8 W(inches): 10 D(	inches): 4 VOLUME(cu.in.): 352	
WEIGHT (1b): 9.46 TEMP RANGE	(deg F): 23,+131	
INPUT VOLTAGE: 10-18 POWER REQUI	REMENT (Watts): 7-11	
DISPLAY TYPE: 2-LOP LCD	0-9 KBY PAD? Y	
NUMBER AND TYPE OF DATA KEYS: 10 +14 SEC	FUN ANTENNA HEIGHT (inches): 52	
STORE CORRECTION TECHNIQUE Stored Correction Points, Linear InterPolation		
****NOTCH FILTERS 6 FIXED		
****NICRO-PROCESSOR TYPE(S) INTEL 8085		
****STATIONS TRACKED & NOW USED MASTER LUS 5 SECONDARIES, 2 SECONDARIES FOR LAT-LONG, STRONGEST SECONDARY, Also Auto Selection of New Gri		
****MULTI-CHAIN CAPABILITY NG		
CERTIFICATIONS HEETS RTCH CRITERIA		
SASSBYRANIC RANGE 9043		
NO MAX. COMPUTERIZED MODEL		
ACCANDISE BANDWIDTH 20km2		
seessitivity ( = VOLTS) 1 = V/METER		
-1843		
-20dB		
-1848 FOR POSITION BISPLAY -1848 FOR WARNING		
***** <sub>N1</sub> 5000 IS MARINE, 5000A IS AI	RCRAPT, \$2595 2 COUPLERS, \$1695 2 OTHER COUPLERS.	

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DATE 02/10/84

MICROLOGIC ML-220 MODEL # 20801 DEARBORN, CHATSWORTH, CA. 91511 PHONE 213-998-1216 ADVERTISED PRICE (USD): 2495.00 02/15/82 LIST PRICE (USD): 2495.00 00/00/79 DESIGNED FOR: N [(N)arime, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUME(cu.in.): 759 D(inches): 11.5 H(inches): 5.5 W(inches): 12 TEMP RANGE (deg F): 23,+131 WEIGHT (1b): 11.5 POWER REQUIREMENT (Watts): 14 INPUT VOLTAGE: 10-18 0-9 KEY PAD? N DISPLAY TYPE: 2-LOP LED ANTENNA HEIGHT (inches): 52 NUMBER AND TYPE OF DATA KEYS: 3 SW, 5-10 POSITIONS \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*NOTCH FILTERS 2 MANUAL, S FIXED (2 IN ANTENNA COUPLER) \*\*\*\*MICRO-PROCESSOR TYPE(S) INTEL 8085 \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS & SECONDARIES, TO DISPLAY, DIRECT RANGE TO MASTER \*\*\*\*WULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS CANADIAN HOT/DOC \*\*\*\*DYNAMIC RANGE 90d3 \*\*\*\*MAX. GDOP FOR LAT-LONG NO \*\*\*\* NOISE BANDWIDTH 221Hz \*\*\*\*SENSITIVITY ( & VOLTS) 1uV/METER \*\*\*\*SHR FOR ACQUISITION -18d8 \*\*\*\*SHR FOR TRACK (HIN) -20dB \*\*\*\*SHR FOR POSITION DISPLAY N/A \*\*\*\*\*\*\*\* NOT CURRENTLY IN PRODUCTION

DATE 02/10/84 LORAN-C RECEIVER MANUFACTURERS MICROLOGIC HODEL # ML-320 20801 DEARBORN, CHATSWORTH, CA. 91311 PHONE 213-998-1216 LIST PRICE (USD): 3395.00 00/00/00 ADVERTISED PRICE (USD): 3995.00 11/00/83 DESIGNED FOR: M [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUME (cu.in.): 759 W(inches): D(inches): H(inches): TEMP RANGE (deg F): 23,+131 WEIGHT (1b): 9 INPUT VOLTAGE: 10-18 POWER REQUIREMENT (Watts): 18 0-9 KEY PADT Y DISPLAY TYPE: 2 LOP LED, LAT-LONG ANTENNA HEIGHT (inches): 52 NUMBER AND TYPE OF DATA KEYS: 1-10 PUSH BUTTON \*\*\*\*ASF CORRECTION TECHNIQUE NO MANUAL CALIBRATION \*\*\*\*NOTCH FILTERS 3 INTERNAL, 2 COUPLER, 2 MANUAL \*\*\*\*MICRO-PROCESSOR TYPE(S) INTEL 8085 \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS 5 SECONDARY, 2 SECONDARIES FOR LAT-LONG, 1 GRI \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS CANADIAN NOT/RTCH \*\*\*\*DYNAHIC RANGE 9043 \*\*\*\*WAX. GDOP FOR LAT-LONG NO HAX \*\*\*\*WOISE BANDWIDTH 22kHz \*\*\*\*SENSITIVITY ( u VOLTS) 1uV/METER \*\*\*\*SHR FOR ACQUISITION -1848 \*\*\*\*SMR FOR TRACK (MIN) - 20d2 \*\*\*\* SNR FOR POSITION DISPLAY -18dB POR WARNING \*\*\*\*\*W1 WAYPOINTS, 10 \*\*\*\*\*\*\* RS232 OUTPUT TO COMPUTER/PRINTER, USER SELECTED THROUGH KEYBOARD, SELECT BAUD LEVELS 300-9600

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LORAN-C RECEIVER MANUPACTURERS	DATE 02/10/84	
NODEL / NL-3000	MICROLOGIC 20801 DEARBORN,CHATSWORTH,CA. 91311	
	PHONE 213-998-1216	
LIST PRICE (USD): 1995.00 02/15/82	ADVERTISED PRICE (USD): 1695.00 05/07/83	
DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther]		
H(inches): 5.2 W(inches): 9.7	D(inches): 11.4 VOLUME(cu.in.): 575	
WEIGHT (1b): 9 TEMP RANGE (deg F): 23,+131		
INPUT VOLTAGE: 10-18 POWER REQUIREMENT (Watts): 20		
DISPLAY TYPE: 2-LOP LCD	0-9 KEY PAD? Y	
NUMBER AND TYPE OF DATA KEYS: 10 +14	SEC FUN ANTENNA HEIGHT (inches): 52	
****ASF CORRECTION TECHNIQUE STORED CORRECTION POINT ****NOTCH FILTERS 6 FIXED, 2 MANUAL, 2 IN	RS, LINEAR INTERPOLATION	
****MICRO-PROCESSOR TYPE(S) INTEL 8085		
	IES, 2 SECONDARIES FOR LAT-LONG, SINGLE GRI, MANGE GRI, IAW LOCATION	
essenulti-Chain Gapability No		
CANADIAN MOT/RTCM		
****DYNAMIC RANGE 9648		
NO MAX, BASELINE EXTENS	SION 20USEC	
****NOISE BANDWIDTH UNKNOWN		
AAAASENSITIVITY ( U VOLTS) 1 UV/METER		
****SNR FOR ACQUISITION -18dB		

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\*\*\*\*SHR FOR TRACK (HIN) -2048

\*\*\*\*SWR FOR POSITION DISPLAY -1848 FOR WARNING

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ACCESSORIES+ EXTERNAL ALARN (INTEGRAL), AUTOPILOT INTERFACE, PLOTTER, Full function remote unit

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DATE 02/10/84

HODEL # ML-4000 HICROLOGIC 20801 DEARBORN, CHATSWORTH, CA. 91311 PHONE 213-998-1216 LIST PRICE (USD): ADVERTISED PRICE (USD): 3495.00 05/07/83 DESIGNED FOR: A [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 3 W(inches): 6.25 D(inches): 12 VOLUME(cu.in.): 225 WEIGHT (1b): 5 TEMP RANGE (deg F): 5,+131 INPUT VOLTAGE: 10-16 POWER REQUIREMENT (Watts): 25 DISPLAY TYPE: 1-LOP INCANDESCENT 0-9 KEY PAD! Y MUMBER AND TYPE OF DATA REYS: 10 + 10 SEC FUN ANTENNA HEIGHT (inches): 19 \*\*\*\*ASF CORRECTION TECHNIQUE LAND/SEA \*\*\*\*STATIONS TRACKED & HOW USED TRACKS ALL MASTER DEPENDENT, AUTO GRI, AUTO SEC, TRACKS 5 SECONDARIES, OPERATOR SELECTED \*\*\*\*SNR FOR ACQUISITION -18dB SINULATOR \*\*\*\*SHR FOR TRACK (HIN) -24dB USCG DEFINITION \*\*\*\*MAX. GDOP FOR LAT-LONG NO SOLUTION WITHIN 200SEC OF EXTENDED BASE LINE \*\*\*\*NOTCH FILTERS 6 FIIBD \*\*\*\*NICRO-PROCESSOR TYPE(S) INTEL BOSS \*\*\*\* MULTI-CHAIN CAPABILITY MÖ \*\*\*\*CERTIFICATIONS FAA IN PROGRESS \*\*\*\*DYNAMIC RANGE 96d3 \*\*\*\* NOISE BANDWIDTH 20kHz \*\*\*\*SENSITIVITY ( u VOLTS) 1 UV/METER \*\*\*\*SHR FOR POSITION DISPLAY -16dB FOR WARNING \*\*\*\*\*\*\*\* INTERFACE WITH CDI

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DATE 02/10/84

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MICROLOGIC 20801 DEARBORN, CHATSWORTH, CA. 91311 HODEL ( ML-2000N PHONE 213-998-1216 LIST PRICE (USD): 1795.00 02/15/82 ADVERTISED PRICE (USD): 1395.00 11/00/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] W(inches): 8.8-D(inches): 12 VOLUME(cu.in.): 369 H(inches): 3.5 WEIGHT (15): 7 TEMP RANGE (deg F): 23,+131 POWER REQUIREMENT (Natts): 9 INPUT VOLTAGE: 10-18 DISPLAY TYPE: 1-LOP LCD 0-9 KEY PAD? Y ANTENNA HEIGHT (inches): 60 NUMBER AND TYPE OF DATA KEYS: 9 +14 SEC FUN \*\*\*\*ASF CORRECTION TECHNIQUE YES, MANUAL CALIBRATION \*\*\*\*NOTCH FILTERS 6 FIXED, 4 INTERNAL AND 2 IN COUPLER \*\*\*\*MICRO-PROCESSOR TYPE(S) INTEL 8085 ALL TRACKED & HOW USED ALL TRACKED, 2 SECONDARIES FOR LAT-LONG, SINGLE GRI, ALL SECONDARIES AVAILABLE, 2 TRACKED \*\*\*\*/WULTI-CHAIN CAPABILITY 10 \*\*\*\*CERTIFICATIONS CANADIAN NOT \*\*\*\*DYNAMIC RANCE 9043 \*\*\*\* MAX. GDOP POR LAT-LONG HO MAY \*\*\*\*HOISE BANDWIDTH 20 kHz \*\*\*\*SENSITIVITY ( u VOLTS) 18 \*\*\*\*SHR FOR ACQUISITION -1848 \*\*\*\*SHR FOR TRACK (MIN) - 26dB \*\*\*\*SHR FOR POSITION DISPLAY -1843 FOR WARNING \*\*\*\*\*N1 ACCESSORY ML-20 EXTERNAL NOTCHES (2) \*\*\*\*\*\*\* N-FULL NAVIGATOR, SYSTEM NOT CURRENTLY IN PRODUCTION

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DATE 02/10/84

MICROLOGIC HODEL # NL-2000R 20801 DEARBORN, CHATSWORTH, CA. 91311 PHONE 213-998-1216 ADVERTISED PRICE (USD): 1036.00 05/07/83 LIST PRICE (USD): 1295.00 02/15/82 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 3.5 W(inches): 8.8-D(inches): 12 VOLUME(cu.in.): 369 TEMP RANGE (deg F): 23,+131 WEIGHT (1b): 7 POWER REQUIREMENT (Watts): 9 INPUT VOLTAGE: 10-18 0-9 KEY PAD? DISPLAY TYPE: 1-LOP LCD Y NUNDER AND TYPE OF DATA KEYS: 9 +14 SEC FUN ANTENNA HEIGHT (inches): 52 \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*NOTCH FILTERS 6 FIXED \*\*\*\*NICRO-PROCESSOR TYPE(S) INTEL 2085 \*\*\*\*STATIONS TRACKED & HOW USED All, TD DISPLAY, 1 GRI, ALL SECONDARIES \*\*\*\*NULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS CANADIAN NOT \*\*\*\*DYNANIC RANGE 90dB \*\*\*\*MAX. GDOP FOR LAT-LONG X/A \*\*\*\*NOISE BANDWIDTH 20 kHz \*\*\*\*SENSITIVITY ( u VOLTS) 10 \*\*\*\*SIR FOR ACQUISITION -1643 \*\*\*\*SHR FOR TRACK (MIN) - 20dB \*\*\*\*SHR FOR POSITION DISPLAY -1848 FOR WARNING \*\*\*\*\*\*\*\* RECEIVER VERSION OF 2000N, NOT FULL FUNCTION NAVIGATOR, TO ONLY, HARDWARE GRI, NO WAYPOINTS

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 MICROLOGIC ML-4100 HODEL # 20801 DEARBORN. CHATSWORTH. CA. 91311 PHONE 213-998-1216 LIST PRICE (USD): ADVERTISED PRICE (USD): 4495.00 05/07/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): 6.7 W(inches): 3.7 D(inches): 11.9 VOLUNE(cu.in.): 359 WEIGHT (1b): 4.5 TEMP RANGE (deg F): 5,+131 ۰. INPUT VOLTAGE: 10-16 POWER REQUIREMENT (Watts): 25 DISPLAY TYPE: 1-LOP INCANDESCENT 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 10 + 10 SEC FUN ANTENNA HEIGHT (inches): 19 \*\*\*\* ASF CORRECTION TECHNIQUE PROB. SEA WATER, BUT YES AND MANUALLY CAL. \*\*\*\*STATIONS TRACKED & HOW USED TRACKS ALL MASTER DEPENDENT \*\*\*\*SHR ACQU -18 DE SIMULATOR \*\*\*\*SHR FOR TRACK (HIN) -24 DB USCG DEFINITION \*\*\*\*MAX. GDOP FOR LAT-LONG NO SOLUTION WITHIN 20 USEC OF EXTENDED BASE LINE \*\*\*\*WOTCH FILTERS 6 FIXED, INTERNAL \*\*\*\*MICRO-PROCESSOR TYPE(S) INTEL 8085 \*\*\*\*WULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS FAA IN PROGRESS \*\*\*\*DYNANIC RANGE 96d3 \*\*\*\*NOISE BANDWIDTH 20kHz \*\*\*\*SENSITIVITY ( & VOLTS) 1 uV/METER \*\*\*\*SHR FOR POSITION DISPLAY -16dB FOR WARNING

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SEPARATE CONTROL DISPLAY UNIT 5.8X3.8X2.9 (WHD), 1 POUND 5 OUNCES

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DATE 02/10/84

NICROLOGIC HODEL # ML-5000 BASIC 20801 DEARBORN, CHATSWORTH, CA. 91311 PHONE 213-998-1216 LIST PRICE (USD): 1495.00 01/01/83 ADVERTISED PRICE (USD): 1098.00 11/00/83 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 5.6 W(inches): 10 D(inches): 4 VOLUME(cu.in.): 224 WEIGHT (15): 7.04 TEMP RANGE (deg F): 23,+131 POWER REQUIREMENT (Watts): 7-11 INPUT VOLTAGE: 10-18 0-9 KEY PAD? DISPLAY TYPE: 2-LOP LCD Y ANTENNA HEIGHT (inches): 4 NUMBER AND TYPE OF DATA KEYS: 10 +14 SEC FUN \*\*\*\*ASF CORRECTION TECHNIQUE MAP OF NORTH AMERICAN COASTLINE LINEAR INTERPOLATION \*\*\*\*NOISE BANDWIDTH 24 KHZ \*\*\*\*STATIONS TRACKED & HOW USED TRACKS ALL 3 STATION SOLUTION \*\*\*\*NOTCH FILTERS 6 FIXED \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS NONE \*\*\*\*DYNAMIC RANGE 90dB \*\*\*\*MAX. GDOP FOR LAT-LONG NO MAX \*\*\*\*SENSITIVITY ( u VOLTS) 10 \*\*\*\*SWR FOR ACQUISITION -184B \*\*\*\*SHR FOR TRACK (MIN) -20dB \*\*\*\*SWR FOR POSITION DISPLAY -18db FOR WARNING \*\*\*\*WICRO-PROCESSOR TYPE(5) INTEL SOSS \*\*\*\*\*N1 NL-5000A HAS TIME CONSTANTS ADJUSTED FOR A/C USE - \$1,595. WITH P/A 4250 kt. ANT \$1,695 \*\*\*\*\*N2 WAYPOINTS, 59 TRACKING SPEED, 200KTS

A-45

# LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 HODEL # C-NASTER X MIECO, div of LSA SCIENTIFIC 109 BRAVER CT. COCKEYSVILLE MD 21030 PHONE 301 667-4660 LIST PRICE (USD): 2595.00 09/00/83 ADVERTISED PRICE (USD): 2595.00 09/00/83 DESIGNED FOR: M [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 11 W(inches): 9.1 H(inches): 3.7 VOLUME(cu.in.): 370 WEIGHT (1b): 6 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 10-45 POWER REQUIREMENT (Watts): 15 DISPLAY TYPE: 2-LOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 11 + 10 SEC. ON 0-9 ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL ENTRY OF DELTA TO OR LAT-LONG \*\*\*\*NOTCH FILTERS 4 AUTOMATIC \*\*\*\*MICRO-PROCESSOR TYPE(S) TWO, 6502 \*\*\*\*STATIONS TRACKED & HOW USED MASTER AND ALL SECONDARIES. ALL USABLE SIGNALS COMBINED IN WEIGHTED SOLUTION \*\*\*\* MULTI-CHAIN CAPABILITY AUTOMATIC HANDOPP TO BEST CHAIN FOR OPERATING AREA \*\*\*\*CERTIFICATIONS RTCH-MPS PART2 \*\*\*\*DYNAMIC RANGE 110dB \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) 107

\*\*\*\*SNR FOR ACQUISITION UNENOWN

\*\*\*\*SNR FOR TRACK (MIN) UNKNOWN

\*\*\*\*SHR FOR POSITION DISPLAY UNKNOWN

\*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN

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REMOTE CONTROL UNIT 5x10.5x4.5 (HWD) WEIGHT 5.5 1bs.ONE REQUIRED FOR COMPLETE RECEIVER.

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R\$232 COMMUNICATIONS BETWEEN RECEIVER CPU AND RENOTE CONTROL UNIT.

DATE 0./10/84

HODEL / C-HASTER IV

# MIECO, div of LSA SCIENTIFIC 109 BEAVER CT. COCKEYSVILLE ND 21030 PHONE 301 667-4660

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LIST PRICE (USD): 1695.00 11/01/82 ADVERTISED PRICE (USD): 1295.00 05/07/83 DESIGNED POR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther} H(inches): 5.5 W(inches): 9.12 D(inches): 11 VOLUME(cu.in.): 363 WEIGHT (1b): 6 TEDP RANGE (deg F): 32,+122 INPUT VOLTAGE: 11-45 POWER REQUIREMENT (Watts): 10 DISPLAY TYPE: 2\_LOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 11 + 10 SEC. ON 0-9 ANTENNA HEIGHT (inches):

\*\*\*\*ASF CORRECTION TECHNIQUE NAMUALLY ENTERED DELTA TD

ANOTCH FILTERS 4 AUTOMATIC

\*\*\*\*MICRO-PROCESSOR TYPE(S) 6502

\*\*\*\*STATIONS TRACKED & HOW USED All Tracked, 2 Selected for TD

NO

\*\*\*\*CERTIFICATIONS RTCH-MPS

\*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN

\*\*\*\*SENSITIVITY ( u VOLTS) 1uV

-10dB

\*\*\*\*SNR FOR TRACK (MIN) UNKNOWN

\*\*\*\* SHR FOR POSITION DISPLAY BLINKS AT PRESET SHR (UNKNOWN VALUE)

\*\*\*\*DYNANIC RANGE

\*\*\*\*NOISE BANDWIDTH WIDE

A-47

DATE 02/10/84

MIECO, div of LSA SCIENTIFIC 109 BRAVER CT. COCKEYSVILLE MD 21030 NODEL # C-MASTER V PHONE 301 667-4660 LIST PRICE (USD): ADVERTISED PRICE (USD):

DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches):

POWER REQUIREMENT (Watts):

H(inches):

TEMP RANGE (deg F):

WEIGHT (1b): INPUT VOLTAGE:

W(inches):

DISPLAY TYPE:

NUMBER AND TYPE OF DATA KEYS:

0-9 KEY PAD? ANTENNA HEIGHT (inches):

VOLUNE(cu.in.):

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\*\*\*\*ASF CORRECTION TECHNIQUE UNKNOWN

\*\*\*\*NOTCH FILTERS UNKNOWN

\*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN

\*\*\*\*STATIONS TRACKED & HOW USED UNKNOWN

\*\*\*\*MULTI-CHAIN CAPABILITY UNENOWN

\*\*\*\*CERTIFICATIONS UNKNOWN

\*\*\*\*DYNANIC RANGE UNKNOWN

\*\*\*\*WAX. GDOP FOR LAT-LONG UNKNOWN

\*\*\*\*NOISE BANDWIDTH UNKNOWN

\*\*\*\*SWR FOR ACQUISITION

\*\*\*\*SIR FOR TRACK (MIN) UNKNOWN

\*\*\*\*SHR FOR POSITION DISPLAY UNKNOWN

\*\*\*\*SENSITIVITY ( u VOLTS) UNKNOWN

\*\*\*\*\*\*\*\*\*

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DATE 02/10/84

MIECO, div of LSA SCIENTIFIC 109 BEAVER CT. COCKEYSVILLE ND 21030

HODEL / C-MASTER IV L/L

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# PHONE 301 667-4660

LIST PRICE (USD): 2095.00 11/01/82 ADVERTISED PRICE (USD): 1539.00 05/07/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 3.62 W(inches): 9.12 D(inches): 11 VOLUME(cu.in.): 363 WEIGHT (1b): 6 TEMP RANGE (deg F): 32,+122 INFUT VOLTAGE: 11-45 POWER REQUIREMENT (Watts): 10 DISPLAY TYPE: 2\_LOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 11 + 10 SEC. ON 0-9 ANTENNA HEIGHT (inches):

\*\*\*\*ASF CORRECTION TECHNIQUE NAMUALLY ENTERED, DELTA TO OR LAT-LONG

\*\*\*\*NOTCH FILTERS 4 AUTOMATIC

\*\*\*\*MICRO-PROCESSOR TYPE(S) 6502

\*\*\*\*STATIONS TRACKED & NOW USED ALL STATIONS TRACKED, 2 LOP USED FOR LAT-LONG

\*\*\*\*WULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS RTCH-MPS

\*\*\*\*DYNAMIC RANGE 110dB

\*\*\*\*NOISE BANDWIDTH WIDE

\*\*\*\*SENSITIVITY ( u VOLTS) 1uV

\*\*\*\*SHR FOR ACQUISITION -10dB

\*\*\*\*SNR FOR TRACK (MIN) UNKNOWN

\*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN

\*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN

A-49

DATE 02/10/84

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HODEL # MAVL-1 MOTOROLA, INC. 1301 B. ALGONQUIN RD. SCHAUMBURG, IL, 60196 PHONE 312-576-5955 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: L [(N)arine, (A)ircraft, (S)urvey/momitor, (T)iming, (L)and, (O)ther] H(inches): W(inches): VOLUNE(cu.in.): 280 D(inches): WEIGHT (1b): TEMP RANGE (deg F): -40,+185 INPUT VOLTAGE: 6-15 POWER REQUIREMENT (Watts): 12 DISPLAY TYPE: 600 BAUD DPSK MODEM 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: NONE ANTENNA HEIGHT (inches): 18

\*\*\*\*ASF CORRECTION TECHNIQUE

\*\*\*\*WOTCH FILTERS

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\*\*\*\*MICRO-PROCESSOR TYPE(S)

\*\*\*\*STATIONS TRACKED & HOW USED

\*\*\*\* MULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS

\*\*\*\*DYNANIC RANGE

\*\*\*\*MAX. GDOP FOR LAT-LONG

\*\*\*\*NOISE BANDWIDTH

\*\*\*\*SENSITIVITY ( u VOLTS)

\*\*\*\*SWR FOR ACQUISITION

\*\*\*\*SHR FOR TRACE (NIN)

\*\*\*\*SHR FOR POSITION DISPLAY

BATE 02/10/84 LOBAN-C RECEIVER MANUFACTURERS NAUTICAL ELECTRONICS CO., INC. 7095 Milford Industrial Rd., Baltinore, ND 20218 HODEL / AUTOFIX 911 PHONE 301-484-3284 LIST PRICE (USD): 1995.00 ADVERTISED PRICE (USD): 1775.00 05/07/83 DESIGNED FOR: N. [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] VOLUME(cu.in.): 466 W(inches): 10.1 D(inches): 11 H(inches): 4.2 WEIGHT (1b): TEMP RANGE (deg F): 10,+122 POWER REQUIREMENT (Watts): 7.5 INPUT VOLTAGE: 10.5-50 DISPLAY TYPE: 2-LOP 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 15 + SEC ON 9 ANTENNA HEIGHT (inches): 80 \*\*\*\*ASF CORRECTION TECHNIQUE 6 USER ENTERED CALIBRATION POINTS \*\*\*\*MOTCH FILTERS 2 PRESET, 2 OPERATOR CONTROLLED \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\* STATIONS TRACKED & NOW USED MASTER PLUS 5 SECONDARIES. LAT-LONG COMPUTED FROM TWO SELECTED TO \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS USCG MPS-TYPE 1 \*\*\*\*DYNAMIC RANGE UNKNOWN \*\*\*\*NAX. GDOP FOR LAT-LONG THE REAL PROPERTY. \*\*\*\*NOISE BANDWIDTH 24kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 247 \*\*\*\*SHR POR ACQUISITION -10d3 \*\*\*\*SHR POR TRACK (MIN) DISC MONTH \*\*\*\*SHR FOR POSITION DISPLAY 

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ER MANUFACTURERS DATE 02/10/84
AUTOFIX 921 NAUTICAL ELECTRONICS CO., INC. 7095 NILFORD INDUSTRIAL RD., BALTIMORE, MD 20218
PHONE 301-484-3284
D): ADVERTISED PRICE (USD): 2595.00 05/07/83
A [(M)arime, (A)ircraft, (S)urvey/momitor, (T)iming, (L)and, (D)ther}
W(inchen): 10.1 D(inches): 11 VOLUNE(cu.in.): 466
TEMP RANGE (deg F): 10,+122
10.5-50 POWER REQUIREMENT (Watts): 7.5
2-LOP 0-9 KEY PAD? Y
E OF DATA KEYS: 15 + SEC ON 9 ANTENNA HEIGHT (inches):
TION TECHNIQUE NERONN BRS NERONN
ESSOR TYPE(S) NKNOWN
RACKED & HOW USED NKNOWN
N CAPABILITY Nenown
IGNS NKNOWN
NGB NKNONN
POR LAT-LONG NKNOWN
MIDTH NENOWN
Y ( u VOLTS) Nenown
QUISITION NENOWN

\*\*\*\*SWR FOR TRACE (HIN) UNKNOWN

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\*\*\*\*SHR FOR POSITION DISPLAY UNKNOWN

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DATE 02/10/84

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NAUTICAL ELECTRONICS CO., INC. 7095 Milford Industrial RD., Baltimorr, MD 20218 MODEL # AUTOFIX 911-A PHONE 301-484-3284 LIST PRICE (USD): 1995.00 ADVERTISED PRICE (USD): 1995.00 05/07/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): 4.2 W(inches): 10.1 D(inches): 11 VOLUME(cu.in.): 466 WEIGHT (1b): TEMP RANGE (deg F): 10,+122 POWER REQUIREMENT (Watts): 7.5 INPUT VOLTAGE: 10.5-50 DISPLAY TYPE: 2-LOP 0-9 KEY PAD? Y MUNBER AND TYPE OF DATA KEYS: 15 + SEC ON 9 ANTENNA HEIGHT (inches): 80 \*\*\*\*ASF CORRECTION TECHNIQUE 6 USER ENTERED CALIBRATION POINTS \*\*\*\*NOTCH FILTERS 2 AUTOMATIC, 2 MANUAL \*\*\*\*WICRO-PROCESSOR TYPE(5) UNKNOWN \*\*\*\* STATIONS TRACKED & HOW USED NASTER PLUS 5 SECONDARIES. 2 LOP OPERATOR SELECTED FOR LAT-LONG \*\*\*\* MULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS UNKNOWN \*\*\*\*DYNANIC RANGE **INFERIOR** \*\*\*\*MAX. GDOP POR LAT-LONG **UNEXCOME** SASSHOISE BANEWIDTH 24kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 2u¥ \*\*\*\*SIR FOR ACQUISITION -1043 \*\*\*\*SHR FOR TRACK (HIN) UNKNOWN \*\*\*\*SWR FOR POSITION DISPLAY UNKNOWN \*\*\*\*\*\*\*\* THE 911A HAS BEEN HODIFIED FOR VFR AIRCRAFT OPERATION.

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DATE 02/10/84

NAUTICAL ELECTRONICS CO., INC. 7095 MILFORD INDUSTRIAL RD., BALTINORE, ND 20218 HODEL- # AUTOFIX 911 PHONE 301-484-3284 LIST PRICE (USD): 1995.00 ADVERTISED PRICE (USD): 1775.00 05/07/83 DESIGNED FOR: M [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 11 VOLUME(cu.in.): 466 H(inches): 4.2 W(inches): 10.1 WEIGHT (1b): TEMP RANGE (deg F): 10,+122 INPUT VOLTAGE: 10.5-50 POWER REQUIREMENT (Watts): 7.5 DISPLAY TYPE: 2-LOP 0-9 KEY PAD? Y ANTENNA HEIGHT (inches): 80 NUMBER AND TYPE OF DATA KEYS: 15 + SEC ON 9 \*\*\*\*ASF CORRECTION TECHNIQUE 6 USER ENTERED CALIBRATION POINTS \*\*\*\*NOTCH FILTERS 2 PRESET, 2 OPERATOR CONTROLLED \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS 5 SECONDARIES. LAT-LONG COMPUTED FROM TWO SELECTED TD \*\*\*\*MULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS USCG MPS-TYPE 1 \*\*\*\*DYNAMIC RANGE UNEXCHOUSE \*\*\*\*NAX. GDOP FOR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH 24kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 2u¥ \*\*\*\*SHR FOR ACQUISITION -Ì0**db** \*\*\*\*SHR FOR TRACK (MIN) UNKNOWN \*\*\*\*SWR FOR POSITION DISPLAY UNENOWN

MERICINEE DATE 01/10/14 1-700// MATIBUT COMMATING 11161 FIGHING YOUT BE REPORT REPORT AND A LINE 11161 FIGHING YOUT BE REPORT REPORT AND A LINE 11161 FIGHING YOUT BE REPORT REPORT AND A LINE 11161 FIGHING YOUT BE REPORT YOUT BE REPORT AND A LINE 11161 FIGHING YOUT BE REPORTED AND YOU WAS ADDREED AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU AND A LINE YOU YOU AND A LINE 11161 FIGHING YOU AND A LINE YOU AND LORAN-C RECEIVER MANUFACTURERS 852-7000/N MODEL # LIST PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 11.9 W(inches): 16.9 WEIGHT (15): 32 INPUT VOLTAGE: 10-40 DISPLAY TYPE: CRT 13 LINES x 32 CHAR NUMBER AND TYPE OF DATA KEYS: 13 2 WITH SEC. FUN \*\*\*\*ASF CORRECTION TECHNIQUE UNKNOWN \*\*\*\*NOTCH FILTERS 2 INTERNAL FACTORY PRESET, 2 ADJUSTABLE \*\*\*\*MICRO-PROCESSOR TYPE(S) Z-80 \*\*\*\* STATIONS TRACEED & HOW USED All Available Stations are used for Position Computation

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\*\*\*\*WULTI-CHAIN CAPABILITY UNKNOWN

\*\*\*\*CERTIFICATIONS UNKNOWN

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\*\*\*\*DYNANIC RANGE GREATER THAN 110dB

\*\*\*\*MAX. GDOP POR LAT-LONG TRUCKOWN

\*\*\*\*NOISE BANDWIDTH THE OWNER

\*\*\*\*SENSITIVITY ( u VOLTS) LESS THAN 1uV

\*\*\*\*SHR FOR ACQUISITION -2043

\*\*\*\*SHR FOR TRACK (HIN) - 28d3

\*\*\*\*SHR FOR POSITION DISPLAY - 20d3

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DATE 02/10/84

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NAVIDYNE CORPORATION 11824 FISHING POINT DR, NEWPORT NEWS, VA, 23606 MODEL # ESZ-7000 PHONE 804-874-4488 LIST PRICE (USD): ADVERTISED PRICE (USD): 2950.00 10/08/82 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 11.9 W(inches): 16.9 D(inches): 16.3 VOLUME(cu.in.): 3217 WEIGHT (16): 32 TEMP RANGE (deg F): 32.+122 INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 60 DISPLAY TYPE: CRT 13 LINES x 32 CHAR 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 13 2 WITH SEC. FUN ANTENNA HEIGHT (inches): 102 \*\*\*\*ASF CORRECTION TECHNIQUE \*\*\*\*NOTCH FILTERS \*\*\*\*MICRO-PROCESSOR TYPE(S) \*\*\*\*STATIONS TRACKED & HOW USED \*\*\*\*MULTI-CHAIN CAPABILITY \*\*\*\*CERTIFICATIONS \*\*\*\*DYNANIC RANGE \*\*\*\*NAX. GDOP FOR LAT-LONG \*\*\*\*NOISE BANDWIDTH \*\*\*\*SENSITIVITY ( & VOLTS) \*\*\*\*SHR POR ACQUISITION \*\*\*\*SHR POR TRACK (NIN)

\*\*\*\*SHR POR POSITION DISPLAY

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DATE 02/10/84

OFFSHORE NAVIGATION INC 5728 JEFFERSON HWY POB 23504, NEW ORLEANS, LA, 70183 HODEL # ONI 7000 PHONE 504-733-6790 ADVERTISED PRICE (USD): 20950.00 05/07/83 LIST PRICE (USD): 17900.00 06/00/82 DESIGNED POR: A [(N)arime, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 7.62 W(inches): 7.5 D(inches): 12.6 VOLUME(cu.in.): 887 WEIGHT (16): 18.1 TEMP RANGE (deg F): -76,+170 INPUT VOLTAGE: 18-32 POWER REQUIREMENT (Watts): 60 DISPLAY TYPE: FIBER OPTIC 0-9 KEY PAD? Y MUMBER AND TYPE OF DATA KEYS: 7 + 12 POS ROTARY ANTENNA HEIGHT (inches): 6.25 \*\*\*\*ASF CORRECTION TECHNIQUE FULLY AUTOMATIC WITH DYNAMIC STORED MODEL \*\*\*\*NOTCH FILTERS THREE AUTONATIC COMPUTER-CONTROLLED \*\*\*\*MICRO-PROCESSOR TYPE(S) TWO, 6809 \*\*\*\*STATIONS TRACKED & HOW USED UP TO 8 STATIONS IN UP TO 4 CHAINS SIMULTANEOUSLY, CROSS-RATE RECEIVER \*\*\*\*CERTIFICATIONS TSO, C-60A, STC FOR IFR \*\*\*\*DYNAMIC RANGE 127dB \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 35kHz, 3dB \*\*\*\*SENSITIVITY ( u VOLTS) 1048 ABOVE 1uV/METER \*\*\*\*SHR FOR ACQUISITION -124B FIRST STATION ON CHAIN, -184B FOR REMAINING STATIONS \*\*\*\*SHR FOR TRACK (MIN) -1843 \*\*\*\*SHR FOR POSITION DISPLAY

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DATE 02/10/84

MODEL # ADL 81 RACAL-DECCA AVIONICS INC. \$841 MONRAD DR. : SILVER SPRING, ND. 21208 PHONE 301-585-7460 00/00/75 LIST PRICE (USD): ADVERTISED PRICE (USD): 19000.00 09/06/83 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 12.6 VOLUME(cu.in.): 470 H(inches): 7.63 W(inches): 4.9 WEIGHT (1b): 15 TEMP RANGE (deg F): -67,+158 INPUT VOLTAGE: 115 POWER REQUIREMENT (Watts): 50 DISPLAY TYPE: INCANDESCENT 7-SEG, 2LOP 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: ROTARY SWITCHES ANTENNA HEIGHT (inches): NONE \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*NOTCH FILTERS 2 AUTOMATIC, OPTIONAL EXTERNAL AS REQUIRED \*\*\*\*MICRO-PROCESSOR TYPE(S) NONE \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS 3 SECONDARIES, THREE TO OUTPUTS PROVIDED \*\*\*\*HULTI-CHAIN CAPABILITY TWO CHAINS, ONE TO EACH CHAIN POSSIBLE \*\*\*\*CERTIFICATIONS NIL-E-5400 CLASS II, MIL-I-461A \*\*\*\*DYNANIC RANGE 120dB \*\*\*\*WAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 23kHz, 3dB IN TRACK; SkHz 3dB SBARCH \*\*\*\*SENSITIVITY ( & VOLTS) 100V/METER ASSUMING Scm ANTENNA \*\*\*\*SHR POR ACQUISITION -6dB \*\*\*\*SHR FOR TRACK (MIN) - 20d3 \*\*\*\*SHR FOR POSITION DISPLAY UNKNOWN \*\*\*\*\*\*\* ASSOCIATED CONTROL BOX 5.75WX4.5HX4.125D, 2.5 POUNDS

DATE 02/10/84 LORAN-C RECEIVER MANUFACTURERS RACAL-DECCA AVIONICS INC. 8841 MONRAD DR. : SILVER SPRING, MD. 21208 ADL 82 HODEL # PHONE 301-585-7460 00/00/80 ADVERTISED PRICE (USD): 21000.00 09/06/83 LIST PRICE (USD): DESIGNED FOR: A [(M)arime, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 12.6 VOLUNE(cu.in.): 470 H(inches): 7.63 W(inches): 4.9 TEMP RANGE (deg F): -57,+158 WEIGHT (1b): 15 INPUT VOLTAGE: 115 POWER REQUIREMENT (Watts): 50 DISPLAY TYPE: \*N1 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: \*N1 ANTENNA HEIGHT (inches): NONE \*\*\*\*ASF CORRECTION TECHNIQUE NONE \*\*\*\*NOTCH FILTERS 2 AUTOMATIC, OPTIONAL EXTERNAL AS REQUIRED \*\*\*\*MICRO-PROCESSOR TYPE(S) NONE \*\*\*\* STATIONS TRACKED 4 HOW USED MASTER PLUS 3 SECONDARIES, 3TD OUTPUTS PROVIDED \*\*\*\*MULTI-CHAIN CAPABILITY TWO CHAINS, ONE TD BACH \*\*\*\*CERTIFICATIONS MIL-E-5400 CLASS II, MIL-I-461A \*\*\*\*DYNAMIC RANGE 120dB, 100dB DIFFERENTIAL \*\*\*\* MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH 23kHz 3dB TRACK, 5kHz -3dB SEARCH \*\*\*\*SENSITIVITY ( u VOLTS) 10uV/METER ASSUMING 5 cm ANTENNA \*\*\*\*SWR FOR ACQUISITION -6d3 \*\*\*\*SHR FOR TRACK (MIN) - 20dB \*\*\*\*SHR FOR POSITION DISPLAY UNICHONN \*\*\*\*\*W1 OPERATES WITH ASSOCIATED FLIGHT MANG SYSTEM. OUTPUT VIA MIL-1553 INTERFACE.

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DATE 02/10/84

HODEL / RDI-XXX RADAR DEVICES INC. CALIFORNIA PHONE LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): W(inches): D(inches): VOLUME(cu.in.): WEIGHT (1b): TEMP RANGE (deg F): INPUT VOLTAGE: 11-16 POWER REQUIREMENT (Watts): 12 DISPLAY TYPE: 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 26 ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED \*\*\*\*STATIONS TRACKED & HOW USED MASTER + 4 SECONDARIES, AUTOMATIC SELECTION, MASTER INDEPENDENT \*\*\*\*NOTCH FILTERS 4 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\* MULTI-CHAIN CAPABILITY ю \*\*\*\*CERTIFICATIONS UNKNOWN \*\*\*\*DYNAMIC RANGE UNKNOWN \*\*\*\*MAX. GDOP FOR LAT-LONG NOT LINITED \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) UNKNOWN \*\*\*\*SWR FOR ACQUISITION -15dB \*\*\*\*SMR FOR POSITION DISPLAY -15dB \*\*\*\*SHR FOR TRACE (MIN) -20 dB \*\*\*\*\*N1 USED AS LORAN SENSOR IN INTEGRATED NAVIGATION SYSTEM

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 RAYTHEON MARINE COMPANY 676 Island Pond RD Manchester NH 03103 RAYNAY 7000 MODEL # 603 668 1600 PHONE ADVERTISED PRICE (USD): LIST PRICE (USD): 4990.00 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUNCE(cu.in.): 314 W(inches): 8.8 D(inches): 7.93 H(inches): 4.5 TEMP RANGE (deg F): WEIGHT (1b): 4 • POWER REQUIREMENT (Watts): 8 INPUT VOLTAGE: 10-40 0-9 KEY PAD? DISPLAY TYPE: 2xLOP LCD ANTENNA HEIGHT (inches): 96 NUMBER AND TYPE OF DATA KEYS: 14 \*\*\*\*ASF CORRECTION TECHNIQUE UNKNOWN \*\*\*\*NOTCH FILTERS 4 COMPUTER CONTROLLED \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED MASTER PLUS 5 SECONDARIES, COMPUTED FROM TWO LOP \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS UNKNOWN \*\*\*\*DYNANIC RANGE 110dB \*\*\*\*MAX. GDOP POR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SEMSITIVITY ( u VOLTS) 0.1uV \*\*\*\*SMR FOR ACQUISITION UNKNOWN \*\*\*\*SWR FOR TRACK (MIN) UNKNOWN

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\*\*\*\* SWR FOR POSITION DISPLAY UNKNOWN

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DATE 02/10/84

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RAYTHBON MARINE COMPANY 676 ISLAND POND RD MANCHESTER NH 03103 RAYNAY 750 MODEL # PHONE 603 668 1600 LIST PRICE (USD): 1895.00 ADVERTISED PRICE (USD): 1795.00 05/07/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] VOLUNE(cu.in.): 378 H(inches): 4.5 W(inches): 8.25 D(inches): 10.2 WEIGHT (1b): 8.9 TEMP RANGE (deg F): POWER REQUIREMENT (Watts): 13 INPUT VOLTAGE: 10-45 DISPLAY TYPE: 2xLOP LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6 + 5 SEC. 12 POS RO ANTENNA HEIGHT (inches): 108 \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED \*\*\*\*NOTCH FILTERS 6 AUTOMATICALLY ADJUSTED \*\*\*\*MICRO-PROCESSOR TYPE(S) \*\*\*\*STATIONS TRACKED & HOW USED NASTER PLUS 4 SECONDARIES, COMPUTES POSITION BASED ON TWO LOP \*\*\*\*WILTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS UNKNOWN \*\*\*\*DYNAMIC RANGE 110d3 \*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) 1uV \*\*\*\*SHR FOR ACQUISITION UNKNOWN \*\*\*\*SHR POR TRACK (MIN) UNKNOWN \*\*\*\*SNR FOR POSITION DISPLAY UNENOWN \*\*\*\*\*\*\*\* WAYPOINTS, 50 TRACK SPEED, 300 KTS

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 DATE 02/10/84

RAYTHEON MARINE COMPANY 676 ISLAND POND RD MANCHESTER NH 03103 HODEL / RAYNAV 6000 PHONE 603-688-1600 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/momitor, (T)ining, (L)and, (O)ther] H(inches): 11.5 W(inches): 19.7 D(inches): 11 VOLUNG(cu.in.): 2492 WEIGHT (1b): 25 TEMP RANGE (deg F): • • INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): 45 DISPLAY TYPE: 2-LOP 0-9 KEY PADT N MUMBER AND TYPE OF DATA KEYS: 4-ROTARY SW'S ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE UNKNOWN \*\*\*\*NOTCH FILTERS 2 MANUALLY ADJUSTED \*\*\*\*NICRO-PROCESSOR TYPE(S) . UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED MASTER LUS 5 SECONDARIES, TWO LOP \*\*\*\* MULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS UNENOWN

\*\*\*\*DYNANIC RANGE 110dB

\*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN

\*\*\*\*NOISE BANDWIDTH UNKNOWN

0.8uV

\*\*\*\*SWR FOR ACQUISITION UNKNOWN

\*\*\*\*SHR FOR TRACK (MIN) UNKNOWN

\*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN

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DATE 02/10/84

POB 6700, CLEARWATER FLA, 33518

NODEL # SI-TEX/KODEN 760

# PHONE \$13-535-4681

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LIST PRICE (USD): 1795.00 06/00/83 ADVERTISED PRICE (USD): 1795.00 06/00/83 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): W(inches): D(inches): VOLUNE(cu.in.): 199.6 WEIGHT (1b): 8 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 11-38 POWER REQUIREMENT (Watts): 6 DISPLAY TYPE: 2-LOP, LCD, LAT/LONG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6,+L',L/R FUNCT SCAN ANTENNA HEIGHT (inches):

SI-TEX

\*\*\*\*ASF CORRECTION TECHNIQUE TD AND LAT-LONG, CALINODE OR EQUIVALENT

\*\*\*\*NOTCH FILTERS 2 FIXED, THREE AUTOMATIC

\*\*\*\*SENSITIVITY ( u VOLTS) 1 uv/meter, being upgraded

\*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN

\*\*\*\*STATIONS TRACKED & HOW USED ALL STATIONS, TD & LAT-LONG/GC COURSE COMPUTER

\*\*\*\*MULTI-CHAIN CAPABILITY NO

\*\*\*\*CERTIFICATIONS FCC, CANADA D.O.C., RTCH MPS 70

\*\*\*\*DYNAMIC RANGE 105d3

\*\*\*\*MAX. GDOP FOR LAT-LONG NO

\*\*\*\*NOISE BANDWIDTH UNKNOWN

\*\*\*\*SNR FOR ACQUISITION UNKNOWN

\*\*\*\*SNR FOR TRACE (MIN) UNKNOWN

\*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN

DATE 02/10/84

HODEL # SI-TEX/KODEN 787 SI-TEX POB 6700, CLEARWATER FLA, 33518 PHONE 813-535-4681 LIST PRICE (USD): 1095.00 02/01/83 ADVERTISED PRICE (USD): 629.00 05/07/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 6.5 W(inches): 5.5 D(inches): 3 VOLUME(cu.in.): 107.3 WEIGHT (1b): 3 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 11-15 POWER REQUIREMENT (Watts): 6 DISPLAY TYPE: 2-LOP, LCD 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6,+2,L/R FUNCT SCAN ANTENNA HEIGHT (inches): N/A

\*\*\*\*ASF CORRECTION TECHNIQUE NONE

\*\*\*\*NOTCH FILTERS 2 FIXED, ONE OPTIONAL

\*\*\*\*SENSITIVITY ( u VOLTS) SuV/METER

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\*\*\*\*NICRO-PROCESSOR TYPE(S) UNKNOWN

\*\*\*\*STATIONS TRACKED & NOW USED MASTER PLUS 4 SECONDARIES, 2 TD DISPLAYED

\*\*\*\*/WULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS FCC, CANADA D.O.C.

\*\*\*\*NAX. COOP FOR LAT-LONG UNKNOWN

\*\*\*\*WOISE BANDWIDTH UNENOWN

UNKNOWN

\*\*\*\*SIR FOR TRACK (MIN) UNENOWN

\*\*\*\*SIR POR POSITION DISPLAY

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DATE 02/10/84

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SI-TEX/KODEN 787C HODEL # SI-TEX POB 6700, CLEARWATER FLA, 33518 PHONE 813-535-4681 LIST PRICE (USD): 1395.00 02/01/83 ADVERTISED PRICE (USD): 899.00 05/07/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 5.5 D(inches): 3 VOLUME(cu.in.): 107.3 H(inches): 6.5 TEMP RANGE (deg F): 32.+122 WEIGHT (16): 3 POWER REQUIREMENT (Watts): 6 INPUT VOLTAGE: 11-15 0-9 KEY PAD? Y DISPLAY TYPE: 2-LOP, LCD NUMBER AND TYPE OF DATA KEYS: 6,+2,L/R FUNCT SCAN ANTENNA HEIGHT (inches): N/A \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED AT KNOWN LOCATION AND TD-ANY LOCATION \*\*\*\*NOTCH FILTERS 2 FIXED 1 OPTIONAL \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED ALL STATIONS, TD AND LAT-LONG \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS FCC, CANADA D.O.C., RTCH MPS 70 \*\*\*\*DYNAMIC RANGE 10548 \*\*\*\* WAX. GOOP FOR LAT-LONG TREEMONIN +J\*\*\*\*NOISE BANEWIDTH **WEIGHOWNI** \*\*\*\*SENSITIVITY ( & VOLTS) LESS THAN SUV/NETER \*\*\*\*SIR FOR ACQUISITION UNKNOWN \*\*\*\*SNR FOR TRACE (HIN) UNENOWN \*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN \*\*\*\*\*N1 WAYPOINTS, 8 TRACK SPEED, 40 KTS

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DATE 02/10/84

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HODEL # SI-TEX/KODEN 717 SI-TEX POB 6700, CLEARWATER FLA, 33518 PHONE 813-535-4681 LIST PRICE (USD): 2995.00 05/07/83 ADVERTISED PRICE (USD): 1995.00 11/00/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] W(inches): 10.5 D(inches): 10.7 VOLUME(cu.in.): 719 H(inches): 6.4 TEMP RANGE (deg f): 32,+122 WEIGHT (16): 12.5 INPUT VOLTAGE: 11-40 POWER REQUIREMENT (Watts): 16 DISPLAY TYPE: 2-LOP, 1-NAV, INFO LCD, 2L/L 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 7,+5-SEC,+12 ROT,1TG ANTENNA HEIGHT (inches): N/A \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL-FOR ANY OR ALL TD, MANUAL-AT KNOWN LOCATION \*\*\*\*NOTCH FILTERS 4 AUTOMATIC, 1 PRESET 88kHz \*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*STATIONS TRACKED & HOW USED ALL STATIONS, TD \*\*\*\*WULTI-CHAIN CAPABILITY 110 \*\*\*\*CERTIFICATIONS PCC, CANADA D.O.C. \*\*\*\*DYNANIC RANGE 80d3 \*\*\*\* WAX. GDOP FOR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH UNLINOWN \*\*\*\*SENSITIVITY ( u VOLTS) LESS THAN 2uV/METER \*\*\*\*SHR FOR ACQUISITION UNICHOWN \*\*\*\*SIR POR TRACK (MIN) UNICADADE \*\*\*\* SIR FOR POSITION DISPLAY

DATE 02/10/84

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MODEL A SINGAD, INC 2215 N.W. MARKET ST., SETTLE, WA 98107 TL-838 PHONE 206-733-1334 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 4.9 W(inches): 12.6 D(inches): 12.6 VOLUME(cu.is.): 777 WEIGHT (1b): 13.2 TENP RANGE (deg F): INPUT VOLTAGE: 12-36 POWER REQUIREMENT (Watts): 26 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: ROTARY SW'S ANTENNA HEIGHT (inches): 120 \*\*\*\*DYNANIC RANGE 110 DB

\*\*\*\*STATIONS TRACKED & HOW USED MASTER DEPENDENT

\*\*\*\*ASF CORRECTION TECHNIQUE NONE NO CALIBRATION CAPABILITY

\*\*\*\*SENSITIVITY ( u VOLTS) 1 uV/M

\*\*\*\*SNR FOR ACQUISITION UNKNOWN

\*\*\*\*SHR FOR TRACK (MIN) UNKNOWN

\*\*\*\*SNR FOR POSITION DISPLAY UNKNOWN

\*\*\*\*WOTCH FILTERS 4 ADJUSTABLE, 2 PRESET

\*\*\*\*MICRO-PROCESSOR TYPE(S) UNKNOWN

NO NULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS RTCH-70 PART 2 MPS

\*\*\*\*WAX. GDOP FOR LAT-LONG N/A

\*\*\*\*NOISE BANDWIDTH UNENOWN

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LOBAN-C RECEIVER MANUFACTURERS DATE 02/10/84 SIMRAD, INC 2215 N.W. MARKET ST., SETTLE, WA 98107 HOBEL # TL-856 PHONE 206-733-1334 LIST PRICE (USD): ADVERTISED PRICE (USD): DESIGNED POR: N [(M)arine. (A)ircraft. (S)urvey/monitor. (T)iming. (L)and. (O)ther] H(inches): 6.2 W(inches): 12.6 D(inches): 12.6 VOLUNE(cu.in.): 984 WEIGHT (16): 14.3 TEMP RANGE (deg F): POWER REQUIREMENT (Watts): 29 INPUT VOLTAGE: 12-36 DISPLAY TYPE: 2-LOP LED 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 6-THUNB + 3 ROTARY ANTENNA HEIGHT (inches): 120 \*\*\*\*ASF CORRECTION TECHNIQUE NONE NO MANUAL CALIB. \*\*\*\*STATIONS TRACKED & HOW USED MASTER DEPENDENT TRACKS 2 SECONDARIES \*\*\*\*NOTCH FILTERS 4 TUNEABLE, 2 PRESET \*\*\*\*WICRO-PROCESSOR TYPE(S) UNKNOWN \*\*\*\*HULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS RTCH-70 PART 2 MPS \*\*\*\*DYNANIC RANGE 11041 \*\*\*\*MAX. GDOP FOR LAT-LONG UNKNOWN \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) luV \*\*\*\*SHR POR ACQUISITION UNKNOWN \*\*\*\*SIR FOR TRACK (MIN) UNK HOWN \*\*\*\*SHR FOR POSITION DISPLAY **TENEX SECOND** 

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HODEL # . CLX-95 SRD LABS 381 MCGLINCEY LN. CAMPBELL CA 95008 PHONE LIST PRICE (USD): 1795.00 10/00/81 ADVERTISED PRICE (USD): 00/00/00 DESIGNED FOR: M [(N)srine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 2.5 W(inches): 6.25 D(inches): 10.5 VOLUME(cu.in.): 164 WEIGHT (1b): 6 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 11-16 POWER REQUIREMENT (Watts): 14 DISPLAY TYPE: 15 LEDS 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 6 + 6 SEC FUNCT. ANTENNA HEIGHT (inches): 96 \*\*\*\* ASF CORRECTION TECHNIQUE MANUALLY ENTERED AT KNOWN POINT. LINEAR APPROXIMATION TO GRID \*\*\*\*WOTCH FILTERS 4 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 8085 \*\*\*\* STATIONS TRACKED & NOW UMED MASTER PLUS & SECONDARIES, AUTO OR MANUAL SELECTION \*\*\*\*MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS SINCHOWN \*\*\*\*CERTIFICATIONS **UNIX MOWN** \*\*\*\*MAX. GDOP FOR LAT-LONG NOT LIMITED \*\*\*\*SENSITIVITY ( u VOLTS) **INCOME** \*\*\*\*SHR POR ACQUISITION -1043 \*\*\*\*SHR POR TRACK (MIN) -16dB \*\*\*\*SWR POR POSITION DISPLAY BRROR INDICATION -104B \*\*\*\* NOISE BANDWIDTH UNIXMOWN \*\*\*\*\*N1 \$295 PRICE ADVERTISED AS "OVER-STOCKED" OF /ERING \*\*\*\*\*\*\* WAYPOINTS, 99 TRACK SPEED, 99 KTS

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 MODEL # SRD LABS L-NAV 25 381 MCGLINCEY LN. CAMPBELL CA 95008 PHONE LIST PRICE (USD): 995.00 01/01/83 ADVERTISED PRICE (USD): 995.00 01/01/83 DESIGNED FOR: A [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 2.5 W(inches): 6.25 D(inches): 10.5 VOLUME(cu.in.): 164 WEIGHT (15): 3 TEMP RANGE (deg P): 32,+122 INPUT VOLTAGE: 11-16 POWER REQUIREMENT (Watts): 11 DISPLAY TYPE: 15 LEDS 0-9 KEY PAD7 N NUMBER AND TYPE OF DATA KEYS: 6 + 6 SEC FUNCT. ANTENNA HEIGHT (inches): \*\*\*\*SWR FOR ACQUISITION -10dB \*\*\*\*SNR FOR TRACK (HIN) -16dB \*\*\*\*ASF CORRECTION TECHNIQUE MANUALLY ENTERED USES LOCAL GRADIENTS AND TD CORRECTION \*\*\*\*STATIONS TRACKED & HOW USED TRACKS MASTER AND TWO SECONDARIES \*\*\*\*NOTCH FILTERS 6 FIXED \*\*\*\*MICRO-PROCESSOR TYPE(S) 2025 \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS NONE \*\*\*\*MAX. GDOP FOR LAT-LONG NOT LIMITED \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) UNKNOWN \*\*\*\*DYNAMIC RANGE UNKNOWN

\*\*\*\*SHR FOR POSITION DISPLAY ERROR INDICATION -10dB

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DATE 02/10/84

NODEL # NLX SRD LABS 381 McGLINCEY LN. CAMPBELL CA 95008 PHONE ADVERTISED PRICE (USD): 995.00 01/01/83 LIST PRICE (USD): 995.00 01/01/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 6.25 D(inches): 10.5 VOLUME(cu.in.): 164 H(inches): 2.5 WEIGHT (1b): 3 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 11 INPUT VOLTAGE: 11-16 DISPLAY TYPE: 15 LEDS 0-9 KEY PAD? N NUMBER AND TYPE OF DATA KEYS: 6 + 6 SEC FUNCT. ANTENNA HEIGHT (inches): 96 \*\*\*\*SNR FOR ACQUISITION -10dB \*\*\*\*SNR FOR TRACK (MIN) -16dB \*\*\*\* ASF CORRECTION TECHNIQUE NANUALLY ENTERED USES LOCAL GRADIENTS AND TD CORRECTION \*\*\*\*STATIONS TRACKED & HOW USED TRACKS MASTER AND TWO SECONDARIES \*\*\*\*NOTCH FILTERS 4 PRESET \*\*\*\*MICRO-PROCESSOR TYPE(S) 1015 \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS NONE \*\*\*\* MAX. GDOP POR LAT-LONG NOT LIMITED \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SEMSITIVITY ( w VOLTS) UNKNOWN \*\*\*\*DYNAMIC RANGE UNENOWN \*\*\*\*SNR FOR POSITION DISPLAY BRROR INDICATION, -10dB

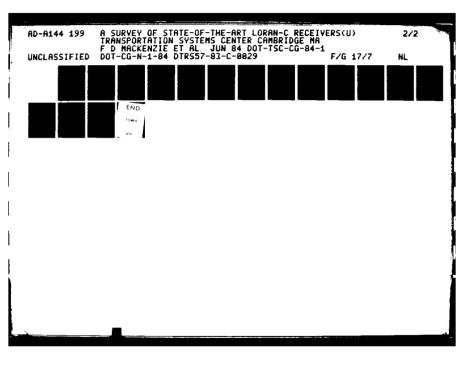
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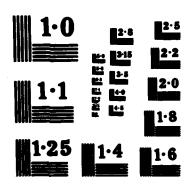
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LORAN-C RECEIVER WANUFACTURERS DATE 04/10/84 . TELEDYNE SYSTEMS COMPANY TDL-711A MODRI, # 19601 NORDHOPP STREET NORTHRIDGE, CA 91324 PHONK 213-886-2211 LIST PRICE (USD): 14950 01/01/83 ADVERTISED PRICE (USD): 12000.00 02/01/84 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 12.6 VOLUME(cu.in.): 720 H(inches): 7.62 W(inches): 7.5 TEMP RANGE (deg F): -67,+170 WEIGHT (1b): 12 POWER REQUIREMENT (Watts): 40 INPUT VOLTAGE: 18-32 DISPLAY TYPE: GAS DISCHARGE 0-9 KRY PAD? Y ANTENNA HEIGHT (inches): 16.5 NUMBER AND TYPE OF DATA KEYS: 16 +ROTARY SW. \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL INPUT \*\*\*\*NOTCH FILTERS MANUAL + OPTIONAL EXTERNAL AS REQUIRED 2 \*\*\*\*MICRO-PROCESSOR TYPE(S) PPS4 \*\*\*\*STATIONS TRACKRD & HOW USED MASTER + 4 SECONDARIES. MANUAL SELECTION, RECEIVER ADVISES BEST \*\*\*\*MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS STC, TSO IN PROCESS \*\*\*DYNAMIC RANGE UNKNOWN \*\*\*\*NOISE BANDWIDTH UNKNOWN \*\*\*\*SENSITIVITY ( u VOLTS) 10uV \*\*\*\*SNR FOR TRACK (MIN) UNKNOWN \*\*\*\*SWR FOR POSITION DISPLAY UNKNOWN \*\*\*\*MAX. GDOP FOR LAT-LONG N/A

\*\*\*\*\*N1

CDU 4.5(B) X 5.75(W) X 6.5(D) 3 LBS





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LOBAN-C RECEIVER MANUFACTURERS DATE 02/10/84 HODEL # TI 9900 TEXAS INSTRUMENTS MARINE PROD. POB 405 NS 3438 LEWISVILLE TX 75067 PHONE 214-462-5220 LIST PRICE (USD): 3895.00 11/01/82 ADVERTISED PRICE (USD): 1499.00 05/07/68 DESIGNED FOR: N [(M)srine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 12.5 VOLUNE(cu.in.): 412 H(inches): 3.4 W(inches): 9.7 TEMP RANGE (deg F): 32,+122 WEIGHT (15): 9 INPUT VOLTAGE: 11-16 POWER REQUIREMENT (Watts): 16 DISPLAY TYPE: 2TD OR L/L.GAS DSCHRG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 20PB.18 SEC FNCT ANTENNA HEIGHT (inches): 102 \*\*\*\*ASF CORRECTION TECHNIQUE DIRECT CALIBRATION FROM KNOWN POSITION, OR NAMUAL IMPUT OF KNOWN ASP CORRECTION. \*\*\*\*NOTCH FILTERS 4 FACTORY PRESET FOR AREA OF OPERATION \*\*\*\*MICRO-PROCESSOR TYPE(S) THS 9900 \*\*\*\*STATIONS TRACKED & NOW USED - ALL IN CHAIN, USER SELECTED PAIR POR LAT-LONG CONVERSION \*\*\*\* MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS MPS TYPE 1, PART 2 OF RTCH-70 \*\*\*\*DYNAMIC RANGE 90dB, 10uV TO 300mV \*\*\*\*WAX. GDOP FOR LAT-LONG N/A \*\*\*\*SENSITIVITY ( w VOLTS) N/A \*\*\*\*SNR FOR ACQUISITION -13dB, -10dB PREFERRED FOR ACCURACY \*\*\*\*SHR POR TRACE (HIN) -1548 \*\*\*\*SWR FOR POSITION DISPLAY -1548 \*\*\*\*NOISE BANDWIDTH N/A

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DATE 02/10/84

nodel 4	TI 9908N		STRUMENTS INE PROD. POB 4	05 MS 3438 LEWIS	VILLE TX 75067
		PHO	NE 214-462-5	220	
LIST PRICE (USD)	: 2295.00	11/01/82 ADV	ERTISED PRICE (U	SD): 1836.00 0	5/07/83
DESIGNED POR: N	[(M)arime,	(A)ircraft, (S)wrv	ey/momitor, (T)i	ming, (L)and, (O	)ther]
N(inches): 3.4	W(inches)	9.7 D(inches)	: 12.5 VOLUNE	(cu.in.): 412	
WEIGHT (1b): 9		TEMP RANGE (deg P)	: 32,+122		
INPUT VOLTAGE: 1	1-16	POWER REQUIREMENT	(Watts): 16		
DISPLAY TYPE:	2 LOP GAS D	I SCHRG	0-9	KEY PAD? Y	
NUMBER AND TYPE	OF DATA KEYS	20PB,18 SEC FNCT	ANTE	NNA HEIGHT (inch	es): 102
****ASP CORRECTI DIR		ION FROM KNOWN POSI	TION, OR MANUAL	INPUT OF KNOWN A	SF CORRECTION.
****NOTCH FILTER 2 P		T FOR OPERATIONAL A	RRA PLUS 2 USER .	ADJUSTED FROM FR	ONT PANEL
****MICRO-PROCES THS	SOR TYPE(S) 9900				
****STATIONS TRA ALL		SED Chain, USER Select	ED PAIR FOR LAT-	LONG CONVERSION	
****MULTI-CHAIN NO	CAPABILITY				
****CERTIFICATIO	NS Type 1, par	T 2 OF RTCH-70			
****BYNAMIC RANG 904	E B, 10wV TO 3	Jeny			
****WAX. GDOP PO N/A					
N/A					
****SENSITIVITY N/A					
****SHR FOR ACQU -13		EFERRED FOR ACCURACY	r		
****SHR FOR TRAC -15					
****SHR FOR POST -15					

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 DATE 02/10/84

TEXAS INSTRUMENTS AVIONIC PROD. POB 405 NS 3438 LEWISVILLE TX 75067 HODEL # **TI 5000** PHONE 214-462-5220 LIST PRICE (USD): ADVERTISED PRICE (USD): 3495.00 11/00/83 DESIGNED FOR: N [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): W(inches): D(inches): VOLUNE(cu.in.): WEIGHT (1b): TEMP RANGE (deg F): INPUT VOLTAGE: 10-40 POWER REQUIREMENT (Watts): DISPLAY TYPE: 5X7 DOT MATRIX 0-9 KEY PAD? NUMBER AND TYPE OF DATA KEYS: ANTENNA HEIGHT (inches): \*\*\*\*ASF CORRECTION TECHNIQUE Y-PROBABLY SEAMATER, CAN USE MANUAL UPDATE/CAL. \*\*\*\*STATIONS TRACKED & HOW USED RECEIVES TOS FRON LC \*\*\*\*NOTCH FILTERS MA \*\*\*\*NICRO-PROCESSOR TYPE(S) TNS9995 (?) \*\*\*\*WULTI-CHAIN CAPABILITY MA \*\*\*\*CERTIFICATIONS **MARCHON** \*\*\*\*BYNANIC RANGE HA. \*\*\*\*NAX. GDOP FOR LAT-LONG NA A STORE BANGWIGTH \*\*\*\*SENSITIVITY ( & VOLTS) MA \*\*\*\*SHR FOR ACQUISITION \*\*\*\*SHR POR POSITION DISPLAY 114 \*\*\*\*SHR POR TRACE (HEH) MA \*\*\*\*\*\*\* TYPICAL ARRANGEMENT TO INTERPACE WITH 9900/9000 OR SOMETHING TAKES TC , CONVERTS TO LOPS, COMPARES WITH BAT HAV, BALMAN FI SAT MAY AUGNENTED WITH LORAN-C

DATE 02/10/84

TEXAS INSTRUMENTS MARINE PROD. POB 405 NS 3438 LEWISVILLE TX 75067 HODEL # **TI 9000A** PHONE 214-462-5220 LIST PRICE (USD): 995.00 11/01/82 ADVERTISED PRICE (USD): 749.00 05/07/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)ining, (L)and, (O)ther] W(inches): 9.7 D(inches): 12.5 VOLUME(cu.in.): 412 H(inches): 3.4 WEIGHT (1b): 9 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 18 INPUT VOLTAGE: 11-16 DISPLAY TYPE: AUT/SEQ 4LOP, GAS DSCHRG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 20 PB ANTENNA HEIGHT (inches): 102

\*\*\*\*NOTCH FILTERS 4 FACTORY TUNED NOTCHES SET FOR AREA OF OPERATION

\*\*\*\* ASF CORRECTION TECHNIQUE NAMUAL, WITH CHARTS OR AUTOMATIC WITH TIS000 LORSAT(TH) INTEGRATED NAVIGATION SYSTEM

\*\*\*\*MICRO-PROCESSOR TYPE(S) THS 9900

\*\*\*\*STATIONS TRACKED & NOW USED All in Chain, direct readout of th

\*\*\*\*WULTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS

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\*\*\*\*BYNAMIC RANGE 9043, 10w7 TO 300m7

\*\*\*\*NAX. COOP POR LAT-LONG B/A

NOISE BANDWIDTH

\*\*\*\*SENSITIVITY ( = VOLTS) N/A

\*\*\*\*SHR POR TRACE (HEN) -13dB

\*\*\*\*SIR POR POSITION DISPLAY

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# DATE 02/10/84 LORAN-C RECEIVER NAMUFACTURERS TEXAS INSTRUMENTS NARINE PROD. POB 405 NS 3438 LEWISVILLE TX 75067 TI 9000N HODEL # PHONE 214-462-5220 LIST PRICE (USD): 1395.00 11/01/82 ADVERTISED PRICE (USD): 1349.00 05/07/83 DESIGNED FOR: N [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] W(inches): 9.7 D(inches): 12.5 VOLUNE(cu.in.): 412 H(inches): 3.4 TEMP RANGE (deg F): 32,+122 WEIGHT (15): 9 POWER REQUIREMENT (Watts): 18 INPUT VOLTAGE: 11-16 DISPLAY TYPE: AUT/SEQ 4LOP, GAS DSCHRG 0-9 KEY PADT Y ANTENNA HEIGHT (inches): 102 NUMBER AND TYPE OF DATA KEYS: 20 PB \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL, WITH CHARTS, OR AUTOMATIC WITH TISOOD LORSAT(TN) INTEGRATED NAVIGATION SYSTEM \*\*\*\*NOTCH FILTERS 2 FACTORY TUNED NOTCHES SET FOR AREA OF OPERATION PLUS 2 EXTERNAL USER TUNED NOTCHES \*\*\*\*MICRO-PROCESSOR TYPE(S) THS 9900 \*\*\*\*STATIONS TRACKED & HOW USED ALL IN CHAIN, DIRECT READOUT OF TD \*\*\*\*WUTI-CHAIN CAPABILITY 10 \*\*\*\*CERTIFICATIONS LORAN HRS \*\*\*\*DYNAMIC RANGE 96dB, 10wV TO 300mV \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH N/A \*\*\*\*SENSITIVITY ( w VOLTS) N/A \*\*\*\*SHE FOR ACQUISITION -1343, -1043 PREFERRED FOR ACCURACY \*\*\*\*SHR FOR TRACK (MIN) -1343 \*\*\*\*SIR FOR POSITION DISPLAY N/A

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DATE 02/10/84

1000001. 0 TI 90005 TEXAS INSTRUMENTS MARINE PROD. POB 405 NS 3438 LEWISVILLE TX 75067 PHONE 214-462-5220 LIST PRICE (USD): 1295.00 11/01/82 ADVERTISED PRICE (USD): 1036.00 05/07/85 DESIGNED FOR: N [(N)ariae, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): 3.4 W(inches): 9.7 D(inches): 12.5 VOLUNE(cu.in.): 412 WEIGHT (1): 8.6 **TEMP RANGE (deg F): 32,+122** POWER REQUIREMENT (Watts): 18 INPUT VOLTAGE: 11-16 DISPLAY TYPE: AUT/SEQ 4TD, GAS DSCHEG 0-9 KEY PAD? Y MUNBER AND TYPE OF DATA KEYS: 20 PB ANTENNA MEIGHT (inches): 102

\*\*\*\*ASF CORRECTION TECHNIQUE MANUAL WITH CHARTS OR AUTOMATIC WITH TISSON LORSAT(IN) INTEGRATED NAVIGATION SYSTEM

\*\*\*\*NOTCH FILTERS 4 PACTORY TUNED NOTCHES SET FOR AREA OF OPERATION

\*\*\*\*NICRO-PROCESSOR TYPE(S) THE9900

\*\*\*\*STATIONS TRACKED & HOW USED ALL IN CHAIN, DIRECT READOUT OF TO

\*\*\*\*WELTI-CHAIN CAPABILITY

\*\*\*\*CERTIFICATIONS

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\*\*\*\*BYNAMIC RANGE 94dB, 10wY TO 300mY

\*\*\*\*NAX. GOOP FOR LAT-LONG N/A

\*\*\*\*NOISE BANDWIDTH N/A

\*\*\*\*SENSITIVITY ( w VOLTS) N/A

\*\*\*\* SHR FOR ACQUISITION -1348, -1648 PREFERRED FOR ACCURACY

\*\*\*\*SHR POR TRACE (MIN) -13dB

\*\*\*\*SIR FOR POSITION DISPLAY

LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 HODEL # TI 9100 TEXAS INSTRUMENTS AVIONIC PROD. POB 405 MS 3438 LEWISVILLE TX 75067 PLACET 214-462-5220 LIST PRICE (USD): ADVERTISED PRICE (USD): 7995.00 11/01/82 DESIGNED POR: A [(N)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] W(inches): 6.25 H(inches): 3.25 D(inches): 11.6 VOLUME(cu.in.): 235 WEIGHT (1b): 6.7 TEMP RANGE (deg F): 5.+131 INPUT VOLTAGE: 11-33 POWER REQUIREMENT (Watts): 24 DISPLAY TYPE: 2TD OR L/L,GAS DSCHRG 0-9 KEY PAD? Y MUMBER AND TYPE OF DATA KEYS: 20PB, SEC FN 18 ANTENNA HEIGHT (inches): 21 \*\*\*\*ASF CORRECTION TECHNIQUE DIRECT CALIBRATION AT KNOWN POSITION OR MANUAL INPUT OF KNOWN ASF CORRECTION \*\*\*\*WOTCH FILTERS AUTOMATIC \*\*\*\*WICRO-PROCESSOR TYPE(S) TH\$9901 \*\*\*\*STATIONS TRACKED & HOW USED ALL STATIONS IN CHAIN, AUTO SELECT OF TRIAD INCLUDING MASTER-INDEPENDENT OPERATION \*\*\*\*WULTI-CHAIN CAPABILITY MO \*\*\*\*CERTIFICATIONS TSO C60A, MULTIPLE STC, IPR CERTIFIED FOR US NATIONAL AIRSPACE, LORAN-C COVERAGE AREA \*\*\*\*DYNANIC RANGE X/A \*\*\*\*WAX. GDOP FOR LAT-LONG N/A \*\*\*\*WOISE BANDWIDTH N/A \*\*\*\*NOISE BANDWIDTH N/A \*\*\*\*SHR POR TRACE (HIN) -1543 \*\*\*\*SHR FOR POSITION DISPLAY -1348

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LORAN-C RECEIVER MANUFACTURERS	DATE 02/10/84
NOBEL ( TI 99605P	TEXAS INSTRUMENTS Marine prod. pob 405 ns 3438 lewisville TX 75067
	PHONE 214-462-5220
LIST PRICE (USD): 2395.00 11/01/82	ADVERTISED PRICE (USD): 1995.00 05/07/83
DESIGNED FOR: N [(N)arine, (A)ircraft	t, (S)urvey/monitor, (7)iming, (L)and, (0)ther]
M(inches): 3.4 W(inches): 9.7 I	D(inches): 12.5 VOLUME(cu.in.): 412
WEIGHT (1b): 9 TEMP RANGE	E (deg F): 32,+122
INPUT VOLTAGE: 11-16 POWER REQU	UIRBUENT (Watts): 16
DISPLAY TYPE: 2TD OR L/L,GAS DSCHRG	0-9 KEY PAD? Y
NUMBER AND TYPE OF DATA KEYS: 20PB, 145	SEC FICT ANTENNA HEIGHT (inches): 102
****ASF CORRECTION TECHNIQUE DIRECT CALIBRATION FROM & ITH TISGGG LORSAT(TM) INTEGRATE	NOWN POSITION, MANUAL INPUT OF KNOWN ASF CORRECTION OR AUTOMATIC W
****NOTCH FILTERS 4 FACTORY PRESET FOR OPER/	ATIONAL AREA
****NICRO-PROCESSOR TYPE(5) THE 9900	
****STATIONS TRACKED & HOW USED ALL IN CHAIN, USER SELECTI	ED PAIR FOR LAT-LONG CONVERSION
NO	•
****CERTIFICATIONS MPS TYPE 1, PART 2 OF RTC	14-70
****BYNAMIC RANCE 9048, 10wy TO 300my	
NAL GOOP FOR LAT-LONG	
N/A	
**** <b>SENSITIVITY ( * VOLTS)</b> N/A	
****sun por ACQUISITION *1348, *1048 PREFERRED PO	R ACCURACY
-1548	
•••• <b>SHR FOR POSITION DISPLAY</b> -15 <b>49</b>	

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LORAN-C RECEIVER NAMUFACTURERS DATE 02/10/84 TI 99005PM TEXAS INSTRUMENTS HODEL # MARINE PROD. POB 405 MS 3438 LEWISVILLE TX 75067 PHONE 214-462-5220 LIST PRICE (USD): 2795.00 11/01/82 ADVERTISED PRICE (USD): 2495.00 05/07/85 DESIGNED POR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): 3.4 W(inches): 9.7 D(inches): 12.5 VOLUNE(cu.in.): 412 TEMP RANGE (deg F): 32,+122 WEIGHT (1b): 9 POWER REQUIREMENT (Watts): 16 IMPUT VOLTAGE: 11-16 DISPLAY TYPE: 2TD OR L/L, GAS DSCHRG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 20PB, 18 SEC FNCT ANTENNA HEIGHT (inches): 102 \*\*\*\*ASF CORRECTION TECHNIQUE DIRECT CALIBRATION FROM KNOWN POSITION, MANUAL INPUR OF KNOWN ASF CORRECTION OR AUTOMATI WI TH TISOGO LORSAT(TN) INTEGRATED \*\*\*\*NOTCH FILTERS 2 FACTORY PRESET FOR OPERATIONAL AREA PLUS 2 USER ADJUSTED FROM FRONT PANEL \*\*\*\*WICRO-PROCESSOR TYPE(S) TN59900 \*\*\*\*STATIONS TRACKED & NOW USED All in Chain, User Selected Pair for Lat-Long Conversion \*\*\*\* MULTI-CHAIN CAPABILITY 100 ABAACURTIFICATIONS NPS TYPE 1, PART 2 OF RTCH-70 \*\*\*\* DYNAMIC RANGE 9045, 10uV TO 300mV \*\*\*\*MAX. GBOF FOR LAT-LONG N/A NOISE BANGWIDTH \*\*\*\*SENSITIVITT ( u VOLTS) N/A \*\*\*\*SIR FOR ACQUISITION -134B, -104B PREFERRED FOR ACCURACY \*\*\*\*SHR FOR TRACE (HIN) -1543 \*\*\*\*SIR FOR POSITION DISPLAY -15d3 \*\*\*\*\*\*\*\*\* MAYPOINTS, 10 TRACK SPEED, 40 KTS

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LORAN-C RECEIVER MANUFACTURERS	DATE 02/10/84
MAR	STRUMENTS INE PROD. POB 405 NS 3438 LEWISVILLE TX 75067
PHO LIST PRICE (USD): 1695.00 11/01/82 ADV	
	ERTISED PRICE (USD): 1356.00 05/07/83
DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urv H(inches): 3.4 W(inches): 9.7 D(inches)	Truck (Truck (Land, Cother)
WEIGHT (1b): 8.6 TEMP RANGE (deg P)	
INPUT VOLTAGE: 11-16 POWER REQUIREMENT	• = -
DISPLAY TYPE: AUT/SEQ 4TD, GAS DSCHEG	0-9 KEY PADY Y
MUNBER AND TYPE OF DATA KEYS: 20	ANTENNA HEIGHT (inches): 102
NUMBER AND TITE OF DATA REID. 20	ARTENNA HEIGHT (INCRES): 102
****ASP CORRECTION TECHNIQUE NAMUAL WITH CHARTS OR AUTOMATIC WI	TH TISGOG LORSAT(TM) INTEGRATED NAVIGATION SYSTEM
****WOTCH FILTERS 2 FACTORY PRESET FOR AREA OF OPERA	TION, 2 USER TUNED FROM FRONT PANEL
****MICRO-PROCESSOR TYPE(S) THS 9900	
ALL IN CHAIN, DIRECT READOUT OF TD	
****WULTI-CHAIN CAPABILITY No	
****CERTIFICATIONS N/A	•
9945, 10uv TO 300mv	
****MAX. GOOP FOR LAT-LONG W/A	
****NOISE BANEWIETH N/A	
**** <b>SERSITIVITY ( = VOLTS)</b> N/A	
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\*\*\*\*SHR POR TRACE (NIH) -1348

\*\*\*\*SIR FOR POSITION DISPLAY N/A

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DATE 02/10/84

NODEL # TI 91 TEXAS INSTRUMENTS AVIONIC PROD. POB 405 MS 3438 LEWISVILLE TX 75067 PHONE 214-462-5220 LIST PRICE (USD): 10950.00 05/07/83 ADVERTISED PRICE (USD): 00/00/00 DESIGNED FOR: A [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] VOLUNE(cu.in.): 476 H(inches): 7.1 W(inches): 4.9 D(inches): 13 WEIGHT (1b): 9.1 TEMP RANGE (deg F): -40,+158 INPUT. VOLTAGE: 11-33 POWER REQUIREMENT (Watts): 28 DISPLAY TYPE: 2TD OR L/L.GAS DSCHRG 0-9 KBY PADT Y NUMBER AND TYPE OF DATA KEYS: 20PB, SEC FN 18 ANTENNA HEIGHT (inches): 21 \*\*\*\*ASF CORRECTION TECHNIQUE DIRECT CALIBRATION AT KNOWN POSITION OR MANUAL INPUT OF ASF CORRECTION \*\*\*\*NOTCH FILTERS AUTOMATIC \*\*\*\*MICRO-PROCESSOR TYPE(S) THS9901 \*\*\*\*STATIONS TRACKED & HOW USED ALL STATIONS IN CHAIN, AUTO SELECT OF TRIAL INCLUDING MASTER-INDEPENDENT OPERATION \*\*\*\*MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS TSO C60A, MULTIPLE STC & IFR FOR US NATIONAL AIRSPACE, LORAN-C COVERAGE AREA \*\*\*\*DYNAMIC RANGE N/A \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH N/A \*\*\*\*SENSITIVITY ( u VOLTS) N/A \*\*\*\*SHR POR ACQUISITION -13dB, -10dB PREFERRED FOR ACCURACY \*\*\*\*SHR FOR TRACE (MIN) -15dB \*\*\*\*SHR FOR POSITION DISPLAY -13dB

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DATE 02/10/84

MODEL # TI 9000NS TEXAS INSTRUMENTS MARINE PROD. POB 405 NS 3438 LEWISVILLE TX 75067 PHONE 214-462-5220 LIST PRICE (USD): 1695.00 11/01/82 ADVERTISED PRICE (USD): 1356.00 05/07/83 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] D(inches): 12.5 W(inches): 9.7 VOLUME(cu.in.): 412 H(inches): 3.4 WEIGHT (1b): 8.6 TEMP RANGE (deg F): 32,+122 INPUT VOLTAGE: 11-16 POWER REQUIREMENT (Watts): 18 DISPLAY TYPE: AUT/SEQ 4TD, GAS DSCHRG 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 20 ANTENNA HEIGHT (inches): 102 \*\*\*\*ASF CORRECTION TECHNIQUE MANUAL WITH CHARTS OR AUTOMATIC WITH TISOOD LORSAT(TM) INTEGRATED NAVIGATION SYSTEM \*\*\*\*NOTCH FILTERS 2 FACTORY PRESET FOR AREA OF OPERATION, 2 USER TUNED FROM FRONT PANEL \*\*\*\*MICRO-PROCESSOR TYPE(S) TNS 9900 \*\*\*\*STATIONS TRACKED & HOW USED ALL IN CHAIN, DIRECT READOUT OF TD \*\*\*\*WULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS N/A \*\*\*\*DYNAMIC RANGE 90dB, 10uV TO 300mV \*\*\*\*MAX. GDOP FOR LAT-LONG N/A \*\*\*\*NOISE BANDWIDTH N/A \*\*\*\*SENSITIVITY ( u VOLTS) N/A \*\*\*\*SNR FOR ACQUISITION -13dB, -10dB PREFERRED FOR ACCURACY \*\*\*\*SNR FOR TRACK (MIN) -13dB \*\*\*\*SNR FOR POSITION DISPLAY N/A

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 TRINBLE MAVIGATION 1077 INDEPENDENCE AVE MOUNTAIN VIEW CA 94043 TRINBLE 100A HODEL # PHOME 415-962-9893 LIST PRICE (USD): 5195.00 01/06/82 ADVERTISED PRICE (USD): 3595.00 00/09/82 DESIGNED FOR: M [(M)arine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (0)ther] H(inches): S W(inches): 10.8 D(inches): 12.1 VOLUDE(cu.in.): 653.4 WRIGHT (16): 12 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 20 INPUT VOLTAGE: 11-30 DISPLAY TYPE: 1 LOP LCD 0-9 KEY PADT Y NUMBER AND TYPE OF DATA KEYS: 6 + SECONDARY ON 16 ANTEMNA HEIGHT (inches): 96 \*\*\*\* ASF CORRECTION TECHNIQUE AUTOMATIC VIG CONDUCTIVITY MAP, N.AMERICAN MEDITERRANEAN. MAMUAL CORRECTIONS MAY BE INSERTE D \*\*\*\*NOTCH FILTERS 4 AUTOMATIC SOFTWARE TUNED HARDWARE \*\*\*\*NICRO-PROCESSOR TYPE(S) 6809/6802 \*\*\*\* STATIONS TRACKED & HOW USED ALL TRACKED, 4TH STATION USED TO RESOLVE ANDIGUITY \*\*\*\* MULTI-CHAIN CAPABILITY NO \*\*\*\*CERTIFICATIONS NORE \*\*\*\*DYNANIC RANGE 110db \*\*\*\*MAX. GDOP FOR LAT-LONG NO LIMITATION \*\*\*\* HOISE BANDWIDTH UNIXIONIN \*\*\*\*SEMSITIVITY ( w VOLTS) 10s¥ \*\*\*\*SHR FOR ACQUISITION -16 TO -2943 \*\*\*\*SHR FOR TRACK (HIN) -16 TO -2048 \*\*\*\*SHR FOR POSITION DISPLAY -16 TO -29dS

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LORAN-C RECEIVER MANUFACTURERS DATE 02/10/84 HOBEL # TRIMBLE 200 TRIMBLE NAVIGATION 1077 INDEPENDENCE AVE NOUNTAIN VIEW CA 94043 PHONE 415-962-9893 LIST PRICE (USD): 00/00/00 ADVERTISED PRICE (USD): 2995.00 01/06/82 DESIGNED FOR: N [(N)srine, (A)ircraft, (S)urvey/monitor, (T)iming, (L)and, (O)ther] H(inches): 5 W(inches): 10.8 D(inches): 12.1 VOLUME(cu.in.): 653.4 WEIGHT (1b): 12 TEMP RANGE (deg F): 32,+122 POWER REQUIREMENT (Watts): 17 INPUT VOLTAGE: 11-30 DISPLAY TYPE: 2 LOP FLOR. 0-9 KEY PAD? Y NUMBER AND TYPE OF DATA KEYS: 6 + SECONDARY ON 16 ANTENNA HEIGHT (inches): 96 \*\*\*\*ASF CORRECTION TECHNIQUE AUTOMATIC BASED ON CONDUCTIVITY MAP N. AMERICAN MEDITERRAMEAN. \*\*\*\*STATIONS TRACKED & HOW USED TRACKS ALL STATIONS. AUTOMATIC STATION SELECTION. 3 STATION SOLUTION. USES FORTH TO ELIMINA TE ANDIGUITY. \*\*\*\*NOTCH FILTERS FOUR AUTOMATIC. SOFTWARE TUNED HARDWARE NOTCHES \*\*\*\*MICRO-PROCESSOR TYPE(S) 2, 6802 IN TRACKER 6809 FOR NAVIGATION FUNCTIONS. \*\*\*\*MULTI-CHAIN CAPABILITY 100 \*\*\*\*CERTIFICATIONS HONE \*\*\*\*DYNAMIC RANGE 110dB \*\*\*\*NAX. GDOP FOR LAT-LONG NO LINITATION \*\*\*\*NOISE BANEWIDTH UNICHOUNT \*\*\*\*SENSITIVITY ( u VOLTS) 10uV \*\*\*\*SHR FOR ACQUISITION -16 TO -2048 \*\*\*\*SWR FOR ACQUISITION -16 TO -2048 \*\*\*\*SHR FOR POSITION DISPLAY -16 TO -2043 \*\*\*\*\*\*\*\* LOGO KEY IS A SPECIAL FUNCTION DISPLAY KEY

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# REFERENCES

<sup>1</sup>L.M. DePalma, et. al., Proceedings of the 10th Annual Technical Symposium, Wild Goose Association, 21-23 October 1981, San Diego.

<sup>2</sup>R.M. Passi, "On Some Aspects of OMEGA Windfinding," <u>Journal of Applied</u> Meteorology, Vol. 14 No. 8, Dec. 1975, pp 1499-1502.

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