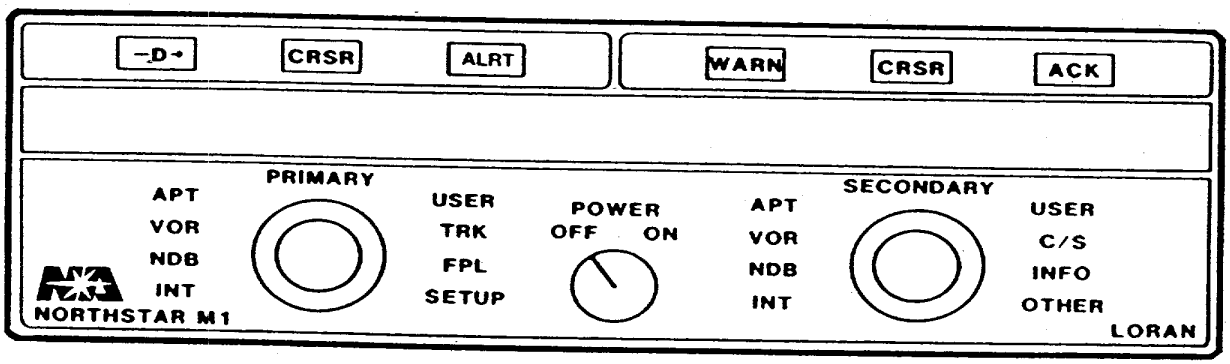
NORTHSTAR M1
LORAN NAVIGATOR

REFERENCE MANUAL



NORTHSTAR TECHNOLOGIES • a division of BSC, Inc.
30 Sudbury Road
Acton, Massachusetts 01720
Main: (978) 897-6600
Service: (978) 897-7253

Revision **M**

Current Product Line is now being maintained by

CMC Electronics Inc.
600 Dr. Frederik Philips Boulevard
Ville Saint-Laurent, Quebec, Canada
H4M 2S9
Tel : 1-888-827-2881 or 514-748-3050

All Manual references to **Northstar** should read CMC Electronics Inc.

NORTHSTAR M1
LORAN NAVIGATOR

REFERENCE MANUAL

NORTHSTAR
TECHNOLOGIES • a division of BSC, Inc.
30 Sudbury Road
Acton, Massachusetts 01720
Main: (978) 897-6600
Service: (978) 897-7253

Revision **M**

LIMITED WARRANTY POLICY
Northstar M1 Loran Navigator

Northstar Avionics, a division of CMC Electronics, warrants the Northstar M1 Loran to be free from defects in materials and workmanship for a period of three (3) years. This warranty applies to the original purchaser and to any subsequent owner during the warranty period, which begins on the date of shipment of the unit, F.O.B Acton, Massachusetts, to an authorized Northstar Avionics dealer.

During the warranty period, Northstar Avionics will repair or replace, at its option, any part of the M1 Loran Navigator it finds to be defective due to faulty material(s) or workmanship. All such repairs and/or replacements will be promptly performed by Northstar Avionics free-of-charge to the M1 owner. The only cost to the M1 owner will be freight charges incurred in shipping the M1 to and from the Northstar factory.

To be covered by this warranty, the M1 Loran Navigator must have been in normal use. The warranty does not apply to units with defects caused by improper installation, physical damage, abuse, tampering, or lightning or other abnormal electrical discharge, or to units with defaced or altered serial numbers, or to units repaired by unauthorized persons or repaired in a manner that violates Northstar Avionics' recommended service procedures.

All repairs and/or replacements made under this warranty must be performed at Northstar Avionics' facilities in Acton, Massachusetts. Performance of warranty work elsewhere is not and will not be authorized, and Northstar Avionics will not accept or pay for any charges for such work.

Northstar Avionics will not be responsible for payment of any charges imposed by a Northstar dealer or other party for services requested by and/or performed for an M1 owner in connection with this warranty. Such services might include removal of the M1 from an aircraft, inspection, packaging, handling, reinstallation, and the like.

Northstar Avionics assumes no responsibility for any consequential losses of any nature with respect to any of its products or services sold, rendered, or delivered. The foregoing is the only warranty expressed or implied. No other warranty exists.

CAUTION

Information contained in the M1's database is obtained from the U. S. Federal Aviation Administration and other reliable sources. While we have made every effort to assure the accuracy of the database information, it is important to remember that any source of navigational data is subject to possible error which could impair accuracy of navigation. The pilot must not use the Northstar M1 in a manner whereby an error would endanger the safety of the flight. Northstar Avionics cannot be responsible for any consequential damages resulting from the use of the M1.

If you become aware of any errors in the M1 database, please notify Northstar Avionics as soon as possible using the postage-paid mailers located at the back of this manual. Reported errors will be promptly verified, and corrections will appear in the next database update.

- - -

A single navigation aid should never be relied upon by the pilot to the extent that the safety of the aircraft, passengers or crew is put in jeopardy.

A navigation aid is just that, an aid, and it must be utilized as such. Information from it should be analyzed and cross-checked against other sources to determine the reliability of navigational information.

TABLE OF CONTENTS

FOR THOSE WHO JUST CAN'T WAIT

For best results, we recommend you study this manual completely before flying with your Northstar M1. But if you just can't wait, here's a simple and effective way to navigate with your M1:

1. Read and understand the safety considerations contained in Section 8. Then familiarize yourself wit the M1's warning messages (See Appendix B). Also, because the M1 might want to let you know about controlled airspace areas, it's a good idea to be aware of its ***Airalert***™ feature (see Sections 2.3.3 and 6.1).

2. Make sure the M1 is properly installed in your plane, as described in the Installation Manual (this is the job of your Northstar dealer). The correct transmitter chain for your area must also have been designated (see Section 2.3.1).

3. Now you're ready to operate the M1. Turn the **POWER** switch on and wait for the M1's automatic self-test and signal acquisition sequence to finish, as shown by the message:

   NAVIGATOR READY USE ANY SWITCH

   indicating that the M1 is locked on to loran signals and ready to navigate.

   As a final M1 installation check, perform the procedure described in Section 6.11 (Antenna Location Designation). Also make sure that the correct loran transmitter chain for your area has been designated (see Section 2.3.1).

4. Turn the ***large left-hand*** knob to illuminate the M1's **APT** (Airport) annunciator. Then turn the ***small left-hand*** knob, and you'll see a list of airports displayed. (Refer to Section 3.3.1 to learn how to find an airport quickly.)

5. Twist the ***small*** knob until you see the airport you want to fly to. If you pass by it on the display, simply twist the knob in the opposite direction, one click at a time if necessary.

6. When the airport is displayed, press the button marked **–D→** (Direct), then press the button marked **ACK** (Acknowledge).

And that's it. You've told the M1 where you want to fly, and it now shows you the bearing and distance to your destination. In flight, you'll see the displayed distance decrease as you approach your destination. And if you stray off course, the M1 will automatically show you the new course to follow. If an M1 button flashes at any time, simply press it to read the waiting message. Press the button again to delete the message and return to normal M1 operation. (If you need to be reminded about the message, the button will remain lit!)

Many other useful information displays and navigation functions are available with your Northstar M1. They are all described in the pages that follow.

But now, before you begin to fly with your M1, we suggest that you turn to the HINT Section of the manual and read the first three paragraphs of Section 7.3 -- APPROACHING YOUR DESTINATION

And when you're parked there and finished using the M1, just turn it off.

HOW TO USE THIS MANUAL

It's natural to want to use your Northstar M1 as soon as you get it, and because the M1's operation is so simple and straightforward, this is easy to do. But, a good set of instructions is necessary if you are to take full advantage of all the M1's advanced features. That's what this manual provides.

The manual is organized into eight main sections, followed by several reference sections (appendices) at the back. The Table of Contents lists the names of all these sections and the information in them.

The best way to use this manual is to sit down with it and your M1 and read the main sections in order. You might want to do this one step at a time. When you're done, you'll be well on your way to being an expert in the M1's operation. After that, the manual becomes a reference guide, just in case you forget something.

As you read the manual, keep the appendices in mind, since they may help to answer questions that might arise. In particular, note the Glossary, where many technical terms are defined. If you encounter a word or a term you don't understand, look there for its meaning.

Information in the M1 Installation Manual will be of interest mainly to the technician who installs your M1. You may wish to read it to learn about what makes a good (or a bad) installation, and to understand the problems of interference and precipitation static which can affect loran reception.

The separate Owner's Manual supplies a brief summary of the information contained in this book, for quick reference while flying.

As we showed you earlier, you don't have to be an expert with all of the features of the Northstar M1 before you fly with it and begin to enjoy its many benefits.

As soon as you feel comfortable accessing waypoints in the database, and reading your distance and bearing to them, you are ready. Start with these, and gradually try out other M1 features as you have need for them. You will soon reach the point where you can develop your own favorite ways of using the M1 -- ways that meet your particular flying requirements. But, above all, enjoy your flying with the M1, and have fun!

Section 1 - INTRODUCTION

Congratulations on your purchase of a Northstar M1 Loran Navigator! We believe you'll find it to be the most reliable, accurate and versatile piece of air navigation equipment available anywhere.

If you've used other Loran-C equipment, be prepared for new standards of accuracy, ease of use, and advanced features. And, if you haven't already used Loran-C, you're about to be introduced to the system that's revolutionizing aircraft navigation. There's only one drawback: you'll never again be satisfied with the old methods.

The Northstar M1 is a highly sophisticated Loran-C receiver-computer combined in a single compact package. The M1 was designed "from the ground up" by Northstar to meet pilots' needs for high accuracy, reliability and ease of use. Although the M1 uses only two vertical inches of panel space, it contains:

- An extremely sensitive, state-of-the-art Loran-C signal receiver, the most accurate and reliable available today.
- Two high-speed computers for calculating position, course, speed and many other functions.
- An extensive database containing more than 20,000 user-selectable waypoints, including all public-use and military airports, larger private airports, and all VORs, NDBs, intersections, TCAs and ARSAs, with room to accept up to 250 user-defined waypoints.
- High-brightness, dual LED readouts to present navigation information to the pilot. The brightness level is automatically maintained under varying light conditions.
- Ultra-simple operation by means of dual, concentric selector switches and illuminated pushbuttons.

1.1 NAVIGATION WITH THE NORTHSTAR M1

With the Northstar M1, you can easily perform many useful navigation functions, including:

Pre-Flight Planning - even when you are on the ground (or when it is removed from your aircraft) the M1 can tell you the distance and bearing to your destination, the distance and bearing of any leg of your flight plan, or the total distance of a complicated flight plan involving many stops. The M1 can also tell you if any portion of your flight plan will pass through a TCA or an ARSA.

Position finding - when operating in flight, the M1 always knows where it is and can tell you your bearing and distance from an airport, a VOR, or any other point in its database.

Direct navigation - simply designate a destination and the M1 will guide you directly there, from whatever your present position happens to be.

Flight plan navigation - select a start point, up to 18 intermediate waypoints, and a destination, and the M1 will automatically guide you along all the proper course legs. The points might be airports, VORs defining an airway, or any other points you choose.

Controlled Airspace Alert - if your current track or your future track will take you near a TCA or an ARSA, the M1's ***Airalert***™ feature advises you and helps you avoid it, or enter it legally.

To help you stay on course, the M1 has a built-in, electronic CDI (Course Deviation Indicator) to tell you how far you are to the left or right of your course line. The M1 can also be interfaced to drive the needle of a standard CDI, and most HSIs and autopilots. The Shadin Digiflo™ or Miniflo™ fuel-management system and/or an Eventide Argus™ 5000 moving map display can also be interfaced to the M1.

1.2 YOUR REGISTRATION CARD

Be sure your owner's registration card is promptly filled out and returned to Northstar Avionics. We must have your complete

mailing address (not just a company name), so that we can send you your *Starguard™* access code (see Section 6.2), and any future information about the M1. Returning your registration card also makes you eligible for a free database update.

1.3 HOW THE NORTHSTAR M1 WORKS

The M1 receives precisely-timed radio pulses from Loran-C transmitters located hundreds of miles apart. The times at which these pulses arrive at the M1's antenna depend on your location relative to each of the transmitters. By being very precise about measuring time differences between these received pulses, the M1 can determine its own position (and hence the position of your aircraft) with exceptional accuracy.

By knowing its own position, the M1 can at any time calculate the bearing and distance to any waypoint whose position is stored in the M1's memory. And, by keeping track of the way its position is changing, the M1 can also calculate your course and ground speed.

The M1 promptly shows the results of its calculations on its LED readouts, so you can see course, speed, bearing and distance to destination, and almost all of the other information you need to help you accurately navigate your airplane.

A complete discussion of the principles of Loran-C is beyond the scope of this manual. If you wish to learn more, there are several well-written books available:

The Loran, RNAV and Nav/Comm Guide, by Keith Connes
Butterfield Press
990 Winery Canyon Road,
Templeton CA 93456
Price: $14.95 + $2.00 postage and handling
(California residents add 6% sales tax)

Airborne Loran-C Navigation, by Bill Welch
Waypoint Press,
67 Boston Post Road,
Waterford CT 06385
Price: $6.95

1.4 DATABASE UPDATES

The database in your Northstar M1 should be updated at appropriate intervals -- at least once or twice a year -- to keep it current with navigational and other changes to airports, navaids, and controlled airspace. Northstar Avionics, through its dealers, issues new database updates (revisions) every 56 days (coincident with the FAA's 56-day update cycle). Any new software features available from Northstar for the M1 are included at no extra charge with the update.

As soon as we receive your M1 owner's registration card, your Northstar will be eligible for one free database update. The factory charge for each subsequent update is $80.00* (does not include shipping and labor charges incurred in dealer-installed updates). Your Northstar dealer can quickly install an update for you, or you can return the M1 directly to the Northstar factory. If you return your M1 to the factory to have an update installed, be sure to include payment of $80.00 (by check, or use MasterCard or Visa number, with expiration date, and cardholder's name and phone number), unless you are requesting your one free update.

1.5 SERVICE AND REPAIRS

In case of an operating problem with your Northstar M1, you may contact your dealer or return the unit to the Northstar factory for diagnosis and repair. Try to be as complete and accurate as possible when you describe an operating problem. Feel free to call Northstar Service at (508) 897-7251 if you need assistance.

The M1 is covered by a three-year limited warranty which, in summary, states that if the M1 is returned by the owner or dealer **to the factory** during the warranty period, Northstar will repair or replace, free-of-charge, any part found to be defective due to faulty materials or workmanship, provided that the M1 has been properly installed and has not been abused. The only cost to the owner will be the shipping charges and any associated charges that might be imposed by the dealer.

*(subject to change)

Shipments to Northstar Avionics should be made to the following address:

Northstar Avionics
30 Sudbury Road
Acton, MA 01720

Remember, if you want your M1's database updated at the same time, include payment of $80.00 (see Section 1.4). However, if you have special overnight or second-day shipping requirements (UPS or Federal Express), please call the factory for turnaround time and freight costs ***before*** shipping your Northstar.

Refer to the Warranty at the beginning of this manual and to Section 3 of your M1 Installation Manual for further details on the M1 warranty, service and update policies and procedures.

1.6 BE CAREFUL!

Although Northstar Avionics has done its best to make the M1 as accurate and reliable as possible, please be sure to remember the following precautions:

1. Navigation data is constantly changing. Therefore, the M1's database will almost certainly contain some errors. As always, double-check any navigation information before you rely on it.

2. The record of reliability for our country's loran system is very impressive, yet there is always the possibility of occasional position errors for any of a number of reasons. Double-check your position often.

3. The M1 contains so much information and so many features that you may find yourself spending too much time looking at it and not watching for other aircraft. ***See and be seen*** is still the most important rule for VFR flight. As with all other aircraft instruments, you should develop the technique of using quick glances at the M1. Learn the number of knob clicks to go from one function to another, and become thoroughly familiar with the operation of each M1 feature you wish to use. Don't let the novelty of the M1 take your attention away from what's happening around you. Remember: ***Fly the aircraft***!

(this page intentionally left blank)

Section 2 - GETTING STARTED

To learn about your Northstar M1, the first step is to make sure that it is operating properly. Your dealer will handle installation and initial check-out of the M1 in your plane and will use the Installation Manual as a guide. You may wish to read that manual, but everything you need to know about operating your M1 will be presented here.

Although your plane may be the best place to learn to use your M1, it isn't your only choice. You can remove the M1 from its mounting tray, take it home, and operate it in the Demo Mode (see Section 6.15). With this mode (which is a built-in simulation program), you'll be able to learn all the features of the M1 and practice using them in realistic navigation conditions.

To use the M1 while it's out of your plane, you'll have to connect it to a 12-volt battery or to a 12- to 24-volt DC power supply. Doing this requires an extra power cable that you can order from your Northstar dealer.

> **Important:** Make certain that the correct polarities are observed when connecting the M1 to a battery or power supply. An incorrect connection will severely damage the unit.

With the M1 removed from your plane, you also have the option to receive loran signals and to observe the M1 acquiring them. A separate antenna/coupler must be ordered from your dealer for this purpose. (The M1 won't receive loran signals unless it's connected to the antenna and coupler. However, many of its functions, such as access to waypoint information, remain fully operable.)

Whatever approach you use in learning to operate the M1, the initial startup procedure is always the same:

With the M1 installed in your plane, or connected to an appropriate power source, turn the **POWER** switch to **ON**. The M1 will then display a series of self-test messages, followed by messages showing that the M1 is searching for loran signals and getting ready to navigate. (If you're new to the M1, this is a good time to visually acquaint yourself with its controls and readouts.) When the M1 locks on to loran signals, and is ready to operate, it will notify you with the message:

NAVIGATOR READY - USE ANY SWITCH

You can now proceed to set up the M1 to navigate with or learn its operation. (When you're finished, simply turn the **POWER** switch to the **OFF** position. This can be done at any time. No special precautions or procedures are needed. When you turn the M1 on again, it will automatically perform its startup sequence and notify you when it is ready to operate. As you've noticed, this takes about a minute, but it can be longer, up to several minutes, if signal conditions are very poor.)

Here are a few important things that you should know at this time:

1. **Post-Installation Checkout.** After the M1 is first installed in your plane, and each time after the M1 has been removed and reinstalled, you should make certain that it is set up for the correct receiving antenna location (the top or bottom of the aircraft) and for the loran transmitter chain (GRI) you want to navigate with. This can be done easily by following the procedures in Sections 6.11 and 2.3.1 in this manual. (If you're in your plane and haven't already done this, do it now!)

2. **Four Cautions.** Before navigating with the M1, read (and then follow) the Safety Considerations contained in Section 8 of the manual. Also, be familiar with the M1's warning messages: they're listed in Appendix B. If you operate the M1 in a controlled airspace area (a TCA or an ARSA), or if your future track will penetrate such an area, the M1 will automatically alert you. Thus, you should briefly familiarize yourself with the M1's *Airalert*™ feature (See Sections 2.3.3 and 6.1). Finally, if you're planning to use the M1's TIME and ETA functions, follow the procedure described in Section 2.3.4. (And

although it's already been pre-set at the factory, you might want to refer to Section 6.10 to check whether the M1's internal map of magnetic variation is set for the current year.)

3. **About Bearings.** All bearings displayed by the M1 are magnetic. The only exception is **winds aloft**, which is reported as true.

4. **Using the M1's rotary knobs.** In the manual, the instruction "turn the knob to the right" means turn it clockwise and "turn the knob to the left" means counter-clockwise. To turn a knob "all the way" to the left or to the right means to turn it until the readout stops changing and further turning has no effect. (The rotary knobs have no mechanical stop, but the effect is the same.)

   When using the M1's ***small*** knobs to select and display information, they can be turned one or more clicks in either direction to select information, or they can be turned rapidly to greatly speed-up the selection process (see Section 3.3.1).

5. **About the Rest of the Manual.** On the next page, you'll find a summary of basic procedures that are used repeatedly in operating the M1. These procedures also appear later in the manual, and after some practice with the M1 you'll be performing them automatically.

   After the summary of procedures, you'll find detailed information about the M1's controls and readouts in Section 2.2. We suggest that you read through this information for an initial familiarization. Then twist knobs and push buttons to get the feel of them and to see what happens. After that, you'll enjoy working with the rest of the manual. And, if you're uncertain about the operation of any of the controls or readouts, just refer to Section 2.2.

6. **In General.** Don't feel that you have to be an expert with all of the features of the M1 before you fly with it and begin to enjoy its many benefits. In fact, as soon as you feel comfortable accessing waypoints in the M1 database, and reading your bearing and distance to them, you are ready. Start there, and then gradually try out other M1 features as you need them or want to practice with them.

Develop your own favorite ways of using the M1 -- ways that meet your own particular flying requirements.

Now it's time for you to get into the left-hand seat! Use the rest of the manual to learn about the details of the M1 and its operation. But before you do, we suggest that you go back to the page entitled "For Those Who Just Can't Wait." Turn your M1 on and follow steps 4, 5 and 6 of the procedure described there. Repeat it a few times. You'll be impressed with how easy it is to use the M1, and you'll be well on your way toward mastering its operation. And, learning what's in the rest of the manual will be much easier, too! Happy flying!

2.1 GENERAL OPERATING PROCEDURES

Here are a few general rules to keep in mind that apply to most aspects of operating the Northstar M1:

1. Use the ***large***, outer knobs to select the **function** you want the M1 to perform. Use the ***small***, inner knobs to select specific **data** or operating options to be displayed by the selected function.

2. The sequence is always the same whenever you specify or change a waypoint you want to fly to, or a heading you wish to fly, or whenever you want to activate a flight plan. You must always first display the information in the primary (left-hand) readout, and then press **–D→** and **ACK**.

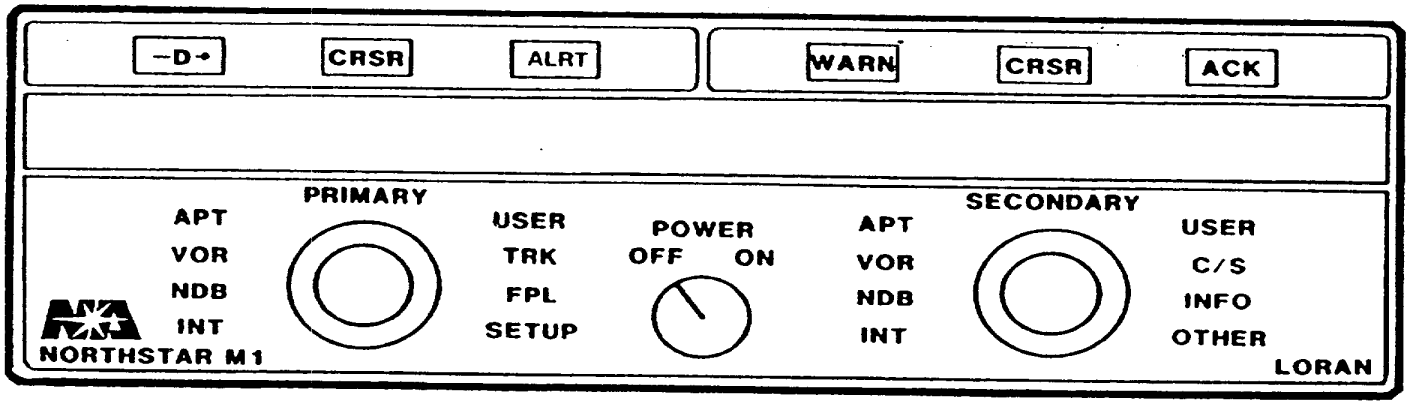
3. Whenever the **ACK** button flashes while you are entering data, it is requesting confirmation. Press the **ACK** button when the data is correctly entered and ready to be locked in.

4. Whenever the **ALRT**, **WARN** or **ACK** button flashes of its own accord, a message is waiting to be displayed. Press the flashing button, read the message, and press the button again to stop the flashing and return to normal operation.

5. When using the flashing cursor to enter data, remember the sequence -- press **CRSR** to turn the cursor on, use the ***small*** knob to scan through the alphabet, numbers or symbols, and use the ***large*** knob to advance the flashing cursor ahead or back to the next character position. Finally, when all characters have been correctly entered, press **CRSR** again to turn the cursor off (see Section 3.3.2).

2.2 CONTROLS AND READOUTS

Here is a diagram of the M1, showing all of its controls and readouts, followed by an explanation of each. As you learn about them in Sections 2.2.1 and 2.2.2, don't be afraid to experiment -- there is no combination of button and switch settings that can cause any damage to the unit (although if you're not paying attention to what you're doing you might accidentally erase waypoints that you have entered). Factory-programmed waypoints cannot be erased or modified except by installing a new database update.



2.2.1 Pushbuttons

There are six buttons across the top of the Northstar M1. The following explains their functions:

Button **Description**

–D→ **(Direct)** Press this button to define a flight path direct from your present position to the waypoint or flight plan leg displayed in the ***primary*** readout. The **ACK** button will automatically flash. Press it to confirm the new path. The M1 then automatically calculates Off-Course Distance, ETE, ETA, etc. for this flight path. Pressing **–D→** and **ACK** also activates a flight plan (see Section 5).

> **NOTE:** While the M1 is operating, pressing **–D→** and the left-hand **CRSR** button **simultaneously** provides a shortcut method for displaying the nearest airport's identifier, bearing, distance and longest runway. (See Section 3.3.1.)

CRSR **(Cursor)** Press to turn on the readout's flashing cursor, allowing you to use the rotary knobs to enter or change data shown on the readout. Press **CRSR** again to turn the cursor off after data has been entered. (The **CRSR** button illuminates while the cursor is activated.) There are two **CRSR** buttons, one to control data entry on the ***primary*** (left-hand) side of the M1 and one for the same purpose on the ***secondary*** (right-hand) side. (See Sections 2.3.4 and 3.3.2.)

ALRT **(Alert)** This button flashes when an airspace alert (***Airalert***™ or Mode C) occurs. ***Airalert***™ messages occur when the aircraft is about to penetrate a TCA or an ARSA, or when a flight path you have specified will pass through a TCA or ARSA. Mode C messages appear whenever the aircraft is within, or near, a thirty-mile radius of the primary airport in a Terminal Control Area. Press **ALRT** to read the alert message. (See Section 6.1 for details.)

The **ALRT** button remains illuminated for as long as the alert condition exists. It will turn off when the aircraft is no longer within about four miles of a TCA or ARSA.

The *Airalert*™ system may be deactivated as described in Section 6.1.5. Pressing **ALRT** when the button is not illuminated will show whether the *Airalert*™ system is currently activated.

WARN (Warn) This button flashes when a warning condition occurs, indicating that the M1's navigation guidance is uncertain and should not be relied upon. Press **WARN** to stop the flashing and display a message explaining the warning condition. Press **WARN** again to clear the message. The button remains illuminated for as long as the warning condition exists. If a new warning condition arises, the button flashes again. When all warning conditions stop, the light goes off. Appendix B lists all the warning messages and their meanings.

You may press **WARN** at any time to display the M1's estimate of its own accuracy. Press **WARN** again to return to the previous display.

ACK (Acknowledge)

First function -- Confirmation of Defined Flight Path

Press after the **–D→** button to confirm a flight path to a waypoint or to a flight plan leg displayed on the primary readout.

Second function -- Data Entry

During certain data entry procedures, such as setting the time or entering flight plan information, the **ACK** button will flash. Press **ACK** after the data is correctly entered to indicate that it should be used by the M1.

Note: There is no specific button for "NEGATIVE ACKNOWLEDGE". To indicate when you do **not** wish to take the displayed action, just turn either large knob one click to turn off the flashing **ACK** light and remove the request from the readout.

Third Function -- Reading Advisory Message

When an advisory message is waiting to be displayed, the button will flash. Press **ACK** to display the message, and press it again to clear the message.

Fourth Function -- Saving your Present Position

Whenever the **ACK** button is **not** illuminated or flashing, you may press it to instantly save your present position for later use. Press **ACK** again to clear the displayed message. (See Section 3.5.3.)

2.2.2 Rotary Switches

The M1 has two separate readouts, each with its own controls and cursor button. The readout on the left-hand side is called the ***primary*** readout and it is controlled by the left-hand dual rotary knob (the ***primary*** knob). The right-hand readout is called the ***secondary*** readout and is controlled by the right-hand dual rotary knob (the ***secondary*** knob).

Each rotary switch has two knobs: a large, outer one and a smaller, inner one. The ***large*** knobs select the **function** (**VOR, APT, USER,** etc.) whose information is to appear in the readout. The ***small*** knobs select the specific **data** to be displayed for the chosen function.

For example, if you turn either ***large*** knob to **APT**, you'll see airport information displayed. You may then turn the ***small*** knob to select among the airports stored in the M1's database.

Here are the functions that can be selected by turning the ***large*** knobs:

APT, VOR, NDB, INT, and **USER** allow you to look at all the waypoints stored in the M1's memory. Use the ***small*** knob to select among the waypoints in the chosen category. The readout shows the waypoint's IDENTIFIER, and also the BEARING and DISTANCE from your present position to that waypoint. The waypoint categories are:

APT - Airports
VOR - VOR transmitters
NDB - Non-Directional Beacons
INT - Intersections
USER - Waypoints entered by the user that don't fall into another category

Note that these waypoint functions are available for both the ***primary*** and ***secondary*** readouts. This means you can display the bearing and distance of two different waypoints simultaneously.

TRK (Track) allows you to display information about the current DESIRED TRACK (which you defined by pressing the button marked "**–D→**", direct). Use the small ***primary*** knob to select the navigation data you wish to display, such as OFF-COURSE DISTANCE, ETE, or ETA. (See Section 4.4.)

FPL (Flight planning) allows you to enter, review and modify flight plans. The flight planning position uses both the ***primary*** and ***secondary*** readouts. The ***small primary*** knob scans through the legs of a flight plan, while the ***large secondary*** knob selects the various flight planning options. Flight planning is covered in detail in Section 5.

SETUP allows you to review or enter certain kinds of standard data in the M1's memory, and also to perform setup functions or to activate special modes and features. The following is a listing of **SETUP** functions (in the order they appear) and the sections where they are described:

Airalert™ (TCA/ARSA alert) list all controlled areas (6.1)
Airalert™ (TCA/ARSA alert) enable/disable (6.1.5)

Mode C Alert -- enable/disable (6.1.6)
Starguard™ theft protection -- enable/disable (6.2.4)
Parallel offset of course lines (6.8)
CDI sensitivity (6.9)
Current time (2.3.4)
Loran transmitter chain selection (2.3.1)
Calendar year for magnetic variation (6.10)
Number of user waypoints available (6.13)
Starguard™ owner's message entry (6.2.3)
Starguard™ alternate code entry (6.2.1)
Demo mode and Look-ahead mode (6.15 and 6.16)
Antenna location designation (6.11)
CDI calibration & annunciator test (6.12)
Oscillator frequency error (6.13)
Database revision date (6.13)
Unit serial number and program revision level (6.13)

The ***small primary*** knob selects the type of data you wish to review or change. Most setup functions use both the ***primary*** and ***secondary*** readouts.

C/S displays your present COURSE (track angle) and GROUND SPEED. The ***small*** knob selects WINDS ALOFT calculations. (See Sections 6.3 and 6.4.)

INFO displays additional information about a waypoint or track shown in the ***primary*** readout. Use the ***small secondary*** knob to select the type of additional information shown, by category:

APT
City and State
Name
Communications Frequencies
Elevation
Runways
Approaches and Lighting
Latitude and Longitude

VOR
City and State
Name
Frequency
Latitude and Longitude

NDB City and State
Name
Frequency
Latitude and Longitude

INT Latitude and Longitude

USER Latitude and Longitude

Note: Only latitude and longitude may be displayed for user-entered waypoints, whether they are stored in the **USER** category or in any other category.

TRACK Additional navigation data that complements the usefulness of the data displayed on the primary side. For example, if the CDI is shown on the primary side, **INFO** will display your ground speed and ETE to the waypoint on the secondary side.

OTHER accesses additional features of the M1:

Latitude/Longitude of present position

Loran TDs and Signal-to-Noise Ratios.

2.2.3 External Annunciators and Interfaces

Several types of annunciators and interfaces may be connected to the Northstar M1 to aid in navigation.

WARN Annunciator -- An external warning light may be installed in the aircraft in a highly visible location. It automatically illuminates in the same manner as the M1's **WARN** light.

PARALLEL OFFSET Annunciator -- This annunciator illuminates whenever a parallel offset is in effect. (See Section 6.8.)

WAYPOINT APPROACH Annunciator -- This annunciator illuminates whenever you approach within a one-minute radius of the current waypoint that the M1 is guiding to.

AUTOPILOT/CDI/HSI Interface -- In addition to its built-in electronic CDI display, the M1 may be interfaced with, and will drive, most types of CDI or HSI instruments and autopilots (see Section 6.17).

The M1 may also be interfaced with the Shadin Digiflo™ or Miniflo™ fuel management system and/or an Eventide Argus 5000™ moving map display.

2.2.4 Introduction to Using Controls and Readouts

If you are new to the M1, and have just read about its controls and readouts, we suggest that you spend a few moments experimenting with them if you haven't already done so. (Remember, no setting or combination of settings that you use can harm the M1.)

Here's a brief demonstration you can try. Do part of it or all of it; it takes only a couple of minutes. You'll learn a lot about operating the M1, and the sequence is similar to one you might actually use in navigating with it.

1. Turn the M1 on and wait for the ready message. If a button flashes, press it and read the waiting message (for instance, the M1 might want to let you know you're in a controlled airspace area). Press the button again. If it remains lit, ignore it (unless the

message was about something that would prevent you from operating the M1). Proceed as follows:

2. Turn the ***large primary*** (left-hand) knob to the **APT** position. Read the ***primary*** display.

3. While watching the ***primary*** display, twist the ***small primary*** knob at various speeds and then click-by-click in both directions. Notice the results. (If you find that you are in the **LOCAL** listing and you come to the **LOCAL-ALL** "signpost," pause briefly and twist the knob to the right in the direction of the **ALL** listing.)

4. Using different speeds to turn the ***small primary*** knob -- from fast to slow and then click-by-click -- display several different waypoints in the **ALL** database listing. In each instance, the airport identifier, and the bearing and distance from your present position to it, will be displayed.

5. Use the ***small primary*** knob to display an airport that is near your present position.

6. Turn the ***large secondary*** (right-hand) knob to the **INFO** position.

7. Watching the ***secondary*** display, turn the ***small secondary*** knob (quickly, slowly, or click-by-click) in either direction to display additional information about the airport shown on the primary display.

8. Press the **–D→** (direct) button and the flashing **ACK** button. (You have just defined your flight track and acknowledged it.)

9. Notice that the primary display has switched automatically to the **TRK** (track) function. Watch the primary display and turn the ***small primary*** knob in either direction to read the track information.

10. Turn the ***large secondary*** knob to the **APT** position. Turn the ***small secondary*** knob in either direction to display the distance and bearing to various waypoints from your present position.

11. Press and hold the **WARN** button to display the M1's calculation of its estimated accuracy.

12. Simultaneously press the –D→ (direct) button and the left-hand **CRSR** button to display the airport nearest your present position. Turn the ***small primary*** knob to show other nearby waypoints.

13. Turn the ***large primary*** knob to **SETUP**.

14. Turn the ***small primary*** knob to scan through the various **SETUP** functions. Find the Antenna Location Designation and Transmitter Chain Selection (GRI) functions.

15. Turn the ***large primary*** knob to the **TRK** position to switch the primary display back to the track function for your original waypoint. Turn the ***small primary*** knob to display track functions for the waypoint.

That's it. If you're fascinated and you want to repeat the exercise (starting with Step 5), or experiment by changing the steps, go right ahead. Among other things, there's more than 20,000 waypoints you can choose to practice with!

2.3 INITIAL SETUP FUNCTIONS

Three of the Northstar M1's important **SETUP** functions are described below. Others, which you won't need until later, are described in Section 6. There is generally no need to repeat these setup functions each time you turn the M1 on.

2.3.1 GRI selection (manual)

The Group Repetition Interval (GRI) is a four-digit number designating the chain of loran transmitters which the M1 is to receive. The first time you use your M1 you may need to tell it which chain to use. (If you're unsure about which is the proper chain for your area, consult the coverage charts in Appendix C.) Once the M1 has locked onto loran signals and knows its position, it will automatically warn you of poor reception conditions and/or recommend any necessary changes.

To set the GRI manually:

1. Turn the ***large primary*** knob to **SETUP**, then turn the ***small primary*** knob clockwise until you see the current GRI displayed. It will look something like this:

   GRI 9960 NORTHEAST U. S.

2. Turn the ***small secondary*** knob. You'll see all the U.S. and Canadian loran chains, displayed one at a time. (If you pass by the one you want, just rotate the knob in the opposite direction.)

3. When the proper chain is displayed, press the **ACK** button.

To help you select the best transmitter chain, the M1 displays a measure of the usefulness of each chain for your present location. This is shown just to the right of the four-digit GRI. The number is a percentage, from 0% to 99%, where 0% means the chain is unusable. Any chain showing over 50% should always give good results. The M1 can only display this percentage number after it has acquired loran signals and has calculated its present position. Also, this useful percentage information cannot be obtained unless you can first decide on and use a reasonably good chain for your area. (Use the charts in Appendix C.)

Ordinarily, the GRI has to be selected and manually set up only once. Normally, your dealer will set the proper GRI for your area, and the M1 will recommend the correct chain of Loran-C stations automatically as you move from one region to another. The only time you should need to set the GRI manually again is if you transport your M1 to a new coverage area while it is turned off.

In extreme fringe loran coverage areas you may find some locations where you can make a better choice of loran chains than the M1 can. This is because the M1 waits until it expects a decided improvement before recommending a change. In western Texas or southern New Mexico, for example, you may want to change to a new chain manually, as indicated in Appendix C, chart C1.

2.3.2 GRI Selection (automatic)

When you fly into an area where the M1's performance would improve if it were receiving a different chain of loran transmitters, it will notify you and ask permission to change to that different chain. This happens as follows:

1. When the M1 wishes to change to a different chain, it will flash the **ACK** button, asking you to press it in order to read a message. Press the **ACK** button.

2. The M1 will display a message such as:

   MAY I CHANGE GRI TO 9940 ACK?

   Press **ACK** to allow the M1 to make the change.

   If you do **not** want the M1 to change the GRI at this time, do not press **ACK**, but just turn any primary or secondary knob one click and back again to clear out the question. The M1 will ask again at a later time.

3. If you press the **ACK** button the M1 will display LORAN GUIDANCE TEMPORARILY GONE for five seconds, and will begin to acquire the new chain automatically.

   You may change your mind and abort this GRI change by turning any knob or pressing any switch during the time the above message is being displayed.

The M1 will normally acquire loran signals and display current navigational data within one to three minutes after a GRI change. Longer acquisition times may be required when experiencing poor signal reception.

If you are within 5 minutes of reaching a waypoint, or have just passed a waypoint, the M1 will not request use of a new GRI until you are two minutes beyond the waypoint and ready to consider the option.

2.3.3 *Airalert*™ Control

Airalert™ is a useful feature of the M1 that tells you if your future track penetrates a controlled airspace (a TCA or an ARSA), or if you are about to enter or are already in one. (See Section 6.1.) While you are learning to use the M1, you may prefer to turn off the airspace messages given by ***Airalert***™ until you are ready to deal with these extra functions.

To disable ***Airalert***™:

1. Turn the ***large primary*** knob to **SETUP**.
2. Turn the ***small primary*** knob to display:

ALL TCAs AND ARSAs: AIRALERT ON

3. Turn the ***small secondary*** knob to display:

ALL TCAs AND ARSAs: NO AIRALERT

4. Press **ACK**, and ***Airalert***™ is disabled.

2.3.4 Time of day

New M1s shipped from the factory as of July 1989 contain a battery-powered chip to maintain the M1's internal, time-of-day clock. This clock chip enables the M1 to constantly keep the precise time, even when the unit is turned off.

To set the current time and time zone upon receiving your M1 from the factory:

1. Turn the ***large primary*** knob to **SETUP**.
2. Turn the ***small primary*** knob to the right to display TIME IS and the time of day. The ***secondary*** readout will show the time zone.

3. Turn the ***small secondary*** knob to select either Coordinated Universal Time (**ZULU**), or your local time zone as standard time (**STD**) or daylight savings time (**DST**).

4. To change the time, press the left-hand **CRSR** button. The leftmost digit of the time display will flash. Turn the ***small primary*** knob to set it to the proper value. (The time is always set and displayed in 24-hour mode.)

5. Turn the ***large primary*** knob to the right and the second digit will flash. Use the ***small*** knob to set it to the proper value.

6. Continue until all digits are correct.

7. Press **ACK** to enter the corrected time.

Whenever you wish, you may change to a different time zone (the time of day will automatically adjust to the new time zone). Just display the time, turn the ***small secondary*** knob to choose the new zone, and then press **ACK**. For a listing of time zone abbreviations and their meanings, see Section 4.4.8.

2.3.5 Using the cursor to enter data

In Sections 2.3.1 and 2.3.4, you entered data in two different ways. To set the GRI, you turned the small knob to select among a number of choices, then pressed **ACK** to lock in the proper choice. To set the time, you activated the cursor and then entered the correct value character-by-character. You should practice both methods to be comfortable with each: they will be used frequently for various types of data entry.

You're now familiar with the M1's **SETUP** functions and ready to do something even more interesting. The next step is to learn about the M1's database of waypoints.

Section 3
USING THE DATABASE OF WAYPOINTS

A database is a collection of useful information in a computer's memory. The Northstar M1 has a very useful database indeed -- over 20,000 locations of interest to pilots. These locations are known as waypoints.

Waypoints in the M1 are grouped into five categories: AIRPORTS, VORs, NDBs, INTERSECTIONS, and USER. All waypoints in each category are listed in alphabetical (A-Z) and numerical (0-9) sequence, according to the first character of the waypoint identifier. Alphabetical listings always precede the numerical.

AIRPORTS: The M1 is programmed with over 7000 airports, including all U.S. "public use" and military airports, privately-owned airports with runway lengths over 2000 feet, Canadian airports with 3- or 4-letter identifiers, and many Mexican and Caribbean airports. In the database, the international prefix "**C**" has been deleted from Canadian identifiers, but the prefix "**M**" has **not** been deleted from Mexican and Caribbean identifiers.

> Military airports are included in the database for use in emergencies, as visual reference points, and for those authorized to land. These airports are distinguished by the letter M to the right of their identifier.
> Privately-owned airports (often restricted or requiring prior permission to land) are distinguished by the small letters Pr (Pr) to the right of their identifier.

VORs: Coordinates of all U.S. VORs and many Canadian, Mexican and Caribbean VORs are included. The M1 does not receive signals from VORs or NDBs -- it simply uses the location of these navaids as familiar and useful reference points.

NDBs: Coordinates of all civil-use NDBs are included.

INTERSECTIONS: Coordinates of all US civil-use intersections are included.

USER: There are no factory-programmed waypoints in the USER category. You can enter up to a total of 250 additional personally-designated waypoints in the M1's database. **These may be stored in any of the five waypoint categories,** including USER.

Note: With the exception of user-entered waypoints, the waypoint listings and information in the M1 database **cannot** be changed or deleted by the user.

3.1 DISPLAYING YOUR POSITION

You can instantly display your position in terms of bearing and distance to any of the thousands of waypoints in the M1's database. To do this, use the ***large primary*** or ***secondary*** knob to select the waypoint category: **APT, VOR, INT, NDB** or (if you have already entered personally-designated waypoints), **USER.** Section 3.3 describes numerous ways to quickly find the specific waypoint you want. However, you can now just turn the ***small*** knob to select a waypoint of interest. The **identifier** of the waypoint (such as **LAX** for Los Angeles International) and its **bearing** and **distance** will be shown on the display.

In keeping with standard aviation practice, the bearing displayed will be magnetic (referenced to magnetic north).

To display your position as LATITUDE/LONGITUDE coordinates, turn the large secondary knob to **OTHER,** as described in Section 6.5.

There are some geographical areas (usually not within the continental U.S.) where the M1 may need to be told approximately where it is before it can provide accurate position information. If a position readout you obtain while operating the M1 is inaccurate by hundreds of miles, check Section 6.7 to correct this condition. (Most M1 users will never need to perform this step.)

3.2 ADDITIONAL WAYPOINT INFORMATION

To display more information about a waypoint shown in the ***primary*** readout, set the ***large secondary*** knob to the **INFO** position. Then turn the ***small secondary*** knob to scan through the available

information. For example, you can display the city and state of airports, VORs and NDBs. This information can be useful when selecting waypoints, since in many cases waypoint identifiers themselves are not descriptive.

Additional information in the **INFO** position is not available for user-entered waypoints.

The next page lists the additional information typically displayed for each category of waypoint.

For AIRPORTS:

BOSTON MA	City and State
LOGAN INTL	Name of Airport
ATIS: 135.0	ATIS frequency
APPROACH: 120.6	Approach Control
TOWER: 119.1	Tower frequency
GROUND: 121.9	Ground frequency
UNICOM: 122.95	Unicom frequency
CTAF: 119.1	Common Traff. Advis. Freq
ELEVATION 20'	Field Elevation
15-33 10100' HARD	Runway designation, length and surface (for up to five runways)
NE-SW 5100' GRAV	
18-36 4000' TURF	
11-29 3500' DIRT	
PREC. APCH, LGTD	Approach* and Lighting†
APT. LAT 42°21.9'	Airport latitude
APT. LON 72°46.3'	Airport longitude

For VORs:

GARDNER MA	City and State
GARDNER	VOR Name
VOR FREQ: 110.6	VOR Frequency
VOR LAT 42°32.8'	VOR latitude
VOR LON 72°03.5'	VOR longitude

For NDBs:

PROVINCETOWN MA	City and State
RACE POINT	NDB Name
NDB FREQ: 232	NDB Frequency
NDB LAT 42°03.8'	NDB latitude
NDB LON 70°14.6'	NDB longitude

For Intersections:

INT. LAT 42°15.5'	Intersection latitude
INT. LON 71°30.5'	Intersection longitude

***Approach Categories**

PREC.	precision
N-P	non-precision
NO	no approach
????	data not available

†Lighting Categories

LGTD	Lighted
UNLGTD	Unlighted
LGTD: T	Telephone rqst
LGT: ??	data not available

General Location Codes: Country, State, Province, Etc.

When the M1 **INFO** function is used, one of the following two-letter codes is displayed to identify the general location of airport, VOR and NDB waypoints in the database:

AT	Alberta
AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
BC	British Columbia
BE	Bermuda
BI	Bahama Islands
BZ	Belize
CA	California
CI	Caribbean Islands
CO	Colorado
CS	Costa Rica
CT	Connecticut
CU	Cuba
DC	District of Columbia
DE	Delaware
DR	Dominican Republic
FL	Florida
GA	Georgia
GE	Greenland
HA	Haiti
HI	Hawaii
HO	Honduras
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
JA	Jamaica
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MB	Manitoba
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
MX	Mexico
NB	New Brunswick
NC	North Carolina
ND	North Dakota
NE	Nebraska
NF	Newfoundland
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NS	Nova Scotia
NT	Northwest Territories
NV	Nevada
NU	Nicaragua
NY	New York
OH	Ohio
OK	Oklahoma
ON	Ontario
OR	Oregon
PA	Pennsylvania
PE	Prince Edward Island
PM	Panama
PR	Puerto Rico
QB	Quebec
RI	Rhode Island
SC	South Carolina
SD	South Dakota
SK	Saskatchewan
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming
YT	Yukon Territory

3.3 SELECTING WAYPOINTS

To select a specific waypoint within a category, you have a choice of three methods. You may **scan** through the waypoints to find the one you want; or you may enter the **identifier** of the waypoint; or you may enter the waypoint's **name** or **city**.

A word of caution: When using the 3- or 4-letter airport identifiers, be careful to distinguish between the **number** zero and the **letter** O. Many airport directories show the number zero with a slash through it (Ø). Other directories do not do this and they must be looked at carefully -- the wider character is the **letter** O, and the narrower character is the **number** zero. Some directories even contain errors in listing the identifiers. Also, there are many examples of potentially confusing identifiers. One is Heart Airport in Kansas City, with an identifier of MOØ6, and which appears in some directories as MO06. (You may even be in the habit of thinking of your local airport as "OY5" when in fact its correct identifier is "ØY5".) Care must also be taken to carefully distinguish between the letter L and the number 1. The M1 Navigator will not recognize an identifier that is entered incorrectly. You must always use O and L for the letters and Ø and 1 for the numbers. When scanning through the database, the waypoints beginning with letters appear first, followed by the digits Ø-9, and then the special characters, if any.

3.3.1 Selecting waypoints by scanning

Scanning and selecting from among the thousands of waypoints stored in the M1 database can be accomplished quickly and easily.

Within each waypoint category (**APT**, for instance) the M1 divides waypoints into two groups: LOCAL and ALL. To access the LOCAL group turn the small knob all the way to the left. To access the group of ALL waypoints, turn the small knob all the way to the right.

The "Local" Group

The LOCAL waypoint group consists of the twenty waypoints nearest your present position. These are the waypoints that will

most often be of interest, and scanning through them is accomplished quickly. Local groups are organized alphabetically and numerically (except for the APT category, where they appear in approximate order of their distance from your present position).

In flight, you will pass some waypoints and approach others. The M1 automatically updates and rearranges the group of Local waypoints continuously. You can observe this when you display the leftmost (nearest) airport in the local group. As you approach a closer airport, the display will flash NEAREST AIRPORT, then automatically display the identifier, bearing, and distance to that airport. If you are using the INFO function to display the airport's city and state, the new city will also be automatically displayed.

> SHORTCUT TO DETERMINE NEAREST AIRPORT: Press –D→ and the left CRSR button **simultaneously** to instantly display the nearest airport's identifier, bearing, distance, and longest runway on the primary and secondary readouts.

The beginning (left end) of the Local group is designated by the display LOCAL ——→ ; the division between the groups is designated by ←——LOCAL ALL——→. These arrowed displays show the direction to turn the ***small*** knob to move between the two waypoint groups (LOCAL and ALL).

The "All" Group

To use a waypoint not in the Local group, turn the ***small*** knob to the right to access the group of ALL waypoints. (You must pause briefly at the ←——LOCAL ALL——→ message before you can access the larger group.) Here, you'll find all the waypoints in the waypoint category you selected, listed in alphabetical and numerical order.

In the AIRPORT category alone more than 7000 different waypoints are listed. It would be time-consuming to have to rotate the small knob for thousands of clicks to select the desired waypoint.

This is not necessary. The M1 steps through the waypoints at a rate proportional to the speed you turn the small knob. If you turn

the knob slowly, the waypoints appear one at a time, in sequence. Turn the knob quickly, and the waypoints jump by rapidly.

You should practice this procedure to get the "feel" of it. Search for well-known airports, such as LAX or DCA (or your local field). Turn the ***small*** knob rapidly to arrive at the correct starting letter or number, then turn slowly as you get near the correct waypoint. You'll soon learn how fast to turn the small knob to produce the right amount of "jump" in the display. With a little practice, you should be able to select any waypoint you want in just a few seconds.

3.3.2 Selecting waypoints by identifier

Instead of scanning through waypoints as described above, you can select a waypoint directly by entering the characters of its identifier. (The "identifier" is the standard one- to five-character code assigned to the waypoint.) To do this, proceed as follows:

1. Press **CRSR** and the leftmost character displayed will flash. Use the ***small*** knob to select the first letter of the waypoint's identifier. Then use the ***large*** knob to move the flashing cursor to the second letter and use the small knob to select the second character of the identifier. Repeat for each character of the waypoint's identifier.

   If you discover that you have entered an incorrect character or characters, simply turn the large knob to locate the cursor over each incorrect character and make the correction.

2. When the identifier is completely entered, press **CRSR** again to turn the cursor off. The completes the selection procedure.

   Note: If you specify the identifier of a waypoint **not** stored in the database, the M1 asks whether you wish to enter a **new** waypoint having this identifier:

XXXXX UNKNOWN: STORE IT. ACK?

If you do not wish to enter a new waypoint (perhaps you merely misspelled an existing identifier), don't press **ACK**, but just turn the small or large knob to delete the entry and allow another identifier to be entered.

Note: In the NDB waypoint category, there are instances where the FAA uses the same identifier code for several different navaids. For example, an NDB co-located with an outer marker may use the same identifier as another NDB located in a different part of the country. In these cases, a suffix is added to the identifiers to distinguish among them. The suffix is a number sign, followed by a single digit, 1-9. For example, two NDBs having the same identifier "CL" would be shown as "CL #1" and "CL #2". When you enter the identifier "CL", you will see "CL #1" displayed as a reminder that there is more than one waypoint designated by that identifier. You can easily determine and select the NDB waypoint you want, in this instance "CL #1" or "CL #2", by checking the displayed bearing and distance, or by using the **INFO** function to display the facility name, or city and state.

3.3.3 Selecting waypoints by name or city

If you do not know the identifier of an airport, a VOR, or an NDB, you can use the waypoint's name or city to find it in the database. To do this, enter the first few characters of the waypoint name or city as described below. Then, turning the ***small primary*** knob will scan through only those waypoints whose name or city begins with the characters you specified. Proceed as follows:

1. Turn the ***large primary*** knob to **APT**, **VOR**, or **NDB** to select the waypoint category.

2. Turn the ***large secondary*** knob to **INFO**.

3. Turn the ***small secondary*** knob to display either any waypoint name or any city, depending on which you wish to search for. (The waypoint that is displayed at this point is of no consequence.)

4. Press the right-hand **CRSR** button, and use the ***secondary*** knobs to enter the first four or five characters of the desired name or city. Do **not** turn the cursor off!

5. If the desired waypoint doesn't appear, turn the ***small primary*** knob to scan through those waypoints which begin with the characters you entered.

6. When you find the desired waypoint, press **CRSR** again to turn the cursor off.

In many cases, the M1 will find several waypoints listed for the same city. For example, there are many airports listed under Houston. Also, there are common city names, such as Springfield and Columbus, that exist in several different states. Check the state code to the right of the city and the identifier code on the far left to help determine which one you want. Entering the waypoint name instead of the city may be a better approach in such cases.

An important rule: **Never** enter a blank space after a city or facility name. If you do, the M1 will not find it.

The M1 will display only those cities or names which precisely match the letters you entered. In general, the first five characters of the waypoint's city and name in the M1's database exactly match the listings in airport directories. However, the following changes have been made in the M1 database to make cities and names easier to find:

1. All periods and apostrophes have been removed.
2. Any blank space between the prefix "MC" and the remainder of a name has been removed. For instance MC BRIAN will appear as MCBRIAN.
3. FORT has been abbreviated to FT.
4. SAINT has been abbreviated to ST.
5. When, NORTH, SOUTH, EAST and WEST are parts of long names, they are usually abbreviated as N, S, E and W.
6. For an airport named for a person, the initials or first names have often been deleted, unless the person is especially well-known (such as for WILL ROGERS AIRPORT).

3.4 TO/FROM INDICATOR

When the waypoint's bearing is displayed, an indicator appears showing whether the bearing is TO or FROM the desired waypoint. Unless changed by the user, the bearing displayed by the M1 will be the bearing TO the waypoint. **Exception:** A VOR waypoint displayed on the ***secondary*** readout will normally be displayed with a FROM bearing.

You may change the TO/FROM indicator in either readout to obtain a bearing which is the reciprocal of the one being displayed. To do this, press **CRSR** and turn the ***large*** knob to the left so that the flashing cursor is positioned on the TO/FROM indicator. Turn the ***small*** knob to select TO or FROM, then press **CRSR** again to turn the flashing cursor off.

ToBOS 010° 45.6nm		"To" bearing
FrBOS 190° 45.6nm		"From" bearing

If you change the TO/FROM indicator for a waypoint, that new indicator will be shown until you change it or you display another waypoint. The indicator will then automatically return to its normal status.

ALWAYS CHECK THE TO/FROM INDICATOR TO BE SURE YOU KNOW WHICH TYPE OF BEARING THE M1 IS DISPLAYING!

Note: The reciprocal of a distant waypoint may differ by an amount other than 180° because of differences in magnetic variation at that waypoint, and because the path calculated by the M1 is a Great Circle.

Note on VOR Radials: The Northstar M1 may display a bearing to or from a VOR which differs slightly from the radial shown on your OBS or RMI. The reason is that the M1 uses the current magnetic variation to display the bearing, while the VOR transmitter may not be recently calibrated for the variation. The M1 displays the actual bearing, not the nominal VOR radial. The two may differ by up to several degrees.

For this reason, it is best not to enter a fix or reporting point in terms of distance and bearing from a VOR, but

instead simply select the name of the fix from the INTERSECTION category of the database.

3.5 ENTERING YOUR OWN WAYPOINTS INTO THE DATABASE

You can add up to 250 of your own waypoints to the M1's memory. A waypoint may be added to the AIRPORT, VOR, NDB, INTERSECTION, or USER category. It may be entered using either the primary or secondary readout. Each waypoint is automatically inserted into its selected category in alphabetical or numerical order, so it can be used in the same way as all other waypoints. For example, an entry in the airport category will be included in the list of nearest airports when appropriate.

Additional waypoint information discussed in Section 3.2 cannot be entered for these new waypoints -- only the waypoint's identifier and position may be entered.

3.5.1 Adding and Defining a User Waypoint

The first step in adding a user-entered waypoint is to choose and enter the identifier of the new waypoint. User-entered waypoint identifiers can be from one to five characters in length and can consist of any combination of letters (A-Z), numbers (0-9) or special characters (#, /, or *). A blank space will be counted as a character.

1. Turn the ***large primary*** or ***secondary*** knob to **APT, VOR, NDB, INT,** or **USER** to select the category in which the waypoint is to be stored. Though you may store any waypoint in any category, you should choose the proper category to avoid confusion.

   Note: Be sure the readout is displaying a waypoint, not the LOCAL-ALL message -- turn the small knob if necessary to change it. For the USER category, if there are no waypoints already entered, you must turn the small knob to display the identifier ***** before proceeding.

2. Press **CRSR** and use the ***small*** and ***large*** knobs to enter the identifier of the new waypoint. (Don't be concerned:

in doing this you are not overwriting the waypoint displayed.) Press **CRSR** again when you're finished.

3. The M1 will display
   XXXXX UNKNOWN: STORE IT. ACK?.
   Press **ACK**.

   If a waypoint with the same identifier is already stored in the database, you will see your distance and bearing to the existing waypoint displayed instead of the above message. In this case, you must choose a different identifier. (Or, if the already-existing waypoint was user-entered, you could erase it as described in Section 3.5.2.)

Next, enter the coordinates of the new waypoint:

4. The M1 now asks how you want to specify the position of the waypoint. Turn the ***small secondary*** knob to choose one of the following four entry methods:

Method 1 -- enter present position:
THIS POS'N. ACK?

1. Press **ACK** to store the aircraft's position at the instant **ACK** is pressed.

Note: Be sure the M1 is receiving Loran signals with no warning flag present.

Note: An estimate of the accuracy of returning to this waypoint may be obtained by pressing **WARN** and reading the repeatability estimate displayed when the waypoint is defined.

Method 2 -- enter lat/lon coordinates:
LAT/LON. ACK?

1. Press **ACK**. Then, using ***small*** and ***large*** knobs:
2. Enter latitude and press **ACK**.
3. Enter longitude and press **ACK**.

Method 3 -- enter distance and bearing from existing waypoint:

D/B FR. WPT. ACK?

1. Press ACK. Then, using ***small*** and ***large*** knobs:
2. Enter distance from existing waypoint. Press ACK.
3. Enter bearing from existing waypoint. Press ACK.
4. Select the waypoint category and identifier. Press ACK.

Method 4 -- use one of ten previously-saved positions: (see Section 3.5.3)

SAVED POS'N. ACK?

1. Press ACK.

Each saved position has been temporarily identified by a phonetic alphabet word (ALFA, BRAVO, etc.) as follows:

XXXXX DEF'N IS: "ALFA" ACK?

> **Note:** You will see the most-recently-saved position first. To use this position, just press ACK. To select an earlier position, turn the small knob to the left until it is displayed, then press ACK.
>
> Note: The advisory indicator ↳ will flash if the warning indicator was on when the position was originally saved.

Now you've finished adding and defining the new waypoint. The M1 will display the waypoint's identifier and the bearing and distance to it.

The new waypoint is now a part of the database in the category you selected.

3.5.2 Erasing a User-entered Waypoint

You may find you no longer need a user-entered waypoint, or you may have entered one incorrectly and wish to erase it. To erase either:

1. Display the waypoint on the ***primary*** readout.

2. Turn the ***large secondary*** knob to **INFO**. Turn the ***small secondary*** knob until the secondary readout shows:
   ERASE XXXXX ACK?

3. Press **ACK** to erase the waypoint.

As you might expect, you may erase only those waypoints that you have entered and defined -- factory-programmed waypoints cannot be erased.

3.5.3 Saving Your Present Position

You may instantly save your present position and at a later time convert it to a database waypoint.

This is a two-step process:

1. Press **ACK** to save your position immediately. Note that up to ten positions can be saved, and when this number is exceeded the M1 automatically deletes the earliest entry.

2. Later, when time and workload permit, give the position a permanent identifier (See Section 3.5.1) and store it as a database waypoint so that it can be used.

In detail, saving your position works as follows. Whenever the **ACK** button is not illuminated or flashing, you may press it to save your position at that instant. The phonetic alphabet words ALFA, BRAVO, etc. are automatically assigned by the M1 to temporarily identify the last ten of these saved positions. Later, when you have time, you may rename any of these ten saved positions as a database waypoint as described in method 4 of Section 3.5.1 under the heading SAVED POSITN.

After you press **ACK** to save your position, the readouts will display *SAVED* ALFA. Press **ACK** a second time to clear the message. (It's a good idea to write down the temporary identifier and the location of saved positions you intend to use later, so you can easily identify them correctly.)

Note that method 1 of Section 3.5.1 describes another method of storing your present position as a waypoint. This method is described under the heading THIS POSN. This alternate method requires just one step instead of two, but requires the preparatory work of entering the waypoint identifier before the instant of saving present position.

Whichever method you choose, be sure that the **WARN**ing light is off when you save your position.

Note that saved positions are stored in the M1's memory. Thus the M1 can be turned off after a position or positions have been saved, and waypoint identifiers can be assigned, if desired, when the M1 is turned on again.

3.6 DATABASE UPDATES

As is the case with all navigational data, the waypoint information in the M1's database is subject to occasional changes. Many changes are relatively insignificant. Others can be critical, such as airports which have been abandoned, or VORs that have been moved or whose identifiers have been changed.

To keep your M1 current, Northstar Avionics makes available updates for your database. Although specific advice cannot be given, it is recommended that your M1 database be updated once or twice a year so that its information might be sufficiently current for VFR use.

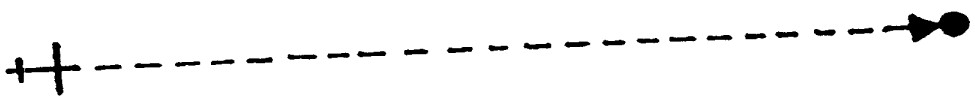
The revision date for your present database is displayed when the unit is turned on, and as one of the **SETUP** functions. New updates are made available on a 56-day cycle. The update can be performed quickly by your dealer in his shop, or at the Northstar factory. Contact your dealer for pricing and availability information.

With the M1 Navigator, you can instantly access information about any one of thousands of waypoints, and you have the ability to enter many of your own. But the primary purpose of waypoints is to help you to navigate. How to do that is the subject of the following sections.

Section 4 - SIMPLE NAVIGATION

This section explains how to fly simple, straightforward flight paths with the M1, such as flying direct to a waypoint, or flying a constant heading. Navigating automatically between two or more waypoints can be done with a flight plan, which is described in Section 5.

4.1 FLYING DIRECT TO A WAYPOINT



The simplest way to navigate with the M1 is to fly directly from your present position to a waypoint. To do this:

1. Pick your waypoint and display it in the ***primary*** (left-hand) readout. (Section 3.3 explains how to do this.)

2. Press the button marked **–D→** (direct). The **ACK** button will flash.

3. Press the **ACK** button.
   You have just defined and confirmed a flight path direct from your present position to the waypoint and the M1 is ready to navigate.

4. The ***primary*** readout will automatically switch to the **TRK** position, and its annunciator will light. Turn the ***small primary*** knob to select any of the following track functions (the displays shown are typical and are further described in Section 4.4):

   a. The lat/long of your starting point:
   Fr 42°26.2' 71°25.8'

b. The lat/long of the waypoint:
42°21.9' 71°00.4'

c. The track you are following:
BOS ▲ DIRECT

d. The bearing and distance to the waypoint:
BOS ▲ 118° 19.3NM

e. Course Deviation Indicator:
[' ' ' ' ' ◆ ' ' ' ' ']

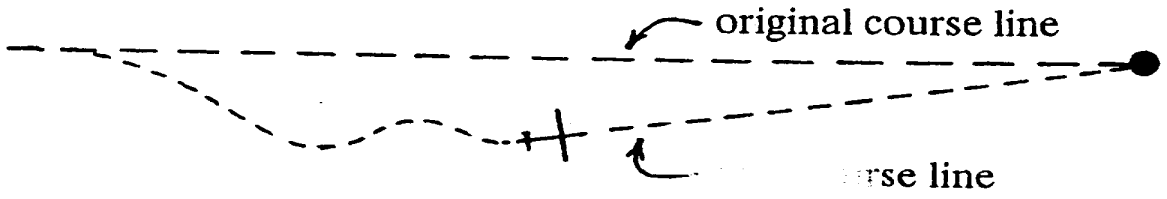
f. Your ground speed and estimated time enroute:
GS 145KT ETE 1:35

g. Your cross-track distance:
FLY RIGHT 1.2NM

h. Your estimated time of arrival:
ETA 2:44 Z

While enroute, you can select any of the displays at any time to review waypoint information, check your current bearing and distance, navigate with the CDI, etc. The M1 will continue to update and display track information no matter what heading you fly or how far you stray from your original course line.

4.2 RESETTING THE CDI



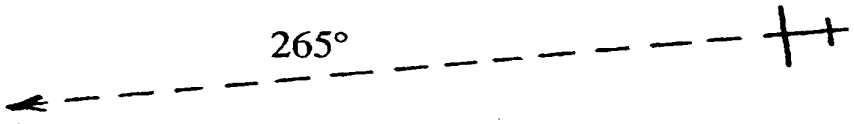
When you set up the M1 to navigate to a waypoint, it automatically sets the CDI for the course line direct to the waypoint. However, when flying to the waypoint, you might stray off the course line and want to use the CDI to fly straight to the waypoint without returning to the original course line. To do this:

1. Turn the ***large primary*** knob to **TRK**.

2. Press **–D→** and **ACK**.

The M1 will resume normal operation, and when you return to the CDI display, you'll see that the course line has been moved to run from your present position direct to the waypoint.

4.3 FLYING A COURSE



Another basic form of navigation you can perform with the M1 is to fly a particular course without specifying a waypoint as a destination. To do this:

1. Turn the ***large primary*** knob to **TRK**.

2. Press the button marked **–D→** . (Don't press **ACK** yet.)

   FLY 265° ACK?

3. Turn the ***small primary*** knob to select the course you wish to fly. When it is correct, press **ACK**. The M1 is now ready to navigate with the designated course.

4. Turn the ***small primary*** knob to see the following typical displays:

   a. The lat/long of your starting point:
   F 42°26.2' 71°25.8'

   b. The course you chose to fly:
   FLYING 265°

   c. Course Deviation Indicator:
   [' ' ' ' ' ' ' ' ' ' ']

   d. Your cross-track distance:
   FLY RIGHT 0.25

As is the case with flying to a waypoint, you can select any of the following displays at any time to review flight information or to navigate with the CDI.

4.4 TRACK FUNCTIONS AND DISPLAYS

You have noticed that the M1 automatically switched to the track display when you set it up to navigate to a waypoint. While operating the M1, you will have to manually switch the primary display at times in order to access or re-access the track functions. The functions shown will depend on how you have set up the M1 to navigate. For instance, if you are flying to a course, only course track functions will appear.

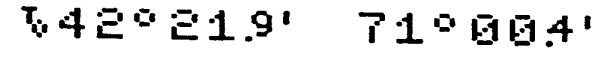
To manually access the M1's track functions and their displays at any time:

1. Set the ***large primary*** knob to **TRK**.

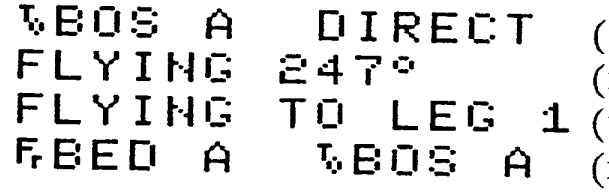
2. Turn the ***small primary*** knob to select one or more of the following functions (typical displays are shown):

4.4.1. The lat/long of your starting point:

4.4.2. The lat/long of the waypoint:

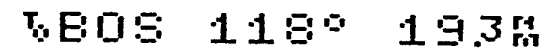


4.4.3. The track you are following: (any one of the following may appear, depending on how you specified the track).



(to a waypoint)
(flying a course)
(to a flight plan)
(in a flight plan)

4.4.4. The bearing and distance to the waypoint:



4.4.5. Course Deviation Indicator:

This display for the M1's built-in electronic CDI simulates the needle of a mechanical CDI. The vertical line represents your desired track. When it moves to the right of center, your course line is to your right. Fly to the needle as in conventional VOR navigation to stay on course.

4.4.6. Your ground speed and estimated time enroute:

The M1 calculates the distance to the next waypoint, divides it by your ground speed, and shows this as your ETE. In other words, the displayed ETE is the time it would take you to get to the waypoint if you flew directly there from your present position at your present speed. If you are more than 4 miles off your defined course line, the ETE display will automatically flash, as the M1 senses that you do not appear to be flying to the designated waypoint.

If you are following a flight plan (Section 5), the above display is shown instead as:

showing the estimated time remaining before your next turn, and the course line of the next leg.

4.4.7. Cross-track distance (distance off-course):

This display means that the course line from your starting position to your destination is 2.2 nautical miles to your left. You should turn to the left to get back on course.

4.4.8. Your estimated time of arrival:

ETA 2:44 Z

ETA is calculated from the time-of-day you set in the **SETUP** function, described in Section 2. The ETA flashes if you are more than 4 miles off your course line. As shipped from the factory, the M1 shows ETA as ZULU time. To change to a local time zone, press **CRSR** and use the ***small primary*** knob to select the desired local standard or daylight time. Press **CRSR** again after you have set the desired time zone. (Note: changing the ETA time zone does not change the time zone displayed in the TIME IS setup function.)

The available time zone abbreviations and their meanings are shown below.

Z	Coordinated Universal Time
SST	Samoa Standard Time
HAS	Hawaii-Aleutian Standard Time
AKS	Alaska Standard Time
PST	Pacific Standard Time
MST	Mountain Standard Time
CST	Central Standard Time
EST	Eastern Standard Time
ATS	Atlantic Standard Time
GST	Greenland Standard Time
SDT	Samoa Daylight Time
HAD	Hawaii-Aleutian Daylight Time
AKD	Alaska Daylight Time
PDT	Pacific Daylight Time
MDT	Mountain Daylight Time
CDT	Central Daylight Time
EDT	Eastern Daylight Time
ATD	Atlantic Daylight Time
GDT	Greenland Daylight Time

4.4.9 Waypoint Category Indicators

When the M1's **TRACK** and **FPL** functions are used, the small letter following the waypoint identifier in the display indicates the waypoint category according to the following table:

A	Public Airport
M	Military Airport
F	Private Airport
H	Heliport
S	Seaplane base
V	VOR
N	NDB
I	Intersection
U	User-entered waypoint (from **any** category)

(Waypoints using codes H and S are available only in optional databases for specialized applications.)

4.5 INFO DISPLAYS

When the ***primary*** readout is displaying **TRACK** data, you may set the ***secondary*** readout to the **INFO** position to show another preset **TRACK** display at the same time.

4.6 OFF-COURSE ALARM

If you deviate from the calculated flight path by more than 4 miles, the Northstar M1 informs you by flashing the **ACK** button. When this happens, press the **ACK** button and the message OFF-COURSE ALARM will appear in the display. Press the **ACK** button again to clear the message.

(this page intentionally left blank)

Section 5 - FLIGHT PLAN NAVIGATION

This section introduces the subject of flight plans. It tells you how to specify a flight plan with the Northstar M1 Navigator and how the M1 can guide you through a flight plan automatically. You will also learn about the various in-flight advisory messages that the M1 will give you, how to revise your flight plan before or during flight, how to divert from it, and more.

5.1 GENERAL INFORMATION

Flight Planning vs Simple Navigation

You have already learned how to set up and operate the M1 for simple navigation. Although the setup procedure for flight planning is different, the operation of M1 controls and displays and the techniques used are similar. The only major difference is that, whereas the techniques covered in the previous section dealt with navigating to a single waypoint, a flight plan involves specifying and navigating to a sequence of waypoints.

> Please Note: You can gain the full benefits of navigating with your M1 either by employing its extensive flight planning capabilities to make your workload easier at each intermediate waypoint, or by simply navigating direct to each intermediate waypoint as described in Section 4.
>
> When considering use of the M1 for flight planning purposes, you should take into account the possible changes you might have to make to the plan while enroute. If you expect many changes, it might be easier to navigate from point-to-point with the M1 rather than specifying an entire flight plan.

Flight Planning Basics

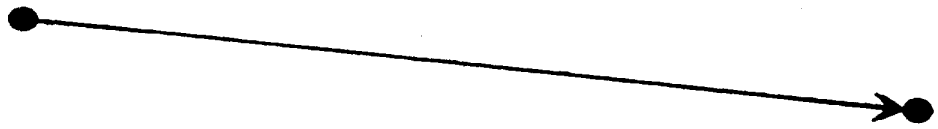


Figure 5-1
A Simple Flight Plan

Flight plans can be simple or complex. The simplest plan consists of only two points: a point of departure or some other starting point, and a destination (see Figure 5-1). Such a flight plan has one "leg," which is the course line between the two points. Obviously, you could fly the flight plan shown by simply selecting waypoints from the M1's database and flying point-to-point. However, with the M1's flight planning capability, you can preselect the points and the M1 will automatically guide you through the plan. That's the simplest case.

Figure 5-2
A More Complicated Flight Plan

Your flight plan could be more complicated (see Figure 5-2). It could consist of a point of departure or some other starting point, a destination, and several locations that you must successively fly to in between. In the example above, a number of legs--or course lines between successive points--is involved. Following this more complicated plan is obviously not a simple procedure. However, with the M1's flight planning capability, you can specify all of the points in such a plan (and more complicated plans) and the M1 will automatically guide you through it.

Flight Planning Terminology

In using loran for flight planning, care must be taken with use of the term "waypoint."

In air navigation, the terms "waypoint" or "checkpoint" are used to describe intermediate points specified in a flight plan; that is, all of the points between the departure point and the destination of a plan. In loran navigation the term "waypoint" is used to describe specific geographical locations, and hence "waypoint" is used to describe the locations stored in the M1 database.

Therefore, in order to avoid possible confusion or misunderstanding, whenever reference is made in this section of the manual (5.1) to a "waypoint," as the term is used in air navigation as described above, the term "intermediate waypoint" will be used instead. The same terminology can also be interpreted to mean "checkpoint."

The M1 Flight Planning Capability

The Northstar M1 can accept and store a flight plan using up to a total of twenty waypoints specified from the M1's database. These waypoints can be used to specify the point of departure or a starting point, intermediate waypoint(s), and the destination of a plan. The M1 will accept a flight plan of up to nineteen or twenty legs, depending on the option chosen to specify the point of departure or starting point (see Section 5.2).

Flight Planning Considerations

You can gain the full benefits of navigating with your M1 by employing its extensive flight planning capabilities to make your workload easier at each intermediate waypoint, or by using the M1 for simple navigation, as described in Section 4.

When considering use of the M1 for flight planning purposes, you should take into account the possible changes you might have to make to the plan while enroute. If you expect many changes, it might be easier to simply navigate from point-to-point with the M1 rather than specifying an entire flight plan.

Accessing M1 Flight Plan Capabilities and Basic Procedures

Flight planning involves two basic procedures: first, specifying the flight plan (Section 5.2); then activating and following it (Section 5.3). You can make revisions to the plan at any time (Sections 5.5 and 5.6).

The flight planning features of the M1 navigator are accessed by turning the large primary knob to **FPL**. The ***primary*** readout shows one leg of the flight plan. Turning the ***small primary*** knob allows you to examine each leg of the flight plan, one leg at a time.

One leg might be displayed like this:

Note that a letter follows the waypoint identifiers to indicate the waypoint's category. The two letter A's in the example above indicate that both these waypoints are airports. The following table lists the available waypoint categories:

A	Public Airport
M	Military Airport
F	Private Airport
H	Heliport
S	Seaplane base
V	VOR
N	NDB
I	Intersection
U	User-entered waypoint (from **any** category)

The ***secondary*** readout shows information and command functions for the leg shown in the ***primary*** readout. Turn the ***large secondary*** knob to see these.

5.2 ENTERING A FLIGHT PLAN

1. Turn the ***large primary*** knob to FPL.

2. If a flight plan is already defined within the M1's memory, as a first step you must erase this old flight plan by turning the ***large secondary*** knob to display ERASE PLAN ACK?. Then press ACK twice. The old flight plan is now erased.

3. The M1 now displays
   Fr????? To ADD WAYPT. ACK?
   Press ACK to prepare to add the first waypoint to the flight plan.

4. Use the ***secondary*** knobs to specify the category (such as AIRPORTS) and the identifier (such as BOS) of the first waypoint. You may use either the cursor method or the scanning method described earlier in Section 3.3. Press ACK.

5. The M1 displays
   Fr BOS To????? ADD WAYPT. ACK?
   Press ACK, and enter the next waypoint of the flight plan as described in Step 4.

6. Repeat steps 5 and 4 to enter each remaining leg.

Note: A special feature makes it easy to jump back and forth from using the primary side to search for waypoints by city or by name, to using the secondary side to enter waypoints into your flight plan.

If you display any waypoint on the primary side, that waypoint will automatically be the first waypoint to be displayed on the secondary side when you jump back to enter the next flight plan leg.

5.3 FOLLOWING A FLIGHT PLAN

A flight plan is activated only when you display the first leg you want to follow, and then press –D→ and ACK as described below.

In addition to guiding you **along** the flight plan that you specified, the M1 will always guide you **directly to** the first leg of the flight plan. It does this by figuring the flight path from your present position to the first leg (See Figure 5-1 and 5-2). Since you always start on this special flight path, your cross-track distance will always start at zero when you begin following a flight plan. When you reach the first leg, the M1 will automatically switch to it.

You have a choice of flying direct to the first waypoint (Step 4a), or of flying a course which will intercept the leg between the two waypoints (Step 4b). Here's how to do it:

1. Turn the ***large primary*** knob to FPL.

   Note: The secondary readout must be displaying data, not asking you a question, before you can continue. If the ACK light is flashing, turn the large secondary knob to the left until it stops.

2. Turn the ***small primary*** knob all the way to the left to display the first leg. (If you want to start at an intermediate leg rather than the first, then display that leg instead.)

   Notice the small flashing arrow (a DIRECT symbol) which points to one of the two waypoints defining the leg. The arrow points to the waypoint to which you will fly in the next step.

3. Press –D→. The M1 will display

```
FLY 135° DIRECT TO BOS  ACK?
```

4a. If you wish to fly direct to the first waypoint, just press **ACK**.

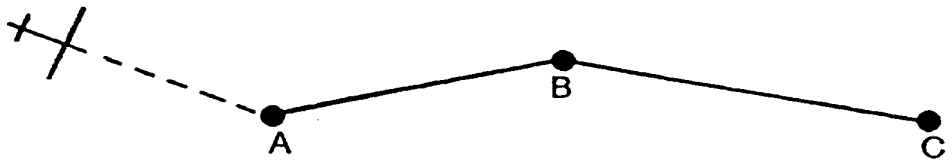


Figure 5-3
Direct to the First Waypoint

-or, instead-

4b. If you wish to intercept the first leg of the flight plan at some point along the leg: before you press **ACK** turn the ***small primary*** knob to change the displayed heading. The M1 will show the resulting intercept angle for each heading you select.

```
FLY 100° INTERCEPT AT 30° ACK?
```

Use the ***small primary*** knob to choose the heading to fly and the intercept angle, and press **ACK**.

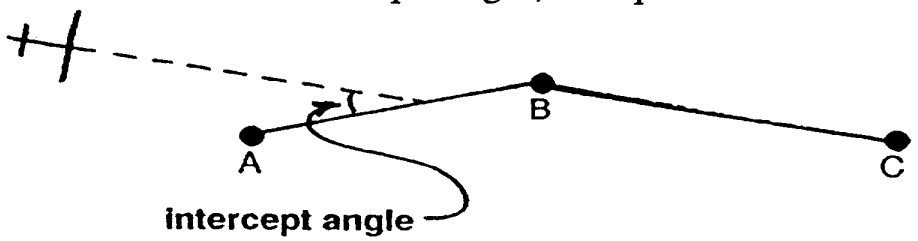


Figure 5-4
Intercepting the First Leg

The M1 will sequence automatically from one leg to the next as you fly.

5.4 HOW THE M1 CHANGES WAYPOINTS

Figure 5-5 shows how the Northstar M1 guides you from one leg to the next as you approach a waypoint. It calculates the point at which you should start a two-minute turn in order to end up on the next leg with the same amount of cross-track distance as you had going into the turn. One minute before you reach this point, the M1 flashes the **ACK** button (asking you to press it). When you press **ACK**, you will see the heading of the next leg, and the time remaining before you should start the turn. Start a two-minute turn to this new heading when this time counts down to zero, and you will end up on the new leg. (The M1 does not take account of any winds which might change the time at which you should start the turn.)

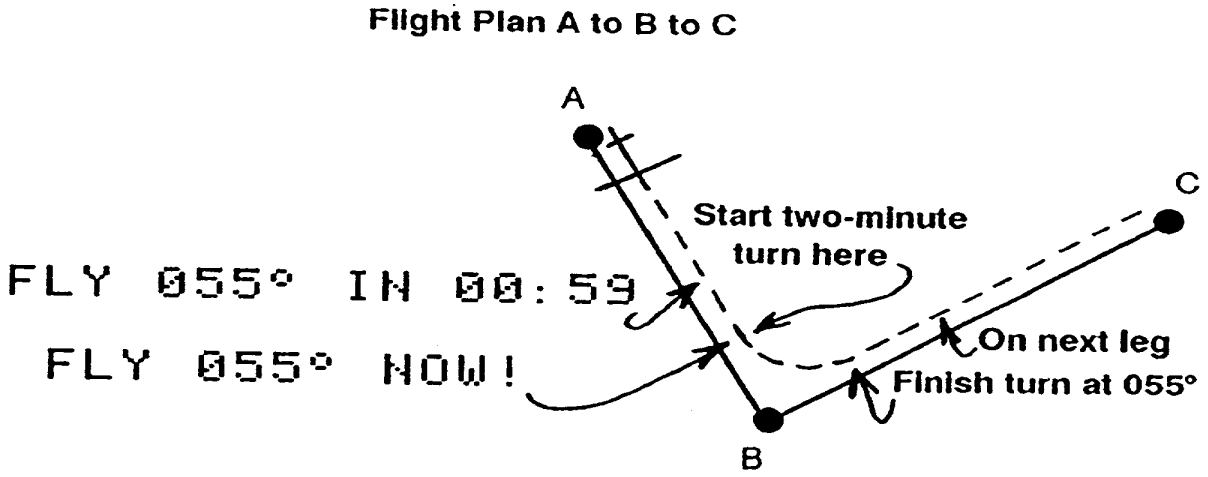


Figure 5-5
Changing Waypoints

If you are off-course by more than four miles coming into the turn, the M1 will not attempt to guide you around the turn but will simply tell you when it has switched to the next leg.

As you might expect, if you are far off-course and not really attempting to follow the flight plan, the M1 may appear to act strangely as it attempts to give you instructions to get you back on the flight plan. Don't be alarmed. You may CANCEL the flight

plan if you no longer wish to follow it, or you may tell the M1 to fly direct to another waypoint, thus cancelling the flight plan.

Advisory messages:

Several messages are activated automatically by the Northstar M1 to inform you of your progress along the flight plan. The **ACK** button flashes to indicate that a message is waiting. Press **ACK** to display the message. Press **ACK** again to clear the message.

1. OFF-COURSE ALARM

   If you deviate from the calculated flight path by more than 4 miles, the Northstar M1 informs you with the above message.

2. FLY 347° IN 0:55

   If you are on-course when you approach within one minute of a waypoint, the Northstar M1 displays the heading of the next leg, along with the time remaining before you should start the turn.

3. NOW ON LEG 3

   If you approach a waypoint while more than four miles off-course, the M1 assumes you have some good reason for being off course and it does not attempt to tell you when to make the turn. It does, however, inform you with this message when it automatically switches to the next leg.

5.5 FLIGHT PLAN INFORMATION

The ***secondary*** readout gives additional information about the flight plan leg displayed in the ***primary*** readout. The information you see depends on whether or not you are following the flight plan.

If you are **not** following a flight plan (that is, if you canceled the previous plan), turning the ***large secondary*** knob makes the following functions appear in the secondary readout:

a. `1ST LEG` / `2ND LEG` / `3RD LEG` etc. — Identifies the leg shown on the primary readout.

b. `BOSTON MA` — Displays additional information from the database about the "To" waypoint currently displayed. Use the ***small secondary*** knob to select the specific information you want.

c. `TCA/ARSA: NONE` / `BOSTON TCA` / `PROVIDENCE ARSA` — The leg displayed on the ***primary*** readout passes through the controlled areas shown

d. `B/D: 287° 17.3NM` Displays the bearing and distance of **this** leg of the flight plan. (Turn the ***small primary*** knob beyond the last leg of the flight plan to read the **total** distance of the flight plan.)

e. `ADD WAYPT. ACK?` Press **ACK** to add a waypoint to the end of the flight plan.

f. `INSERT W/P ACK?` Press **ACK** to insert a new waypoint between the "To" and "From" waypoints.

g. CHANGE BOS ACK? Press **ACK** to change the "To" waypoint.

h. DELETE BOS ACK? Press **ACK** to delete the "To" waypoint from the flight plan.

i. ERASE PLAN ACK? Press **ACK** (twice) to erase the flight plan so that a new plan may be entered.

j. REVERS. PLAN ACK? Press **ACK** to reverse the order of the entire flight plan (end for end) so you may follow it in the reverse order.

The following functions are available when you are following a flight plan:

a. PRESENT LEG
4TH LEG AHEAD
3RD LEG BACK
Identifies the leg shown on the primary readout, relative to the leg you are currently flying.

b. BOSTON MA Information from the database about the "To" waypoint.

c. TCA/ARSA: NONE
BOSTON TCA
PROVIDENCE ARSA
The leg displayed on the *primary* readout passes through the controlled areas shown.

d. B/D: 287° 173NM Displays the bearing and distance of this leg of the flight plan.

e. ADD WAYPT. ACK? Press **ACK** to add a waypoint to the end of the flight plan.

f. CANCEL PLAN ACK? Press **ACK** to stop following this flight plan. (The flight plan is **not** erased.)

5.6 CHANGING A FLIGHT PLAN

It's rare (at least in busy areas) to be able to follow a flight plan without having to make changes to it as you fly. Here are the different ways you can modify it as you go:

> Remember -- you never actually change your intended flight path until you press –D→ and ACK.

Option 1:

You may divert from the flight plan to any database waypoint:

1. Display that waypoint on the ***primary*** readout.
2. Press –D→ and ACK.

Diverting from the flight plan cancels the plan; you may return to any leg of the flight plan using Option 3 below.

Option 2:

You may divert from the flight plan by flying any heading you choose:

1. Turn the ***large primary*** knob to TRK. Press –D→.
2. Turn the ***small primary*** knob to select the heading you wish to fly.
3. Press ACK.

Diverting from the flight plan cancels the plan; you may return to any leg of the flight plan using Option 3 below.

Option 3:

You may fly to any leg of the flight plan. Use exactly the same procedure as when you first started to follow the flight plan as described in Section 5.3. Choose the leg which you wish to rejoin, and either fly to the "To" waypoint of that leg, or intercept the leg in the middle.

Option 4:

You may add one or more waypoints to the end of the flight plan at any time by using the same ADD WAYPOINT function you used earlier when entering the flight plan in Section 5.2.

Option 5:

You may edit the flight plan by using the DELETE, INSERT and CHANGE functions described above in Section 5.5. Note: if you're following a flight plan you must CANCEL (not ERASE) the flight plan before editing it.

(this page intentionally left blank)

Section 6 - MISCELLANEOUS FUNCTIONS

6.1 AIRALERT™ CONTROLLED AIRSPACE ALERT

The US Airspace system presently contains Terminal Control Areas (TCAs) and Airport Radar Service Areas (ARSAs). Within these areas the pilot is required to maintain radio contact. Both TCAs and ARSAs nominally have an inverted "wedding cake" shape, although most TCAs and some ARSAs actually have a highly irregular shape. When the aircraft is near or likely to penetrate controlled airspace, **Airalert™** provides information needed either to avoid the area, or to comply with the regulations for entry.

You may shut off the alerts for any one controlled area, or for all areas, if you wish. (See Section 6.1.5.)

Airalert is programmed with precise descriptions of the **outer boundaries** of all TCAs and ARSAs. No separate warning is given for the inner, lower altitude boundaries.

To display the names of all the TCAs and ARSAs in the database, turn the ***large primary*** knob to **SETUP**. Turn the ***small secondary*** knob to scan through all the controlled areas stored in the M1. The areas are divided into LOCAL and ALL groups in the same manner as waypoints. The LOCAL group contains the areas whose centers lie within roughly 100nm of your present position. You will see the name of each area, and the bearing and distance to its center from your present position.

BOSTON TCA 087° 57.1NM

As new, controlled areas are added to the nation's airspace, they will be included in future database updates for the M1.

6.1.1 What generates an *Airalert* message:

The Airalert feature of the Northstar M1 alerts you when you are likely to enter a TCA or an ARSA requiring radio communication

and control. Specifically, a **continuous** alert is given when any of the following conditions exists:

1. You are inside a controlled area, or
2. You are passing within approximately 5 miles of a controlled area, or
3. You are approximately 10 minutes from penetrating a controlled area.

In addition, a **one-time** alert will be given shortly after you specify a new flight path if that flight path passes through a controlled area. The flight path is tested when you:

1. use **–D→** and **ACK** to fly direct to a waypoint,
2. use **–D→** and **ACK** to fly a heading,
3. change a parallel offset, or
4. activate new flight plan leg.

The M1 checks your "future track" for controlled airspace penetration and displays the names of up to **five** areas that the track will penetrate. Flying a heading, your track is checked up to 100nm ahead of your present position. Other situations check a great circle track as far as the waypoint, or 1000nm, whichever comes first.

This ***Airalert*** message appears as

BOSTON TCA IN FUTURE TRACK .

6.1.2 How to use *Airalert*:

When the M1 detects any of the conditions described above, the **ALRT** button will flash. Press it to display a message describing the situation. Press **ALRT** again to return to the normal navigation display. The **ALRT** button remains illuminated while you are in or near controlled airspace. You may press **ALRT** any time it is illuminated to check the time to the outermost boundary or the distance to the center.

6.1.3 *Airalert* Information:

When you press **ALRT** in response to an *Airalert* message, the following information is displayed (and continuously updated as you fly):

Name of the TCA or ARSA
Bearing and distance to the **center** of the area
Status relative to the **outermost boundary** of the area:
- Time to penetration
- CLOSE or CL
- INSIDE
- CLEAR

Radio call name and frequency for entering the area

Example 1: If you were inside the Providence ARSA, you would see the following two messages alternating on the readout:

```
PROVIDENCE ARSA   237° 7.2M INSIDE
QUONSET: 118.6    237° 7.2M INSIDE
```

The center of the ARSA is 7.2nm away at 237°. The radio call for Providence is **QUONSET APPROACH**, on 118.6 MHz.

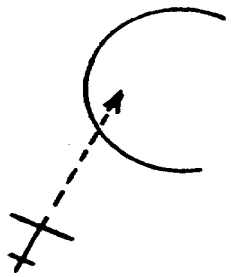
Example 2: If you had just passed the ten-minute mark from the Boston TCA outer boundary, you would see the following:

```
     BOSTON TCA   161° 34.5M 09:55
APPROACH: 120.6   161° 34.5M 09:55
```

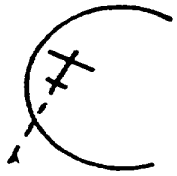
The time indicates just under ten minutes from the boundary. The center of the TCA is 34.5nm at 161°. The radio call is **BOSTON APPROACH**, so no separate call name is shown.

The **bearing and distance** always refer to the *center* of the controlled area, and are useful for monitoring your distance from inner, lower altitude boundaries of the area. For example, if the boundary at your altitude is a 10-mile ring, and the M1 displays 12 nm, you know you are 2 nm from the boundary.

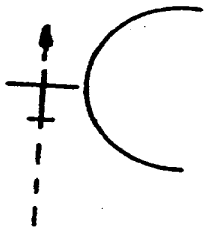
The **time** displayed on the right-hand end of the readout is the estimated time remaining before you will penetrate the *outermost boundary* of the area, based on your present track angle and ground speed as calculated by the M1. The time to penetration is always displayed if the M1 calculates penetration of the outer boundary will happen within about ten minutes.



The word INSIDE on the right-hand end means you are now inside the area.



The word CLOSE on the right-hand end means there is a controlled area somewhere within about five miles of your present position, but your present track indicates you will not penetrate it. Don't make a turn without checking your chart.



The symbol ⋐ is an abbreviation for CLOSE, and is used when you are under ten minutes to penetration, to indicate you are within about four miles of a controlled area. This may be the same area you are about to penetrate, but it might be a separate lobe of the same area, or even an entirely different controlled area. Unless you know the area well, don't make a turn without checking your chart.

The word CLEAR on the right-hand end means you have left the area and no penetration warning, or "close" warning, is needed.

The displayed **frequency** corresponds to the particular sector from which you are approaching the area. Frequencies are those listed in the *Airport/Facility Directory*. The radio call name and frequency alternate with the area name.

Note: The multi-lobed New York TCA is split into three separate sections (for JFK, EWR and LGA airports), and the Washington TCA is split into two sections (for DCA and ADW airports). This allows the M1 to display your distance to the airport whose sector you are entering so you can monitor your distance to the 20- or 15-mile boundary of that sector.

Note: It is normal for the time-to-penetration to show substantial jitter -- this calculation is quite complex and is intended as an approximation.

The FUTURE TRACK alert described earlier does not provide any additional information about the area until you actually approach it.

6.1.4 *Airalert* Limitations:

1. The M1 assumes you are flying at the altitude corresponding to the **largest** perimeter of the controlled area. That is, if you are flying at a relatively low altitude, the M1 will alert when you are about to fly **under** the edge of an area. Once you are under a TCA, you must monitor your distance to the boundary that corresponds to your particular altitude. The M1 does not know your altitude, and so will not supply an alert when you cross the boundary that applies to that altitude.

2. The time-to-penetration is calculated from the M1's track angle and ground speed. You may see a lag of up to two minutes or so, after you change your heading or speed, before any alert made necessary by that change is shown.

3. If you take off near or inside a controlled area, you will naturally get less than a ten-minute warning of penetration.

4. It is very possible for the M1 to simultaneously indicate that you are near one controlled area but will soon penetrate another area. (The time indicated may refer to a different area than the ⊑ symbol refers to.) When you unexpectedly see the ⊑ symbol, it's best to check your chart unless you know the area well.

5. If you are just beginning to learn to use the M1 for the first time, you may wish to disable the **Airalert** feature (as described on the next page) until you feel comfortable using the M1's many other features. Although **Airalert** is very useful, you may prefer to take one step at a time in learning the M1's various operations.

6. The **Airalert** feature is designed to be used as a backup to the pilot's normal navigation procedures. It is the pilot's responsibility to know where he is and where he is going at all times. A chart depicting the controlled area should always be used with the M1. **Airalert** is intended to be a reminder or verification of what the pilot should already know. The data in the M1 has been carefully checked, but it is always possible that errors exist, and new ARSAs are constantly being added to the national airspace. Area boundaries and frequencies may be changed at any time. Northstar Avionics does not encourage pilots to lose their navigation skills by becoming overly-reliant on any one system.

6.1.5 Disabling the *Airalert* messages

If you regularly fly in or near an area whose boundaries you know well, you may not want the M1 to alert you every time you approach the area. Also, when you are flying IFR, you may not want to be given any airspace alerts at all. The Northstar M1 allows you to disable alerts for one particular area, or for all areas.

To turn the alerts off or on:

1. Turn the ***large primary*** knob to **SETUP**.

2. Turn the ***small primary*** knob to display a message like one of the following, indicating the present status of **Airalert**:

```
ALL TCAs AND ARSAs AIRALERT ON
ALL TCAs AND ARSAs NO AIRALERT
      ATLANTA TCA NO AIRALERT
       BOSTON TCA NO AIRALERT
```

   etc.

3. Turn the ***small secondary*** knob to select the desired new status, choosing between three options: **Airalert ON**, **Airalert OFF**, or disabling the warnings for just a single designated area. For the third option, continue turning the knob to the right to scan through all the TCA and ARSA names in the database. Select and display the one particular area you want to disable.

   Note: for those areas which are split into sections (New York and Washington), only one section may be disabled at a time.

4. Press **ACK** to confirm your new selection.

When the **Airalert** system is disabled, a warning message appears each time the M1 is turned on -- before it can be used -- reminding you that the feature is not fully operational. The **WARN** button will flash. Press it to read the message and press it again to turn off the message.

```
AIRALERT IS OFF: WASHINGTON TCA
AIRALERT IS OFF: ALL TCAs&ARSAs
```

No warning is shown if the **Airalert** feature is active for all areas.

This same status message may be displayed by pressing the **ALRT** button any time that it is not already illuminated.

6.1.6 Mode C Veil Alert

Recent changes to federal regulations (FAR 91.24) require pilots to operate, or "squawk," their Mode C altitude encoding equipment whenever flying within a thirty-mile radius of the primary airport in a Terminal Control Area. The Northstar M1 provides an alert to the pilot whenever the aircraft is within or near such a radius, or when the projected track indicates that the aircraft will penetrate this radius within approximately ten minutes. If, however, the aircraft is in, or projected into, a TCA or ARSA, the TCA/ARSA warning is given priority.

This new capability has been added to the M1's *Airalert*™ feature. The display format is the same as the TCA and ARSA alerts, except that, instead of the TCA or ARSA name, the M1 displays:

```
MODE C ALERT  351° 24.2N SQUAWK
```

NOTE: The distance and bearing to the MODE C center may be slightly different than the distance and bearing to the TCA center. This is because MODE C areas are centered on the Airport Reference Point of the primary airport, whereas TCAs are generally centered on a VOR or other similar point.

A new function has been added under the **SETUP** category to separately disable this alert function:

```
MODE C ALERT  ON  ACK?
MODE C ALERT  OFF ACK?
```

Turn the ***large primary knob*** to **SETUP**. Turn the ***small primary knob*** to display the above function. Turn the ***small secondary knob*** to display ON or OFF as desired, and then press **ACK**.

In addition, disabling any TCA alerts will also disable MODE C alerts for those TCA areas.

Please remember that this feature is intended as an advisory only, and that responsibility for compliance with federal regulations always rests entirely with the pilot.

6.2 STARGUARD™ THEFT-PROTECTION SYSTEM

The Northstar M1 loran is fast becoming *the* navigation aid for increasing numbers of pilots. Unfortunately, a few cases have been reported where somebody apparently didn't want to go the normal route of purchasing his own M1 and, instead, just removed an M1 from an aircraft parked on the ramp. Northstar Avionics now offers **Starguard** as a standard feature on all M1's to help alleviate this problem. **Starguard** gives you the option of using two levels of security protection, if you wish.

You may simply leave **Starguard** inactive if you do not wish to use it. It will not impede your operation of the M1 whatsoever.

To activate the first level of protection, your personal access code is used once to enter a special message that is subsequently displayed each time the M1 is turned on, identifying you as the owner.

Activating the full **Starguard** protection prohibits the M1 from functioning at all until your access code has been entered.

A window decal is provided reminding any would-be thief that the Northstar M1 will not function if removed from the aircraft.

6.2.1 Your Personal Access Code:

A plastic card embossed with your access code will be mailed directly to the address shown on your owner's registration card. Under no circumstances will this code be given out over the telephone. ***Be sure your registration card is filled out and mailed with a complete address, so that we may send this access card (and any other update information) to you!***

You may always use this code to access **Starguard**. If you wish to add an alternate, or second, access code, you may do so as described below. Either code may then be used.

To add a second access code that has more meaning to you:

You may choose a new access code up to six characters long, containing the characters A-Z, 0-9, and blank.

1. Turn the large primary knob to **SETUP**. Turn the small primary knob to display ADD ALT. CODE? ACK? Press **ACK**.

2. The M1 will first ask you to enter your existing code. Use the ***small*** and ***large secondary*** knobs to enter the characters, then press **ACK**.

3. The M1 will ask you to enter your new code. Use the ***small*** and ***large secondary*** knobs to enter the characters, then press **ACK**.

4. The M1 will ask you to enter your new code a second time to verify it. Use the secondary knobs, then press **ACK**.

6.2.3 LEVEL 1: Entering your own personal message to be displayed when the M1 is turned on. (Letters, numbers and several punctuation characters are available for your message.)

1. Turn the ***large primary*** knob to **SETUP**. Turn the ***small primary*** knob to display CHANGE YOUR MSG ACK? Press **ACK**.

2. The M1 will ask for your access code:
   YOUR CODE, PLEASE ACK?

3. Use the ***small*** and ***large secondary*** knobs to enter the characters of your access code, then press **ACK**.

4. The M1 will ask you to enter the left-most 16 characters of your message: ACK? LEFT MSG: Use the ***small*** and ***large secondary*** knobs to enter the characters. Press **ACK** when done.

5. The M1 will ask you to enter the right-most 16 characters of your message: ACK? RIGHT MSG: Use the ***small*** and ***large secondary*** knobs to enter the characters. Press **ACK** when done.

6.2.4 LEVEL 2: Activating *Starguard* full protection:

Since the fully-activated **Starguard** requires you to enter your access code every time you turn the M1 on, you may wish to activate this feature only when the aircraft will be left unattended for a long period of time. You may activate or deactivate it at any time.

1. Turn the ***large primary*** knob to **SETUP**. Turn the ***small primary*** knob to the right to display: STARGUARD: OFF

2. Turn the ***small secondary*** knob to change the word OFF to ON, and press **ACK**.

3. The M1 will ask you to enter your access code as described above.

4. If you have entered the code correctly, the M1 will display
   OK, THANK YOU and activate **Starguard**. The M1 will now require entry of the correct code every time it is turned on, until you decide to deactivate **Starguard**.

To deactivate, display the STARGUARD message as described above and turn the ***small secondary*** knob to OFF. Then press **ACK**.

6.3 COURSE AND SPEED

CRS 270° GS 142↑

The M1 displays the current COURSE and SPEED of your aircraft. Turn the large secondary knob to **C/S**. The COURSE (track angle) and GROUND SPEED are calculated from the plane's recent position history during the past minute or two. (You must hold a constant speed and heading for at least two minutes for these calculations to be accurate.)

The course and speed calculations require very good loran signals to provide useful information. In the "mid-continent gap" the course and speed readings will be substantially more jittery than in other areas. In very poor signal areas (southwestern Texas, southern New Mexico and Arizona) the course and speed readouts may not be usable at all.

6.4 WINDS ALOFT

With the large secondary knob set to **C/S**, turn the ***small secondary*** knob to display the true air speed and heading which you entered manually the last time you used this function. Press **CRSR** and use the ***large*** and ***small*** knobs to change these quantities to their present values (press **ACK** after each). The M1 compares these with your GROUND SPEED and TRACK ANGLE, which it determines from loran signals, then calculates and displays the speed and direction of WINDS ALOFT. You must have been holding a steady speed and course for several minutes for this function to be accurate.

```
HEADING IS   145°
TAS IS 137↑
WIND:   313°T   20↑
```

In keeping with normal conventions, you must enter your heading as magnetic, but the displayed wind is shown as true.

Winds aloft calculations may not be reliable in poor signal areas because the calculated course and ground speed may be jittery, as described above.

6.5 LATITUDE AND LONGITUDE

To display the latitude and longitude of your present position, turn the ***large secondary*** knob to **OTHER** and turn the ***small secondary*** knob all the way to the left. Your present lat/long will be displayed.

6.6 SIGNAL MONITORING

Turn the ***large secondary*** knob to **OTHER** and use the ***small secondary*** knob to scan through the displays of master and secondary transmitters. The GRI presently in use (identifying the Master transmitter) or the time difference (for each secondary transmitter) is displayed along with the Signal-to-Noise Ratio (SNR) and specific warning indicators. SNRs range from 0 to 99, while warning indicators are shown as C for uncertainty of Cycle selection, S for low Signal-to-Noise Ratio, and/or B for transmitter in Blink status.

After the cycle indicator has been off continuously for several minutes, the UNLOCK status automatically changes to LOCK status, inhibiting further intentional cycle jumps as the loran might seek to improve signal reception. UNLOCK is shown as ↑ and LOCK is shown as ↓. To manually step a transmitter's track point by 10 microseconds, press **CRSR** and use the ***small secondary*** knob to select the desired TD value. You must press **ACK** to effect the TD change. **Under normal conditions, there should never be a need to step the track point as described above.**

Stepping a track point automatically puts that transmitter into LOCK status. To change the LOCK status, press **CRSR** and use the ***large*** knob to move the cursor to the LOCK/UNLOCK indicator (or). Change the indicator with the **small** knob and press **ACK.** The pair of secondary transmitters currently part of the triad being used for lat/long conversion is indicated by the symbol .

SNR	SIGNAL	Acquisition	Cycle Warning Off
0 -15	very poor	variable	variable
15-30	poor	< 120 sec	< 5 minutes
30-60	usable	< 60 sec	< 3 minutes
60-80	strong	< 20 sec	< 2 minutes
80-99	very strong	< 10 sec	< 1 minute

TYPICAL AVERAGE TIMES FOR SIGNAL ACQUISITION AND CYCLE SELECTION

Important:

Get in the habit of comparing SNR readings with previous readings. Often a problem with the receiver or antenna shows up as a substantial drop in SNRs. To make it easier for you to check, the SNRs are displayed as part of the initial test sequence each time the M1 is turned on.

6.7 AMBIGUOUS SOLUTION

The M1 calculates several lines of position from the loran signals it receives. One line of position is calculated for each ***secondary*** transmitter received. At least two lines are required for the M1 to make a position fix. Any additional lines are used to verify that fix.

When just **two** lines are available, the resulting position fix is termed an *ambiguous solution*. The M1 cannot always be sure of a fix obtained from just two loran lines, because each pair of lines crosses at two points on the earth's surface. The M1 will always make a very good guess as to which intersection point is correct, but it may sometimes select the wrong point. If it is wrong, there

will not be a warning light; your only indication of the error is that your displayed position will be way off (probably by hundreds of miles).

Where this may occur:

This condition is only likely to occur in parts of Western Canada or Alaska, or in extreme fringe areas, where only two secondaries can be received.

How to designate the correct position:

(This procedure can only be performed if the M1 is receiving exactly **two** lines of position.)

Display your present latitude and longitude by turning the **large secondary** knob to **OTHER**. Turn the **small secondary** knob to the left to display lat/lon. Now press the right-hand **CRSR** button. Turn the **small secondary** knob to select the lat/long corresponding to your present position, then press **CRSR** and **ACK**. Once you designate the correct area, the M1 will remember it.

6.8 PARALLEL OFFSET

You may specify a parallel offset to your track. This allows you to fly parallel to a defined course, offset by a fixed distance. The Cross-Track Distance display, the external CDI, and the autopilot signal will refer to the parallel course. The amount of offset may be specified as NONE, or in nautical miles up to a maximum of twenty miles left or right of your original course. When an offset is in use, an indicator such as 4L (designating four miles to the left of the original course) is shown to the left of the Off-Course Distance and CDI displays. Also, an optional external annunciator illuminates (if installed). To enter a parallel offset:

1. Turn the ***large primary*** knob to **SETUP**.

2. Turn the ***small primary*** knob to select the function PARALLEL OFFSET. The secondary readout will show the offset currently in use.

3. Turn the ***small secondary*** knob to select the desired new offset. Press **ACK**.

Any parallel offset is canceled when the M1 is turned off and back on again, and also whenever the **–D→** function is used to specify a new flight path.

6.9 CDI SENSITIVITY

You may control the en-route sensitivity of your CDI or autopilot. Normally, it is set to one mile per dot, giving plus or minus 5 miles full scale. You may change the sensitivity to 1/2, 1/4, 1/8, 1/16, or 1/32 mile per dot for precision flying. (At 1/32 mile per dot, the minimum visible cross-track distance on the M1's electronic CDI is just 37.5 feet!)

To change the sensitivity:

1. Turn the ***large primary*** knob to **SETUP**.
2. Turn the ***small primary*** knob to display CDI SENSITIVITY.
3. Turn the ***small secondary*** knob to select the desired sensitivity.
4. Press **ACK**.

This function controls the sensitivity of both the M1's electronic CDI and also any external CDI or autopilot which may be connected.

Be careful! Some flight directors or autopilots may not function correctly when the CDI is set to a highly sensitive position. Test their operation carefully before using at a critical time!

6.10 MAGNETIC VARIATION

Magnetic variation is the difference between magnetic north and true north. In the continental U.S., it varies from more than 20° west (in Maine) to more than 20° east (in Washington state). In

order to display proper magnetic bearings and courses, the Northstar M1 has an internal map of magnetic variation.

The M1 displays all bearings as magnetic, except for the direction of WINDS ALOFT, which is displayed as true.

Magnetic variation changes slowly from year to year. For this reason, you must set the current year:

1. Turn the ***large primary*** knob to **SETUP**.
2. Turn the ***small primary*** knob until MAG VAR is displayed.
3. Turn the ***small secondary*** knob to select the current year.
4. When the correct year is displayed, press the **ACK** button.

6.11 ANTENNA LOCATION DESIGNATION

Your dealer installed the M1's antenna either on the top or on the bottom of your aircraft. Part of the installation procedure includes setting up the M1 to indicate the installed location. Erratic operation will result if this is not done. Although this is your dealer's responsibility, you should check to be sure it was done correctly after installation. You should also check it after the M1 is removed and reinstalled for any reason.

1. Turn the ***large primary*** knob to **SETUP**.
2. Turn the ***small primary*** knob to display ANTENNA LOCATION:
3. Check that the displayed location, TOP or BOTTOM, is correct for your installation.
4. If it is not correct, please advise your installer, and also correct it yourself by turning the ***small secondary*** knob to display the correct location, and then pressing **ACK**.

6.12 CDI CALIBRATION AND ANNUNCIATOR TEST

The M1's output signal, which drives an external CDI and/or autopilot, may be calibrated at any time. This procedure is normally performed only during installation of the unit, but it is given here in case the user wishes to check or re-calibrate the signal. Panel annunciators may also be checked with this test. Since many CDI needles tend to be somewhat "sticky," this procedure is best performed with the engine running, to supply enough vibration to jiggle the needle and allow it to move to its proper position.

CAUTION: Do not use this function carelessly. If you make any change at all, be sure to follow through and finish the calibration accurately.

1. Turn the ***large primary*** knob to **SETUP**, and turn the ***small primary*** knob to the CHECK CDI&ANNUN. function. Press **ACK**.

2. The CDI needle should move to the center position. Rotate the ***small secondary*** knob, if necessary, to precisely center the needle. When the needle is centered, press **ACK**.

3. The CDI should move to the left. Rotate the ***small secondary*** knob, to cause the CDI to indicate 5.0 nm left deflection. When the needle indicates 5.0 nm left deflection, press **ACK**. The CDI should now be properly calibrated.

4. This last step checks the full range of the CDI needle, and also tests any external annunciators which may be wired to the loran. Turn the ***small secondary*** knob to scan through the CDI's entire range to check its linearity and calibration accuracy. This will also sequentially energize the external annunciators and the external nav flag as described in the M1's readouts. When finished with the test, press **ACK**.

If your M1 is interfaced to an autopilot, but not to an external CDI, you can only calibrate the output by using either of the following two methods:

A. Have your dealer connect a voltmeter to the M1's output signal, and use only steps 1 and 2 above to produce zero volts output.

-or-

B. While flying with the loran controlling the autopilot, use only steps 1 and 2 above to produce straight and level flight.

6.13 MISCELLANEOUS DISPLAYS

Additional information may be displayed using the **SETUP** function. Turn the ***large primary*** knob to **SETUP**, and turn the ***small primary*** knob to display the following:

a. NO. OF USER POSITIONS STILL AVAILABLE. The number of unused slots for user-entered waypoints at the present time. (How many more waypoints you may enter before filling the memory and needing to erase points which are no longer needed.)

b. OSCILLATOR FREQUENCY. The difference between the internal oscillator's actual frequency and its nominal 10 MHz value. Any reading less than 20 to 25 Hz is acceptable.

c. DATABASE REVISION DATE. The date at which the database currently installed in the Northstar M1 was revised and issued.

d. SERIAL NUMBER. The serial number of your particular unit.

e. PROGRAM REVISION. This is the current revision level of the computer program (not the database) presently installed within the M1.

6.14 DISABLING USE OF A TRANSMITTER

The user is given the ability to designate one or more transmitter stations as not being suitable for navigation. This need might occur when a distant station contains heavy skywave contamination, increasing its signal strength to the point where the M1 might choose to use it for navigation if its geometry were reasonably good. This situation might occur in the Phoenix-Tucson area, in the Bahamas, or in Northern Alaska. **Most M1 users will never need to use this feature.** The instructions below are intended for users who are familiar with the operation of the M1.

To disable use of a station, turn the ***large secondary*** knob to **OTHER**, and turn the ***small secondary*** knob to display the TD of the station you want to disable. Press the right **CRSR** button and turn the ***large secondary*** knob one click to the right. Turn the ***small secondary*** knob to display the character Ł (the letter L with a line through it, indicating this station will not be used for calculating lat/long). Press **ACK** to verify that you really want to do it. ***Note: beginning with software version 213, disabled transmitters will be "remembered" while the unit is turned off, and they will not be used again until they are specifically re-enabled. The M1 will also remember any other GRIs involving user-disabled transmitters.***

If any transmitter within the currently-used transmitter chain (GRI) is disabled when the M1 is turned on, a one-time warning message is displayed. A typical message reads as follows:

```
WXZ ARE ONLY L/L STNS(SEE"OTHER")
```

This message means that the transmitters designated W, X and Z are the only stations allowed to be used for calculating latitude/longitude. (In this case, the Y transmitter has been disabled.)

NOTE: The Tango station in Port Clarence, Alaska was recently added to the 7960 chain for test purposes and will soon yield improved performance in central Alaska. Since this station is not yet certified for navigation, it is the FAA's position that it should not be used in the 7960 chain at this time. The procedure described above may be used to disable it.

6.15 DEMO MODE:

Demo Mode enables the user to simulate a flight and practice using the Northstar M1 in realistic navigating situations when the Northstar M1 is removed from his aircraft. All navigation features including *Cross-Track Error, ETE, nearest airport display,* etc. function properly. For safety reasons, Demo Mode can be used **only** when the Northstar M1 is **not** installed in the aircraft. Specifically, the cable between the M1 and the Antenna Coupling Unit (preamp) must be disconnected from the M1 in order to use Demo Mode.

A function in the **SETUP** category allows the user to activate Demo Mode. The user then specifies any database waypoint as the starting point of the simulated flight, and a waypoint to fly to. The M1 will behave exactly as if it were actually flying along the specified track or flight plan, including advising of waypoint arrival and warning of TCA and ARSA penetrations.

6.15.1 Activating Demo Mode:

1. To activate Demo mode, the M1 must be removed from the aircraft. Be sure the antenna cable is disconnected. Turn the ***large primary*** knob to **SETUP**. Turn the ***small primary*** to the right (about eleven clicks) to display the message:

   DEMO MODE?: NO

2. Turn the ***small secondary*** knob one click to change the word NO to YES. Press **ACK**.

3. The Northstar M1 will display:

   SIMULATED POS'N: LAX ACK?

   where LAX is the identifier of a database waypoint. (The waypoint actually shown will be the last waypoint displayed on the ***primary*** readout.)

4. Use the secondary controls to display the identifier of the waypoint from which you wish to start your simulated flight. (Use the ***large secondary*** knob to select the waypoint

category, and either turn the ***small secondary*** knob to select the identifier, or press **CRSR** and use the ***small*** and ***large secondary*** knobs to spell out the identifier.)

When you have displayed the desired identifier, press **ACK**.

5. To simulate motion, you must specify where you want to fly to. Step 5A describes how to specify a database waypoint to fly to, or a flight plan to follow. Step 5B describes how to enter a track angle and ground speed. You may use either method at any time to change the flight path or ground speed.

   5a. You may "fly" to the waypoint shown on the primary readout by pressing **−D→** and **ACK**, or you may activate a flight plan and fly it as described in Section 5 of this manual. If the simulated ground speed was previously zero knots, the flight will start with a default speed of 140 knots.

   -or-

   5b. You may specify a simulated track angle and/or ground speed. Turn the ***large secondary*** knob to **C/S** (course and speed). Press the ***secondary*** **CRSR** button, and enter the desired values one character at a time, using the ***small secondary*** knob to select each character and the ***large secondary*** knob to move the flashing cursor to the next character position. When this is done, press **ACK**.

6.15.2 How the M1 behaves in Demo Mode:

In Demo Mode, the M1 follows the specified track as if it were actually using loran signals. Essentially all navigation functions will work normally. The exception is that the M1 will not recommend any transmitter chain changes. (The transmitter chain quality numbers shown in the GRI **SETUP** function will refer to the *simulated* position.) Also, several warning messages related to real-world operation are inhibited (for example, the M1 will not warn of the missing antenna cable, or of poor accuracy).

6.15.3 Special Notes:

1. Pressing –D→ and CRSR simultaneously to activate the emergency nearest-airport search will show airports near to the *simulated* position.

2. Demo Mode will not attempt to fly precisely to a specified waypoint. It will start flying along the indicated heading, but may very slowly drift away from that track, just as if the pilot were following a constant heading without occasionally correcting his heading. This feature allows the pilot to become familiar with the procedure for adjusting the desired track line to move to his present position. (See Section 4.2.)

3. The track angle you enter is, of course, magnetic, and the M1 will attempt to fly a constant magnetic heading. This means the true heading will vary slowly as you "fly" through areas of different variation.

4. When automatically following a flight plan, Demo Mode will not simulate a two-minute turn at each waypoint. It will simply fly up to the waypoint, make a sudden sharp turn, and continue along the new leg.

5. To enter a new starting position, turn Demo Mode off and then on again.

6. When travelling at simulated supersonic speeds, the M1 may not supply a full ten-minute warning of TCA and ARSA penetration, and some other functions may not work exactly as expected.

6.15.4 Canceling Demo Mode:

Demo Mode is canceled by either of the following actions:
1. Using the SETUP function as described in step 1. Change the word YES to NO and press ACK.
2. Or, turning the M1 off.

6.16 LOOK-AHEAD MODE:

Look-Ahead Mode allows the pilot to temporarily use the M1 while in flight to check for waypoints near any given location. For example, you might simulate being at the destination of a trip in order to find suitable alternate airports before you actually arrive there. NOTE: The antenna coupler must be connected to the M1 to use Look-Ahead Mode.

6.16.1 Activating Look-Ahead Mode:

1. To activate Look-Ahead Mode, turn the ***large primary*** knob to **SETUP**. Turn the ***small primary*** knob to the right to display the message:

   LOOK-AHEAD MODE: NO

2. Turn the ***small secondary*** knob one click to change the word NO to YES. Press **ACK**.

3. The Northstar M1 will display:

   SIMULATED POS' N: LAX ACK?

   where LAX represents the identifier of a waypoint in the database.

4. Use the ***secondary*** controls to display the identifier of the waypoint whose nearby airports you wish to locate. (Use the ***large secondary*** knob to select the waypoint category, and either turn the ***small secondary*** knob to select the identifier, or press **CRSR** and use the ***small*** and ***large secondary*** knobs to spell out the identifier.)

   When you have displayed the desired identifier, press **ACK**.

6.16.2 How the M1 behaves in Look-Ahead Mode:

In *Look-Ahead Mode*, distances and bearings to waypoints will now be displayed relative to the simulated position, not your present position. For example, you may use the LOCAL feature to show the twenty airports, VORs, etc. that are nearest to the simulated position.

6.16.3 Special Notes:

1. The emergency airport search activated by pressing –D→ and **CRSR** simultaneously will immediately cancel Look-Ahead Mode and display the airport nearest your present (actual) position. To see the list of airports nearest your *simulated* position, turn the ***large primary*** knob to **APT**.

2. While the M1 is in Look-Ahead Mode, the **WARN** light will illuminate (but not flash). Pressing the **WARN** button will display the warning message:

LOOK-AHEAD MODE D/B NOT VALID!!!

   This message means that distances and bearings displayed in the **APT, VOR, NDB, INT** and **USER** functions refer to the simulated position, not to your present position.

3. To enter a new simulated position, you must turn Look-Ahead Mode off and then on again.

6.16.4 Canceling Look-Ahead Mode:

Look-Ahead Mode is canceled by any one of the following actions:

1. Press –D→ and **CRSR** simultaneously to activate the emergency nearest-airport search. (This is the easiest way.) The M1 resumes normal navigation.
2. Or, use the **SETUP** function as described above in step 1. Change the word YES to NO and press **ACK**. The M1 resumes normal navigation.
3. Or, turn the M1 off.

6.17 Coupling the M1 to Your Autopilot:

If your Northstar M1 is interfaced to an autopilot, you should be aware of a few simple hints that will help obtain optimum performance when the two devices are "coupled." They are:

1. Set the CDI sensitivity to 1 DOT = 1.4 nm (see Section 6.9).

2. Select the waypoint you wish to fly to, and set the "heading bug" on the directional gyro to the bearing-to-waypoint displayed by the M1.

3. If your autopilot has no "heading bug," hand-fly the aircraft onto the bearing-to-waypoint displayed by the M1.

4. Engage the autopilot in accordance with your dealer's instructions.

You will need to set the CDI sensitivity only once (the M1 will remember where you last set it). 1 DOT = 1.4 nm is the same sensitivity as if your nav receiver were being used 15 miles from a VOR station, the distance at which most autopilots perform best. Since the CDI sensitivity remains constant in the M1, "scalloping" of the flight path (which normally occurs when an autopilot is coupled to a VOR receiver) is now virtually eliminated.

(this page intentionally left blank)

Section 7
HINTS FOR BETTER NAVIGATION

This section contains a number of suggestions for better ways to navigate with loran. Most of these come from the actual experience of pilots flying with loran guidance.

7.1 WAYS TO USE THE M1

There are many combinations of displays which you may find useful. You may decide to pick a standard combination which meets your particular needs for most purposes. Here are several suggestions:

INFO on the secondary readout. The city or name of the airport you are using on the primary readout may be shown continuously on the secondary readout.

NEAREST AIRPORT on the secondary readout. Wherever you fly, the distance and bearing to the nearest database airport will be shown.

DISTANCE and BEARING on primary readout; CDI on secondary readout. Use the TRK and INFO functions to show complete information about the waypoint you are navigating to.

7.2 PRESELECTING WAYPOINTS

Since the Northstar M1 "remembers" which waypoints were last being used for each category on each readout, you may pre-select several waypoints which you will soon be using. You can preselect one airport, VOR, NDB, intersection and user waypoint on each readout. Turning to this position then instantly shows the distance and bearing to the selected waypoint.

7.3 APPROACHING YOUR DESTINATION

If you haven't flown with loran guidance before, you're sure to be amazed by the accuracy of the Northstar M1. There are obviously

many advantages to this system, but you must still use caution when navigating with loran.

One instance may arise when it comes time to land at your destination. Your M1 says the airport is only a few tenths of a mile away, but you can't see it anywhere . . . where is it?

The answer is: directly beneath you. You should start looking for your destination when it is still several miles ahead. If you wait until your M1 says you have arrived, you're probably right over the field, and will have to overfly it as you descend for a landing.

In fact, you may wish to fly not to the airport itself, but to a point from which to approach the airport. This technique might be useful at a busy airport where ATC requires that you be at a particular reporting point when calling for clearance to land, or at a mountain strip which you wish to approach from a safe direction.

This would require an additional waypoint as part of your flight plan. Define the waypoint as part of the **APT** or **USER** database and use the name of the airport as a prefix for the name of the new waypoint. Done this way, the waypoints will appear together in the database and thus be easy to use.

For example, an approach waypoint for airport XYZ might be called XYZAP. Or, if you wanted different approach waypoints for different runways, you might call them XYZ14 (approach point for runway 14 at airport XYZ) and XYZ32 (for runway 32). Don't forget, all the FAA-identified five-letter fixes and reporting points are contained in the INTERSECTION waypoint category.

7.4 AIRPORT REFERENCE POINT

The airport locations contained in the M1's database are known as Airport Reference Points (ARPs). These are the "official" airport latitude and longitude. At airports that have been surveyed the ARP is usually at the "center of gravity" of the runway ends. At other airports, the ARP may not be so well-defined.

7.5 GREAT CIRCLE ROUTES

If you are planning a flight of over 100 miles, and you take the trouble to lay out your course on a Sectional or WAC chart, you'll notice that the course the charts suggest you fly is different from that recommended by your Northstar M1.

The reason is that the M1 always calculates the shortest possible route between two waypoints, a "Great Circle" route. A flat chart is not an accurate model of a spherical Earth; consequently, the route you obtain from a chart will not necessarily be the shortest one possible.

The difference is small on a short flight, larger on a long one.

You should be aware that with loran guidance your course will usually be slightly different from the one you would draw on a chart. This difference is usually an advantage -- you'll get there quicker because you're flying the shortest possible distance. However, your Great Circle route might take you where you do not wish to go -- such as through a TCA or a Restricted Area. (But don't forget, the ***Airalert***™ feature will search your future track for TCA and ARSA penetrations.)

7.6 PIREPS

Flight Service Stations have a system to pass along weather information from one pilot to another. The reports are called Pireps (Pilot Reports). If you encounter, say, moderate turbulence at a certain altitude, you can tell the FSS about it and they will inform other pilots who plan to fly in the same area.

Pireps are a good idea, when they are current. But, it seems that not many pilots make these reports, so there is often little or no useful information available.

With your trusty M1 at your side you can help the Pirep situation in an important area -- winds aloft. To be sure, the FSS has a prediction of winds aloft at various altitudes. But they would certainly appreciate an accurate, up-to-the-minute report. And so

would other pilots who plan to fly in your area and don't have the M1's accurate guidance.

So get in the habit of checking winds aloft every hour or so. When you do, call up the nearest FSS (use the frequency that appears on your Sectional or call Flight Watch on 122.0) and let them know.

7.7 ATIS SCAN:

If you wish to find the closest ATIS transmitter to check on weather conditions or other local information, turn the ***large primary*** knob to **APT**, the ***small primary*** knob all the way left to show the NEAREST AIRPORT, the ***large secondary*** knob to **INFO**, and the ***small secondary*** knob to display ATIS frequencies. Now scan through LOCAL airports with the ***small primary*** knob to see which nearby airports have ATIS and what their frequencies are.

Section 8 - SAFETY CONSIDERATIONS

THESE IMPORTANT SAFETY POINTS SHOULD ALWAYS BE KEPT IN MIND!

Don't rely on a single navigation system.

Don't be tempted to violate FARs concerning visibility requirements for VFR flight.

Don't ignore the M1's warning messages.

Don't fixate on the display and fail to look outside the aircraft.

Do get in the habit of checking estimated accuracy.
Be careful when navigating in fringe areas of loran reception.

Just because the M1 may give you spectacular performance 99 times in a row, don't be lulled into feeling that it is a magic box that you can blindly trust with your life. Your M1 performs extensive cross-checking of itself and signal conditions, but you should **always** double-check your navigation with other means.

Reliance on the M1 is allowed for VFR conditions only. When flying IFR you may find it very comforting to be able to verify your exact position with the M1, but actual navigation must be based only on your IFR-approved instruments.

(this page intentionally left blank)

Appendix A - FEATURES AND SPECIFICATIONS

Features:

- Database of over 20,000 waypoints, including:
  - Public-use and military airports, including many Canadian, Mexican and Caribbean airports, with:
    - city and state
    - name
    - communications frequencies
    - field elevation
    - runways
    - latitude/longitude
  - VORs and NDBs
    - city and state
    - name
    - frequency
  - All civil-use intersections
  - Room for up to 250 user-defined waypoints
- **Starguard™** Theft-protection system
  - Power-up customized identification message
  - Optional system disable
- **Airalert™** Controlled Airspace alerts
  - All US TCAs
  - All US ARSAs
  - Mode C Alert
- Distance and bearing to all database waypoints
- Off-Course Distance
- Estimated Time En-route
- Estimated Time of Arrival
- Flight Planning with automatic turn anticipation
- Time Of Day
- Course and Speed
- Winds Aloft
- Present Latitude/Longitude
- Loran-C TDs and Signal-to-Noise Ratio
- Automatic Magnetic Variation
- Automatic station selection
- Automatic or manual chain selection

Specifications:

Dimensions: Height: 2"
Width: 6.25"
Depth: 11.75" (from rear of front bezel to rear of mounting tray)

Weight: 4.2 lbs

Power Requirements: 12 or 24 VDC, 16 W nominal

Output Interfaces: CDI and its nav flag
Autopilot
Warn Indicator
Waypoint Alert Indicator
Parallel Offset Indicator

Minimum SNRs: Acquisition -20 dB
Track -30 dB

Temperature Ratings:

Receiver
Operating Temperature: -15°C to +55°C (air cooled)
Storage Temperature: -40°C to +75°C

Antenna Coupling Unit:
Operating Temperature: -55°C to +70°C

Antenna:
Operating Temperature: -55°C to +70°C

Appendix B - WARNING CONDITIONS

The following is a list of warning messages which the Northstar M1 may display if its self-diagnostic system detects a problem. When the **WARN** light flashes, press it to read the warning message, and press again to clear the message. Warning messages may indicate either poor signal conditions or equipment malfunction (either transmitter or receiver equipment).

B - 1 INDICATIONS OF SIGNAL PROBLEMS

The following three messages could indicate a receiver problem but more often are related to signal or geometry problems.

NO POSITION INFO AT ALL

This means the M1 has not yet acquired the master transmitter and at least two secondary transmitters (the minimum required for navigation). You will see this warning if you try to use the M1 too soon after it is turned on -- before it displays the message NAVIGATOR READY -- USE ANY SWITCH. There is no harm done by trying to rush things, but the M1 may warn you with these messages that the navigation information displayed is not yet necessarily accurate. The **WARN** indicator will turn off when the M1 is ready.

> If the NAVIGATOR READY message does not appear within a few minutes, this is in itself an indication of a problem, since the M1 is having trouble acquiring the loran signals. Be sure that the correct GRI for your area is selected (Section 2.2.1).

POOR OR DEGRADED ACCURACY

This means the M1's estimate of its accuracy presently exceeds 2.8 miles in en-route mode. In the primary signal coverage areas, this message is an indication that something may be wrong. In poorer

signal areas (see Appendix C), this message may appear frequently, and should be treated as a reminder of the poor signal conditions. You may choose to continue using the M1, but at reduced accuracy.

If the error estimate improves beyond the specified accuracy, the indicator turns off.

How the M1 Computes Estimated Accuracy:

The M1 calculates a 90% confidence-level estimate of your position error. You may press the **WARN** button at any time to display this estimated accuracy. The best accuracy estimate ever displayed by the M1 is 0.4 nautical miles. Estimated accuracy may degrade for the following reasons:

1. In weak coverage areas the loran signals inherently have more jitter.
2. In certain areas (far from the transmitters or near baseline extensions) the geometry of the transmitter locations may reduce the maximum possible accuracy.
3. The receiver may suspect a possible error due to questionable cycle selection.
4. In a region where loran signal coverage has not been accurately surveyed, errors of up to several miles may exist.

The error estimate is made by adding together the following three factors:

1. An error estimate combining the effects of signal strength and transmitter geometry.
2. An error estimate corresponding to any uncertainty in cycle selection. (The distance of a single 10us TD change is added to the error estimate.)
3. An error estimate based on your distance from the nearest calibrated reference points.

LAT/LON GLITCH - CHECK POSITION

This means that through the normal course of operation the M1 has suddenly changed the location of its position estimate by an amount in excess of two miles. This is an advisory message, indicating that you should double check your position using some other navaid if you are navigating in a mode requiring high accuracy. This message generally does not indicate a problem with the unit.

B - 2 AIRALERT WARNING

When the **Airalert™** system is disabled, a warning message appears each time the M1 is turned on -- before it can be used -- reminding you that the feature is not fully operational. The **WARN** button will flash. Press it to read the message and press it again to turn off the message.

AIRALERT IS OFF: WASHINGTON TCA
AIRALERT IS OFF: ALL TCAs&ARSAs

No warning is shown if the **Airalert™** feature is active for all areas.

B - 3 INDICATIONS OF RECEIVER PROBLEMS

PROBLEM: ANTENNA CABLE OPEN/SHORT

The cable between the loran and the antenna coupling unit (preamp) has become open- or short-circuited. If the condition was temporary or intermittent, the message will clear out after WARN is pressed twice. Even if intermittent, this should be repaired by your dealer as soon as possible.

OSC. OUT OF SPEC: CHANGE M1'S TEMP

The frequency of the precision oscillator inside the M1 is far enough away from its proper value so that the M1 may lose lock

on the loran signal or may fail to acquire it. This is probably caused by operation outside of the specified temperature range. If too cold, allow additional warmup time. If too hot, additional forced air cooling may be required. If this message occurs while the M1's internal temperature is within the specified limits, the oscillator probably needs factory re-calibration.

WARNING: CONFIRM ANTENNA LOCATION

The antenna location designation setup procedure has not been performed since the last loss of non-volatile memory data. (See Section 6.11.)

FAILURE: T/N LINK	REPLACE COMP. BD
FAILURE: T. PROM	REPLACE COMP. BD
FAILURE: N. PROM	REPLACE PROM #1
FAILURE: T. RAM	REPLACE COMP. BD
FAILURE: N. RAM	REPLACE COMP. BD
FAILURE: T. SYST	REPLACE COMP. BD
FAILURE: SAMPLER	REPLACE COMP. BD
FAILURE: DATABASE	REPLACE PROM #8

One of several failures on the internal computer board has been detected. Unit must be repaired.

WARNING: PROBABLE RECEIVER FAILURE

The signals coming from the receiver module of the M1 do not have the characteristics of typical loran signals and indicate a failure of the receiver board. The unit may work, but position accuracy should not be trusted. Unit should be checked and probably repaired.

NV MEMORY FAILED USER DATA GONE

The Northstar M1 contains a "non-volatile" memory chip with a design lifetime of 7 to 10 years. This warning indicates that this memory has failed, and any user-entered waypoints will have been

lost. The antenna location designation has also been lost. You may continue to use the unit, but if your antenna is located in the bottom the the aircraft, you must first perform the procedure described in Section 6.11. Other data which has been lost and should be re-entered includes: the selected transmitter chain (Section 2.3.1), the calender year (for magnetic variation calculations) (Section 6.10), the CDI calibration (Section 6.12), and time zone selection (Section 2.3.4). The unit should be repaired as soon as convenient.

→→→NO DATA BASE IS INSTALLED←←←

A database is not presently installed in the M1. The unit will function as a basic navigator, but accuracy will be degraded as reflected in the displayed error estimates.

(This page intentionally left blank)

Appendix C - LORAN-C COVERAGE

The Northstar M1 determines the optimum station and chain selection automatically. This means a pilot need not be constantly concerned with what stations are providing the signals being used for navigation. Nevertheless, it is a good idea to be familiar with coverage areas, and particularly where signal quality (and thus accuracy) is likely to deteriorate.

GRI Selection charts:

Chart C1 shows the preferred GRIs (transmitter chains) for areas of the continental United States and southern Canada. Chart C3 shows the GRIs for northwestern Canada and Alaska.

The charts shown here are calculated from theoretical signal reception conditions corresponding to somewhat poorer than average Signal-to-Noise Ratios. This means that your M1 may sometimes select a different GRI than the one shown here for your area, depending on the particular Signal to Noise Ratios associated with the installation in your aircraft.

Accuracy Repeatability Charts:

Chart C2 shows the calculated repeatability estimates for the continental United States and southern Canada. Chart C4 shows the repeatability estimates for northwestern Canada and Alaska.

The charts shown here are calculated from theoretical signal reception conditions corresponding to somewhat poorer than average Signal to Noise Ratios. You may well find that your M1 performs far better than these calculated estimates.

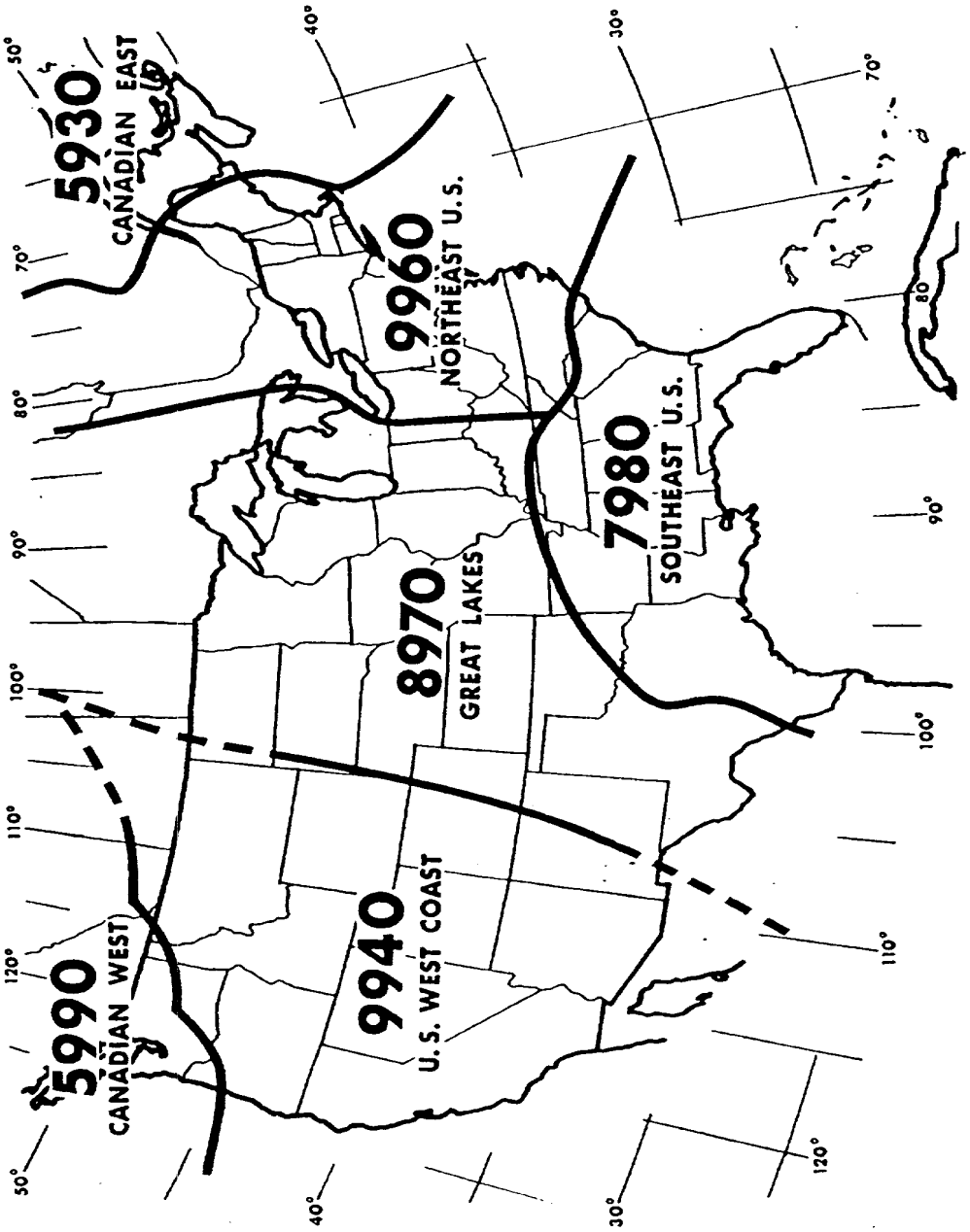


Chart C1
GRI Selection - US and Southern Canada

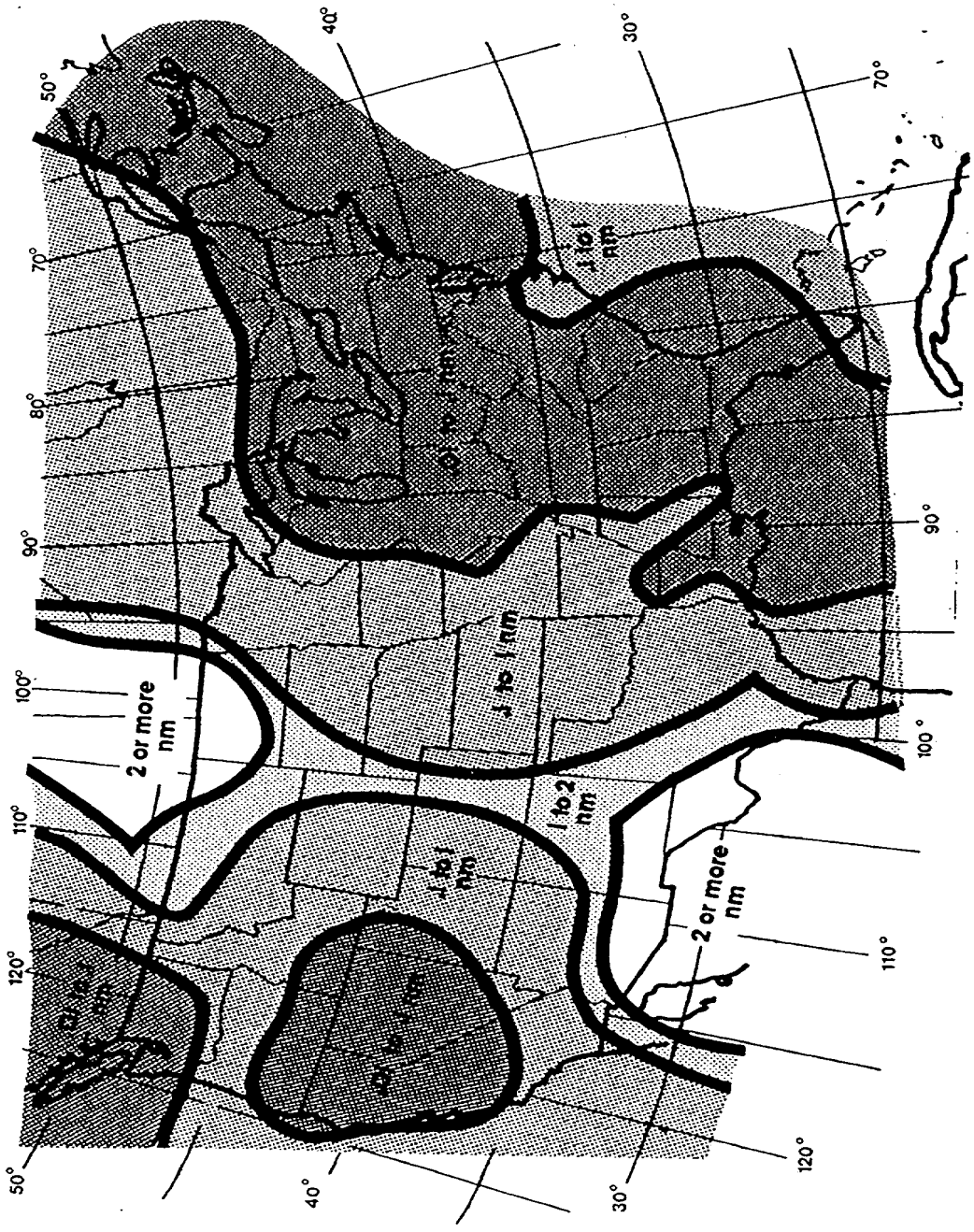


Chart C2
Repeatability Estimate - US and Southern Canada

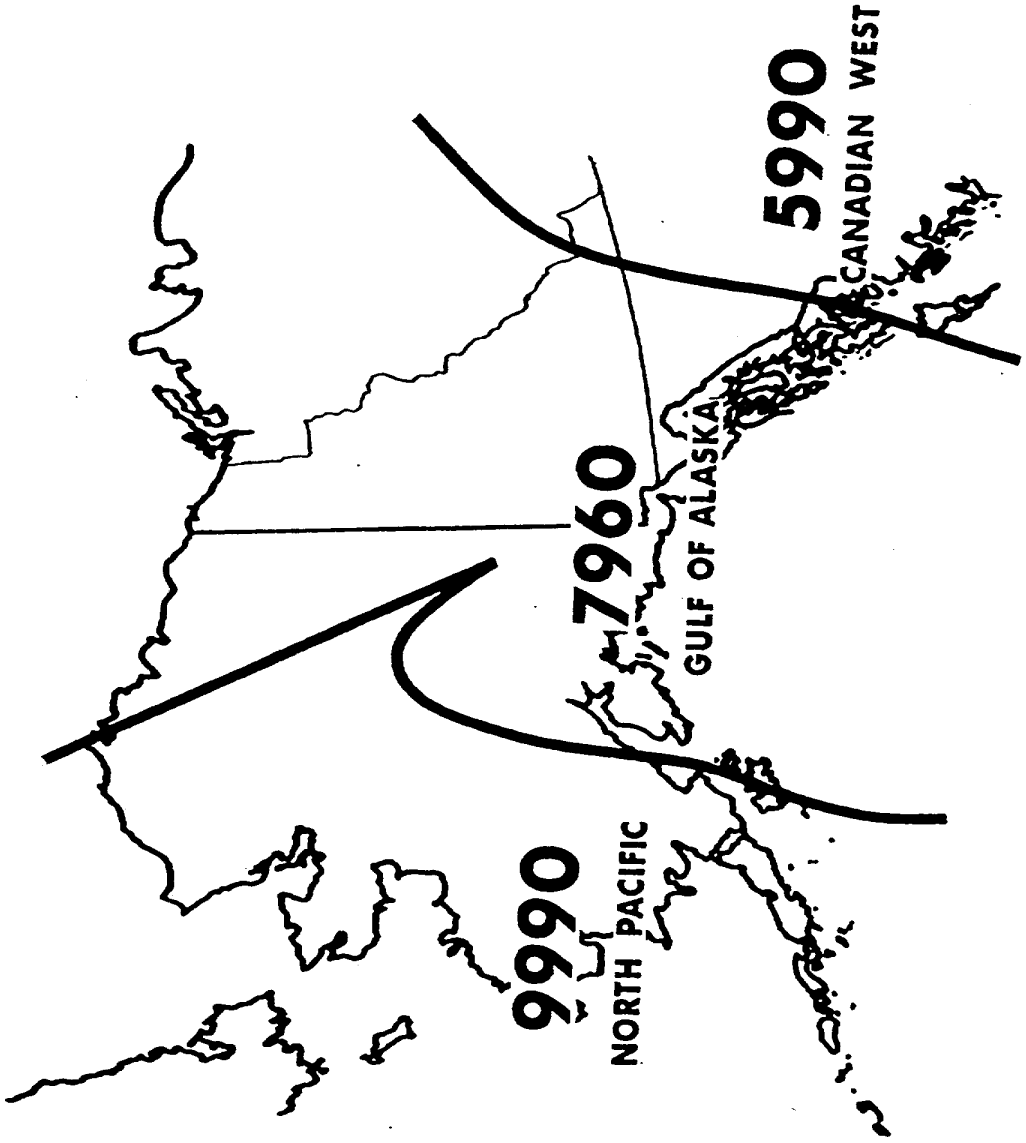


Chart C3
GRI Selection - Alaska and NW Canada

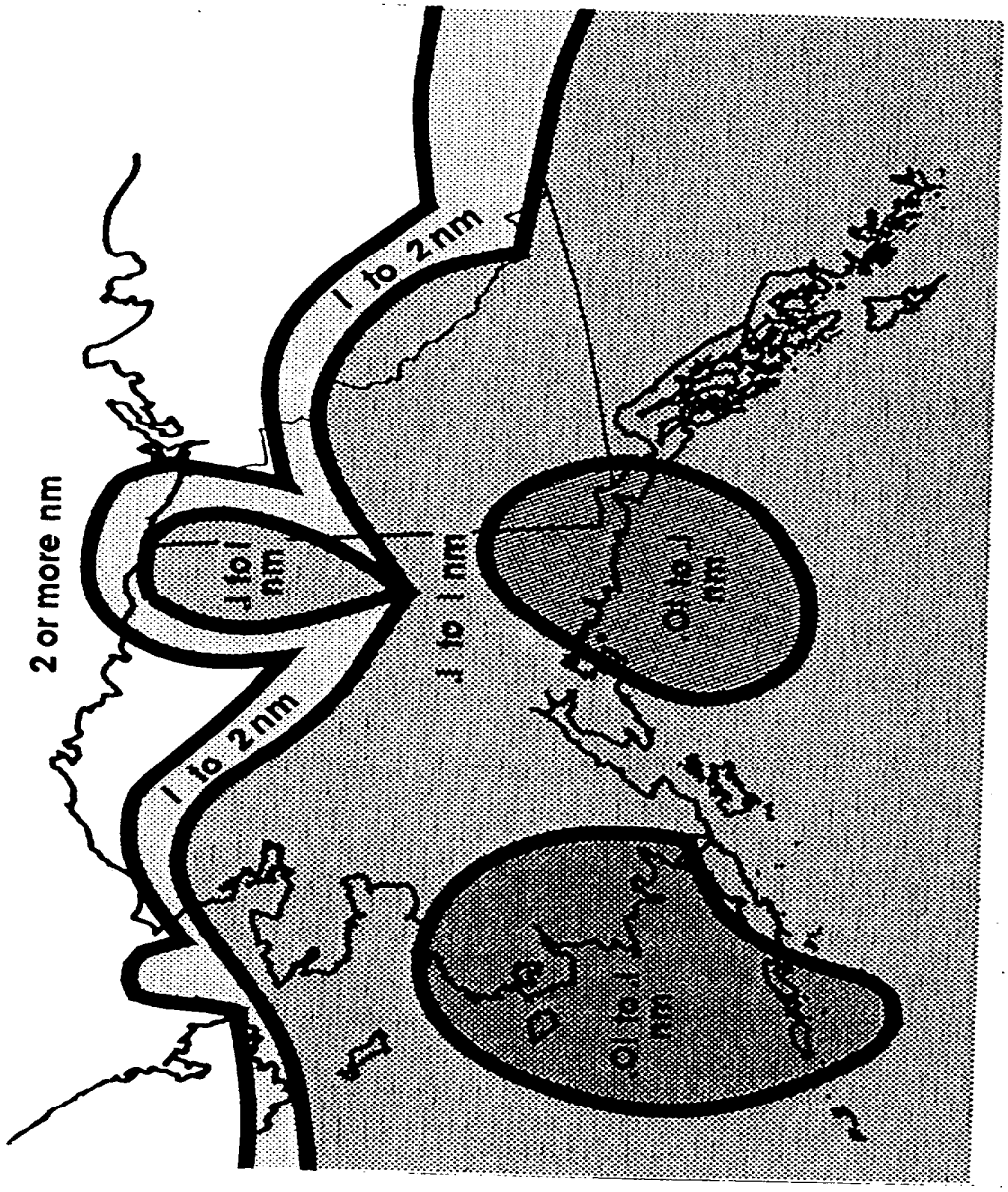


Chart C4
Repeatability Estimate - Alaska and NW Canada

(This page intentionally left blank)

Appendix D - GLOSSARY

accuracy: **Absolute accuracy** -- the accuracy of lat/long coordinates computed by the loran as compared to lat/long determined from a chart or other reference. **Repeatable accuracy** -- the ability to return to the same location using the loran's previously-obtained coordinates. Often significantly better than absolute accuracy: ideal signal reception can result in repeatable accuracy of within 50 feet.

acquisition: The point at which the loran's receiver module has confidently "locked-on" to the correct loran pulse.

Airalert™: The Northstar M1's controlled-airspace alert system that advises when you approach an ARSA or TCA and helps you avoid the area, or enter it legally.

ARSA: Airport Radar Service Area. Controlled airspace surrounding many airports, requiring you to make radio contact before entering.

baseline extension: The continuation in either direction of the line running from a master transmitter to a secondary. When situated on or near this extension, an accurate position fix cannot be obtained from this particular secondary.

blink status: The coded warning contained in a loran signal to alert a user that the transmitted signal is in error.

CDI: Course Deviation Indicator. Instrument used to display one's position relative to an intended track line.

chain: A group of loran transmitters comprised of a master station and at least two secondaries.

coverage: The extent to which a geographical area is encompassed by usable loran signals.

cursor: The display panel indicator that shows which character is ready to be changed or acknowledged by the user. It is activated and positioned by the user when required.

cycle: A 10-microsecond portion of the electromagnetic radio pulse emitted by loran transmitters at a frequency of 100 kiloHertz.

database: A collection of information about waypoints stored in the loran's memory.

ETA: Estimated Time of Arrival at the next waypoint as calculated by the M1 according to your present speed.

ETE: Estimated Time Enroute to the next waypoint as calculated by the M1 according to your present speed.

flight plan: A sequence of flight legs comprising one trip.

great circle: Shortest possible path between two points on the surface of a sphere.

GRI: Group Repetition Interval. The characteristic identifying period of signals emitted by each loran transmitting chain. The identifier 9960 (Northeast US) indicates that the gap between the start of any two adjacent master signals is 99,600 microseconds long.

interference: The electromagnetic interruption of a radio signal causing poor signal reception. Interference may originate from external sources (such as other radio transmitters) or from the aircraft itself (such as alternator noise or precipitation static).

latitude: Imaginary lines on the earth's surface running East/West and expressed in degrees (0-90) north or south of the Equator. Used in conjunction with the North/South lines of longitude to determine position.

leg: A segment of a larger flight plan.

longitude: Imaginary lines on the Earth's surface running North/South and expressed in degrees (0-180) east or west of the Prime Meridian (a line running from the North to South Pole, passing through Greenwich, England).

Loran-C: Acronym for LOng RAnge Navigation. System of land-based radio transmitters emitting precisely-timed pulses which are received and translated into position "fixes." Successor to now-defunct LORAN-A system.

magnetic variation: The difference between magnetic North and true North. Since the difference varies according to geographic location, the Northstar M1 automatically calculates magnetic variation and uses it to display bearings as magnetic north. The variation at any location changes slowly over a period of years, so the M1 allows the user to enter the current calendar year.

master: The one loran transmitter in a "chain" of at least three stations which initiates the series of coded pulses emulated by the secondaries.

Mode C: Altitude encoding system utilized by ATC. The Northstar M1 will warn pilots to operate, or "squawk," their Mode C altitude-encoding equipment whenever flying within a thirty mile radius of the primary airport in a Terminal Control Area.

NDB: Non-Directional Beacon

parallel offset: A flight leg separate from, but parallel to, the original leg.

precipitation static: Also known as "P-Static." Precipitation-induced electrical charge which builds up on aircraft surfaces, resulting in poor radio reception.

readout: The panel of alphanumeric characters used by the loran to display navigation data.

secondary: Transmitting stations in a loran chain other than the "master" station. Formerly known as "slaves."

SNR: Signal to Noise Ratio. Guide number for determining the relative quality of loran signals as compared to background radio "noise."

Starguard™: The Northstar M1's theft-protection system.

TCA: Terminal Control Area. Controlled airspace surrounding the largest airports in the US, requiring the pilot to obtain specific permission before entering.

TD: Time Difference. The measured amount of time in millionths of a second between signals received by a loran from the master and secondary stations.

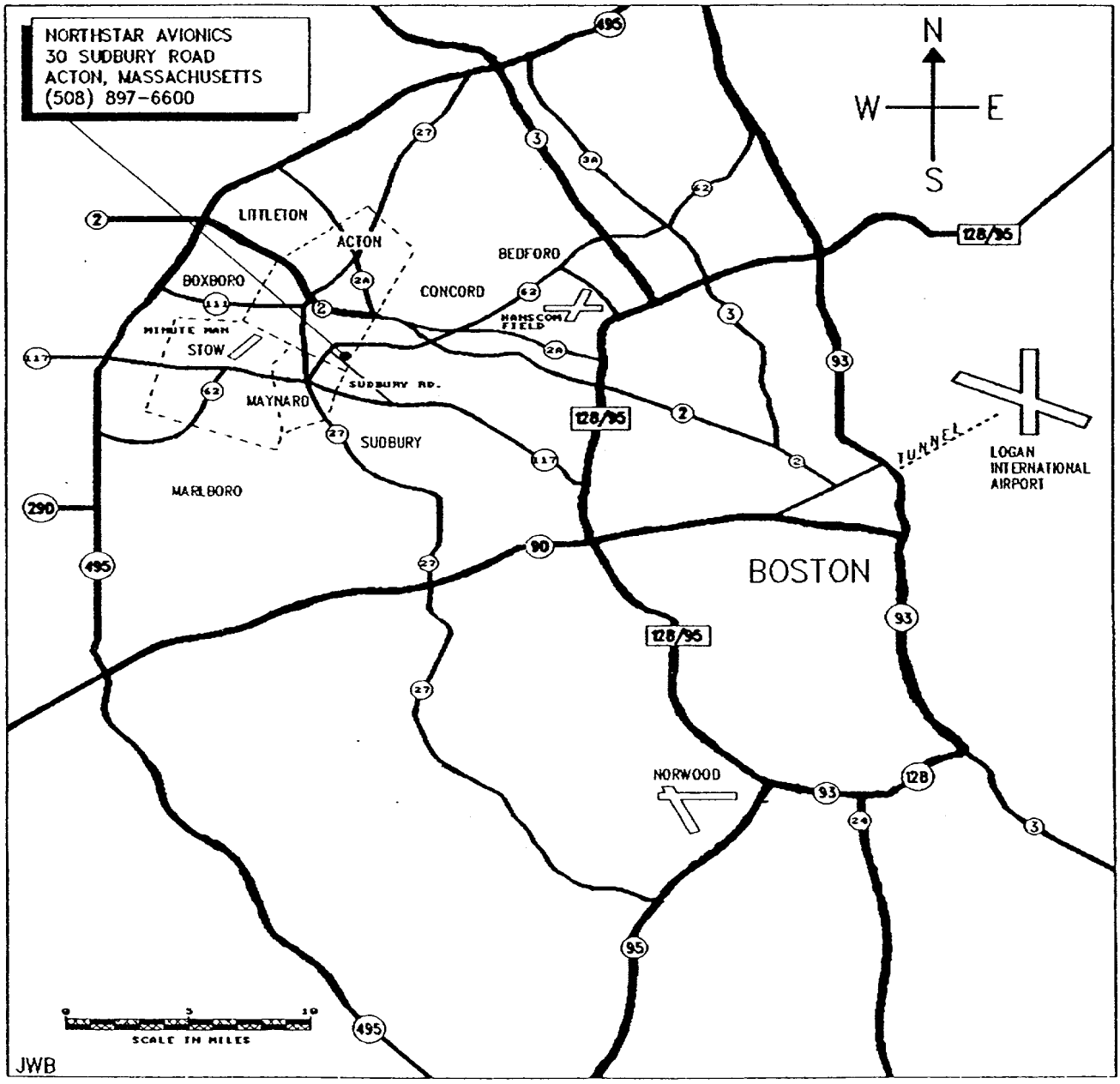
track: A desired line of travel.

triad: A group of three loran transmitting stations (one master and at least two secondaries) whose signals a loran must receive in order to obtain a position "fix."

VOR: Very high frequency Omni-directional Range.

waypoint: A particular location (defined for navigation purposes by its lat/lon), used as an intermediate or final destination.

APPENDIX E - INDEX


NORTHSTAR AVIONICS
30 SUDBURY ROAD
ACTON, MASSACHUSETTS
(508) 897-6600
N
W
E
S
LITTLETON
ACTON
BEDFORD
BOXBORO
CONCORD
HANSCOM FIELD
MINUTE MAN
STOW
SUDBURY RD.
MAYNARD
SUDBURY
MARLBORO
128/95
TUNNEL
LOGAN INTERNATIONAL AIRPORT
BOSTON
NORWOOD
SCALE IN MILES
JWB

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 59 ACTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NORTHSTAR AVIONICS

P.O. Box 287, Acton, Ma 01720 - 9990

Fold here

Tape

Please do not staple

Tape

Database Discrepancy Reporting Form

If you become aware of any error in the Northstar M1's database, please take a moment to write it down here and mail it to us. Data has been obtained from the most reliable sources, but errors may still occur. After your correction has been confirmed, it will appear in later updates of the database.

Northstar Avionics may use and distribute any of the information you supply in any way without incurring any obligation whatsoever.

Revision date of your database: _____
(displayed at turn-on)

Program revision level: _____
(Turn large primary knob to SETUP, small primary knob to display **REV:**)

Waypoint category: _____ Waypoint ID: _____

Incorrect data displayed by the M1:

Corrected data:

Your source for the correction:

Your name:

Address:

City, State, Zip:

Telephone:

Thank you.