

Flying with Flightmaster™

The latest news, tips and techniques for owners of the
Flightmaster handheld flight management system.



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What's New?

Exciting things are happening in the world of Flightmaster. Here is a collection of late-breaking news items that will be of particular interest to Flightmaster owners...

Newsletter

This is the premier issue of *Flying with Flightmaster*. We will be publishing this newsletter quarterly and sending it *free* to every registered Flightmaster owner. So be sure to keep us apprised of your current mailing address.

Each issue of *FwF* will be packed with news about the latest Flightmaster software enhancements, database updates and accessories. You'll also find valuable tips and techniques from the experts to help you get the most out of your Flightmaster. This premier issue is extra large because there is so much to tell you about.

Often, there will be a profile of a particularly interesting Flightmaster owner...you might be amazed at some of the pilots who are using the Flightmaster! This issue features a story about how the Flightmaster was created, and a profile of Mike Busch, the pilot who developed it.

Videotape

We have just completed production of a half-hour videotape about the Flightmaster. The video demonstrates the most important capabilities of the Flightmaster, illustrates its use in a wide variety of pre-flight and in-flight

situations, shows the various accessories available, and includes an interview with Mike Busch, inventor of the Flightmaster.

This is not a typical, boring "talking head" video. It's fast-paced and fun, with lots of action, in-flight footage, and hi-fi stereo sound.

If you'd like a copy of this videotape in VHS format for your own viewing or to show to your flying club, safety seminar, or your pilot friends, call us at (800) 462-6669.

ABC's Wide World of Flying

Speaking of video, be sure to watch for the new Flightmaster "infomercial" in the October issue of ABC's *Wide World of Flying* quarterly videomagazine. From now on, you'll be seeing us regularly in *WWoF* as well as the various aviation-oriented print media.

If you haven't seen *WWoF* yet, you've been missing something mighty good. Each quarterly issue features an hour and a half of outstanding aviation videography with the quality and production values you'd expect from ABC. An annual *WWoF* subscription costs \$119.95 per year, and is well worth it. Call (800) 999-8783 to subscribe.

Incidentally, you might be interested to know that Phil Boyer, publisher and editorial director of *WWoF*, was instrumental in the development of the Flightmaster, and was the first pilot (other than developer Mike Busch) to fly with it. And both Dennis Holmes (executive producer) and Barry Schiff (technical advisor) are enthusiastic Flightmaster owners.

Version 1.04 Now Available

The latest version of the Flightmaster software and database at this writing is version 1.04. This update includes the FAA Flight Data Center database revision effective September 21, 1989. It also includes a number of minor enhancements and bug-fixes to the software. If your Flightmaster is using an earlier version, we suggest that you get it updated.

Flightmaster updates are available on either a one-time or annual-subscription basis. If you plan on updating your Flightmaster at least twice a

year (and we *strongly* recommend that you do), the annual subscription is a very attractive deal. You'll find full details and prices at the end of this (and every) issue of *Flying with Flightmaster*.

If you have questions about updates, or wish to order a one-time update or an update subscription, call us at (800) 462-6669.

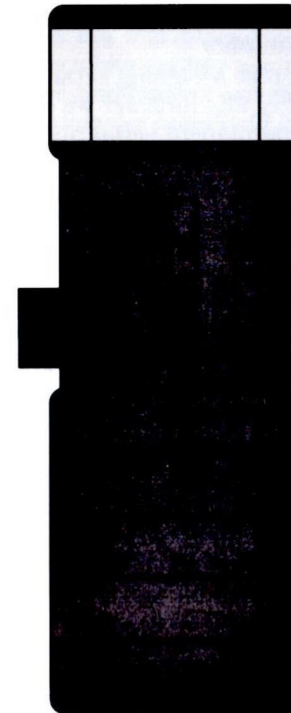
Free Updates!

As a Flightmaster owner, you know that no pilot can watch the Flightmaster being put through its paces without developing an insatiable craving to own one. Right?

You can play a big part in the future success of the Flightmaster by demonstrating your Flightmaster one-on-one to your pilot friends and flight instructors, and by arranging to show the Flightmaster video at flying club meetings, safety seminars, and other aviation-oriented get-togethers. And we've developed a new program to make it worth your while.

You will soon be receiving (if you haven't already) a letter with full details of the Referral Update Credit Program. In a nutshell, it means that each time we sell a Flightmaster as a direct result of your efforts, you are entitled to credit for one free database and software update for your Flightmaster...a \$50 value. (Pilots who purchase a Flightmaster as a result of your referral *also* receive their first update free, which is their incentive to document the referral.) If you show off your Flightmaster a lot, you might easily be able to keep your Flightmaster updated every eight weeks and never spend a dime!

Your referrals will have to be properly documented in order for you to receive credit for them, and the exact procedure is explained in the letter.



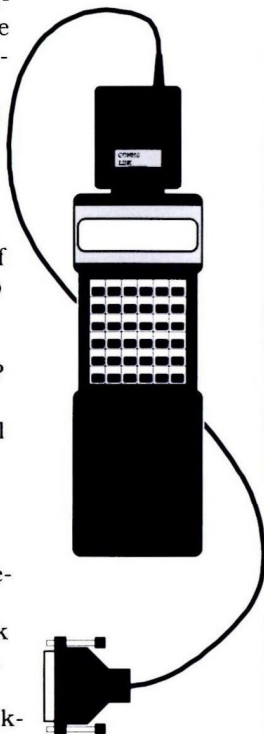
Comms Link Available Again

During August and September, we were unable to fill orders for the Comms Link RS232 communications adapter because PSION inadvertently introduced a serious bug into the Comms Link's built-in firmware that made it incompatible with the Organiser XP.

We're pleased to tell you that PSION has now fixed the firmware and we're now shipping Comms Links once again. If you've been holding off ordering one for your Flightmaster because of the glitch, your wait is over.

Priced at \$100, the Comms Link accessory is worth its weight in gold if you have access to a PC or Macintosh...and these days, who doesn't? The Comms Link lets you backup all your user-defined data (aircraft performance profiles, W&B templates, checklists, user-defined fixes, saved routes, etc.) to disk for safekeeping. It also lets you build and edit your checklists and other data using your favorite text editor (much more convenient than doing it on the Flightmaster itself).

If you ever should run into an unusual software problem with your



Flightmaster that we can't seem to reproduce, you can backup all your Flightmaster files to diskette, send the disk to us, and our customer support technician can download your data into his Flightmaster to duplicate your situation exactly. This has proven very valuable on a few occasions.

The Comms Link will become even more important when we release our forthcoming Flightmaster add-on package that provides access to DUAT. Whoops...sorry! We're saving that exciting topic for the *next* issue of *Flying with Flightmaster!*

Anyway, if you don't have a Comms Link for your Flightmaster, you might want to consider getting one.

Serial Numbers

We are now assigning serial numbers to every Flightmaster we ship, and affixing a permanent serial number plate to the back of each unit. If you purchased one of the first several hundred unnumbered Flightmasters, you should have received a serial number plate for your machine by now, together with a letter explaining how and where to affix it.

The serial numbers will be quite important. Whenever you phone us for support or to order an update or accessory for your Flightmaster, we will need to know your serial number. And you'll definitely need your serial number in order to claim free-updates under our Referral Update Credit Program.

So if you own an unnumbered Flightmaster and somehow haven't received a serial number plate from us, give us a call at (800) 462-6669 right away so we can rectify the situation.

Rave Reviews!

In case you missed it, Flightmaster has started to receive rave reviews in the aviation press. Following are some excerpts.

AOPA Pilot

In the September 1989 issue of *AOPA Pilot* magazine, executive editor Seth Golbey devoted most of his "Pilot Products" column (pages 103-104) to the Flightmaster. Here's part of what he had to say:

"Once in a great while, a new product is so well designed that using is an almost sensuous experience. If you think this this description is ludicrous when applied to a pocket computer, you haven't experienced the Flightmaster hand-held flight management system. It does so much so well that even the most jaded gadgeteer must take notice. Flightmaster's great refinement represents evolutionary technology, but it could revolutionize the way you plan and perform flights.

"We experimented with Flightmaster over a period of about three months, and we are impressed. This is one product that really stands out from the pack. Manufacturers trying to emulate Flightmaster's capabilities will have a lot of catching up to do."

*—Seth B. Golbey, Executive Editor
AOPA Pilot 9/89*

Gee, Seth, don't be so wishy-washy... why don't you just tell us whether or not you like your Flightmaster!

The Aviation Consumer

The staff of *The Aviation Consumer* was so excited about Flightmaster that they devoted seven full pages to it in their 24-page September 1, 1989, issue (pages 7-15). Here's an excerpt:

"The Flightmaster is quite a feat of programming. The pilot basically tells it where he wants to go, and it gives him all the information he needs to get there in one fell swoop. The Flightmaster... does for the handheld flight computer what database cartridges did for LORANs.

"The bottom line is: If you can afford it, you're going to love it."

—Andrew B. Douglas

Contributing Editor

The Aviation Consumer 9/1/89

Andrew's article was part of an 11-page series in that same issue entitled *The Search for an Ideal Cockpit Computer* and also reviewed two competitors: the GeoFlite and the FltGuideEX. The *Aviation Consumer's* conclusion:

"We disliked the GeoFlite and FltGuideEX. Both were cumbersome, difficult to learn, and inflexible in use, in our opinion. Both pale in comparison to the Flightmaster...it's a much better value for the money."

The Aviation Consumer is known to be hard on new products. The editors of the magazine are no pushovers. Many companies react to the prospect of their product being reviewed by *AC* with the same apprehension that you might have if you answered your doorbell and found Mike Wallace on your front porch with a camera crew. But you can see that the Flightmaster survived the *AC* investigation pretty well.

The Flightmaster Story

Many of you have asked about how the Flightmaster was developed. This premier issue of FwF seemed like a good place to relate the Flightmaster story and to introduce you to the pilots who were involved in its creation.

Meet Mike Busch...

The "father of Flightmaster" is Mike Busch, a fellow who looks more like a retired linebacker than a pilot or computer nerd, but who has rather remarkable background in both aviation and computing. Mike is 45 years old, blissfully married to Jan (his wife and business partner for 15 years), and lives on the California coast about halfway between Los Angeles and San Francisco.

Mike first got involved with computing in 1960(!) when he was attending high school in New York and working nights and weekends at IBM's Watson Research Center. As an honors mathematics major at Dartmouth College during the '60s, Mike did pioneering work in the development of time-sharing systems, and was a co-developer of the BASIC language. He moved to California in 1967 and continued his work in state-of-the-art operating systems at Computer Sciences Corporation. In the late '70s and early '80s, Mike became fascinated by microcomputers, co-founded a very successful microcomputer software company, and was instrumental in the creation of TurboDOS, the first microcomputer local-area network (LAN).

Mike became a private pilot in 1966 in Phoenix, earned his instrument

rating in New York a year later, and his commercial ticket and glider rating in Los Angeles a year after that. In 1971, he became an airplane and instrument flight instructor. In 1987 he obtained his multiengine rating, and this year he became a multiengine flight instructor. He has logged about 3,500 hours total, and now flies about 300 hours a year.

Mike first became an aircraft owner in 1968 when he picked up his brand-new Cessna 182 at the factory in Wichita. After putting 1,000 hours on the Skylane, he traded up to a 300 hp retractable Bellanca Super Viking. Mike now owns and flies a twin-engine Cessna T310R. He does a lot of the maintenance on the airplane himself, and maintains his multiengine and instrument proficiency by going to FlightSafety for intensive simulator-based training three or four times a year.

The Birth of an Idea...

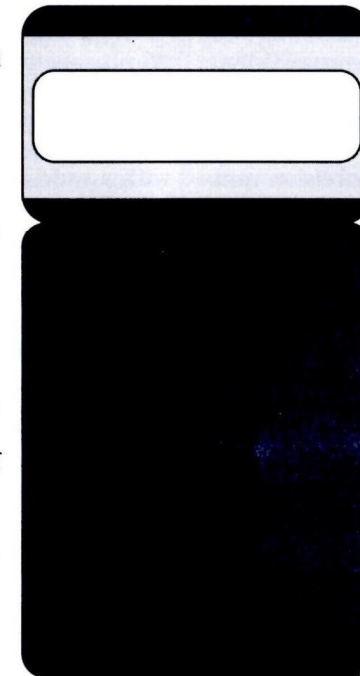
Mike first started fantasizing about developing a pocket-sized gizmo that could handle all his pre-flight and in-flight planning chores about five or six years ago. He recognized immediately that the key to such a device would be a built-in navigation database of navaid and airport locations. Mike found that both Hewlett-Packard and Texas Instruments manufactured handheld programmable calculators with adequate computing power, but he was disappointed to learn that nobody made a machine with adequate storage capacity to accommodate a decent-sized aviation database. So the idea wound up on the back burner for several years.

Then, in early 1987, Mike ran into an old friend in Hawaii who told him about a nifty new handheld computer called the *Organiser* manufactured in England by a company called PSION and almost unknown in the U.S. Mike had never heard of PSION, but one look at the specs instantly convinced Mike that this was exactly the machine he had been searching for to turn his old idea of a handheld flight planning computer into reality. Two weeks later, Mike got his first PSION *Organiser* and started teaching himself to program it. Two months later, he had his first crude flight planning software running on the machine. Boy, was it crude!

Problems, Problems...

It quickly became clear that developing a really good handheld flight planning machine would not be easy.

For one thing, obtaining the database information proved to be far more difficult than expected. Mike's first prototype contained a 500-fix database which he laboriously keyed-in by hand from the information in his Jeppesen chart service. He then discovered that it was possible to subscribe to the NOAA navaid database on DOS diskette, but that no information on airports, intersections or airways was available from NOAA in machine-readable format. The FAA National Flight



Data Center offered to provide the necessary data, but it was only available on 9-track reel-to-reel computer tape...five giant 40-megabyte reels of data every 56 days! Mike discovered that Doug Kaye, a pilot friend from San Francisco, had a Data General minicomputer system capable of processing the FAA tapes. So for almost a year, Mike wound up flying his 310 up to SFO every eight weeks with a carton of tapes and doing the data conversion, reduction and compression with Doug late into the night on the minicomputer.

(Later, Flightmaster, Inc., acquired its own magnetic tape processing equipment.)

Another problem was processing speed. The PSION *Organiser* uses an 8-bit HD6303X microprocessor with a slow 1 MHz clock speed. Mike's early flight planning software on the machine ran very slowly and required great patience. Not satisfied with this, Mike wound up collaborating with programmer Ron Raikes to write a set of super-fast database management routines and trig functions in HD6303X assembly language in order to achieve a high level of performance. He also developed a bunch of high-speed approximation "tricks" that made the Flightmaster's automatic routing algorithms operate remarkably fast.

Alpha Testing...Phil Boyer

By late 1987, the flight planning system was sufficiently operational that Mike felt it was time to try it out on another pilot. That pilot was Phil Boyer, a Sr. Vice-President of Capital Cities/ABC in New York, publisher and editorial director of ABC's *Wide World of Flying*, and owner of a twin-engine pressurized Cessna 340A based at Teterboro, New Jersey. Phil was the perfect choice as "alpha test" pilot for this handheld gizmo: a very active instrument pilot and aviation enthusiast, a dyed-in-the-wool gadgeteer, and yet a relative novice when it came to computers, with a remarkable talent for tripping over bugs. And there were *lots* of bugs! It was a tribute to Phil's dedication and fortitude that he didn't chuck the darned thing out the storm window of the 340 and be done with it.

Phil also turned out to be a fountain of great ideas for improvements to the original flight planning software. Phil came up with the idea of adding checklists, for example, and contributed many other ideas for enhancements and refinements. Phil even helped come up with a name for this hitherto-nameless device: *Flightmaster*.

Phil and Mike flew with their Flightmasters for a year, and Mike implemented a steady stream of bug-fixes, enhancements and refinements. Mike also wrote the first draft of a Flightmaster User's Guide. By the end of 1988, the Flightmaster was finally ready to move into the next phase of testing.

Beta Testing...The Dirty Dozen

Mike and Phil put together a list of 25 prospective pilots who would be offered the opportunity to act as beta-testers for the Flightmaster. The list was carefully crafted to include pilots with a wide range of experience from low-time private pilots to multi-thousand-hour ATPs, flying a variety of aircraft from Mooneys to Aerostars to Falcon 20 bizjets to L-1011 airliners. It was decided that in order for the beta-test to be valid, the testers would be asked to pay for their Flightmasters... that way, they'd feel freer to criticize if it didn't live up to their expectations.

Phil videotaped a brief Flightmaster demo with a camcorder in his living room and had 25 VHS duplicates made. The videotapes plus copies of the draft User's Guides were sent to the list of 25 prospective beta-test pilots. A dozen of them accepted the offer. Finally, the Flightmaster beta test got underway in March 1989, and continued for four months.

For the record, the brave beta testers were: Phil Boyer, John Haverland, Allen Holman, Dennis Holmes, Steve Kahn, Doug Kaye, Don Mann, Bill McKinney, Paul Millner, Barry Schiff, Peter Schulz, Johnny Sewell, and Chuck Suss.

The beta test yielded some additional bug reports and a wealth of terrific product enhancement ideas. Mid-way through the beta test, Mike added Victor and Jet Airways to the Flightmaster database, and implemented automatic routing-by-airways. By June 1989, the Flightmaster had reached a highly refined and reliable state, and was ready for prime time.

Enter Flightmaster, Inc.

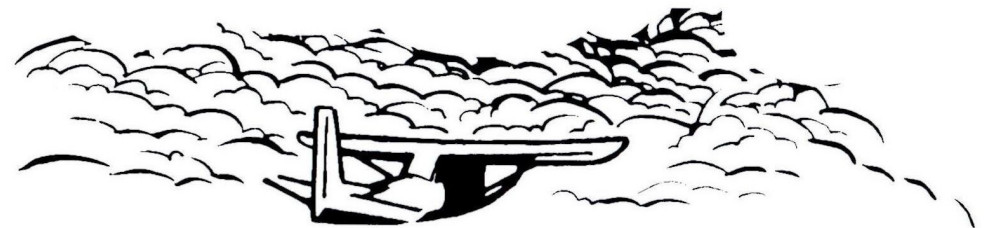
While the beta test was going on, Mike and Jan started looking for joint-venture partners who could help turn the Flightmaster into a viable commercial product. From past experience, they knew that they could not handle the order fulfillment and product support responsibilities and still continue on with further technical development of the Flightmaster.

They received several joint-venture proposals from various aviation-related companies, but were not satisfied that any of them were competent to handle the support requirements for such a technically challenging product.

Finally, they received a proposal from Richard and Sandy Wilkes of Support Group, Inc., in Maryland. Richard

and Sandy had built a very successful business of international scope providing technical support to users of WordPerfect, the leading word processing package for the IBM PC, and had developed a superb reputation for customer support. They are aircraft owners (Rick is a pilot), and were very enthusiastic about the Flightmaster. After much discussion and meetings, Jan and Mike agreed that these were the ideal people to give Flightmaster the marketing, operations and customer support that it deserved.

A new joint-venture company called Flightmaster, Inc., was incorporated, staffed, and brought quickly up to speed. First commercial deliveries of the Flightmaster began in early July 1989. The rest, as they say, is history.

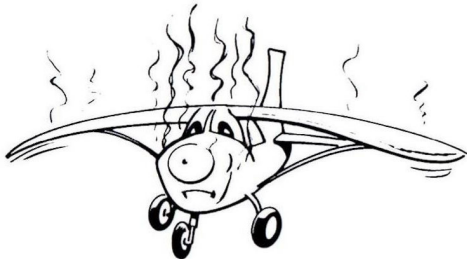


Tips & Techniques

Here are some tips from the experts intended to help you get the most from your Flightmaster. This will be a regular feature in each issue of FwF.

Temperature limits

The Flightmaster is rated to operate at temperatures of 32° to 122° Fahrenheit (0° to 50° Celsius), and a relative humidity of 5 to 95 percent. The allowable temperature range for "storage" is somewhat wider than this, but since the Flightmaster is always "operating" (keeping time and maintaining internal memory) even when it is "switched off," the operating temperature range should always be observed.



This means you should take care that your Flightmaster isn't exposed to intense heat, cold, or dampness. Don't leave it lying on the glareshield in a locked-up cockpit on a hot day...you might damage the LCD display. Don't leave it in the trunk of your car in sub-zero weather...you might freeze the battery and lose your memory contents. Don't spill your Diet Pepsi on it...the keyboard might not work so well afterwards. Try not to drop it, either.

If you treat the Flightmaster as you might treat a camera or other moderately-sensitive piece of equipment, you shouldn't have any trouble.

Battery life and replacement

We have had reports of widely varying battery life, from as short as one week to as long as three months. If you are getting one month or more from each 9-volt alkaline battery, you are doing okay. Otherwise, read on.

A good, fresh, name-brand 9-volt alkaline battery should be good for roughly 500 milliampere-hours before it needs to be replaced. Off-brand alkalines and even occasional name-brand batteries will not provide full rated capacity. So it's a very good idea never to be caught out on a trip without a spare battery.

From a power-consumption standpoint, the Flightmaster operates in three different modes. When it is switched off (display blank), it uses hardly any power at all...about 40 microamperes (0.04 milliamps). Even a nearly-dead battery can keep the Flightmaster's memory and clock alive for months in this switched-off mode.

When the Flightmaster is switched on (display active) but not computing or searching its database (which is most of the time), it draws about 3 or 4 milliamperes. A fresh battery could run the Flightmaster continually in this mode for at least a week. (Of course, this can't actually happen because the machine automatically switches itself off after five minutes if inactivity.)

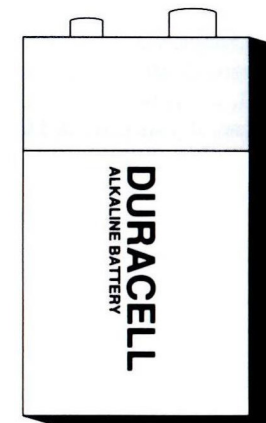
But during the period when the Flightmaster is actually computing or searching its database, it draws a lot of current...roughly 100 milliamperes. A fresh battery could only sustain this sort of operation continuously for about five hours.

And when the Flightmaster is displaying a screen with a dynamic time display (e.g., an ETA in column 'L' of

the trip log, or any of the screens of the Time function), the current drain oscillates between 3-4 milliamperes and 100 milliamperes, and averages something in-between.

So...the longevity you can expect from a battery depends a lot on just how you use your Flightmaster. If you frequently use functions that involve extensive database searches (automatic routing, name-search, geographic-search, waypoint function), your battery life will be quite a bit shorter. And if you leave your Flightmaster displaying a column 'L' ETA until it times itself out (instead of punching the 'O' key to shut off the display when you're not looking at it), your battery life will be somewhat shorter.

Furthermore, early versions of the Flightmaster software contained a bug which can drain the battery rather rapidly if you spend very much time in the database Search or Wpt functions. This problem was corrected last July in version 1.03. So if you are having battery-life problems and are using an earlier version of the software, ordering an update might help.



A couple of other battery tips: Always buy name-brand alkaline batteries, preferably in time-dated packages. (We've had particularly good luck with Duracells, and that's what we ship with all new Flightmasters.) When changing batteries, make sure the contacts on both the battery and the battery-compartment clip (inside the machine) are clean and free of oxidation. Swabbing them with some alcohol or contact cleaner is a good idea...using the A.C. adapter accessory gives you more time to do this.

And no matter what else you do, *always* carry a spare battery!

User-defined fixes can save keystrokes

The home base airport of Flightmaster, Inc., is a decidedly non-major airport (Garrett County Airport in Oakland, MD) whose identifier is '2G4'. We were expending lots of keystrokes entering this identifier all the time (particularly annoying because entering the digits require holding down the shift key) until we discovered a simple trick that really saves keystrokes.

We simply used the DataBase→Def function to define a user-defined airport with a one-letter identifier (we used 'G' for Garrett). We entered the name, state, CTAF, and elevation, then specified the location as 'Fix' and '2G4'.

Now we can specify our home airport with a single keystroke: 'G'. You can use this same trick for any hard-to-enter identifier that you use a lot.

Using auto-RNAV with a non-database LORAN

If you have a non-database LORAN (such as an Azure Locator or Long Ranger, or one of the earlier II Morrow, Micrologic or Texas Instruments units), you already know that the Flightmaster is the perfect companion unit, providing instant access to the latitude and longitude for any airport, navaid, or intersection you may want to key into your LORAN.

But you may not have tried using Flightmaster's automatic RNAV routing function to calculate a series of intermediate waypoints along the great circle route to your destination. The trip log displays the lat/lon position of these waypoints so that you can enter them into your LORAN. This gives you plenty of enroute progress checks that are vital if you want to keep up-to-date on your projected ETA and fuel reserves.

Just because you don't have RNAV is no reason not to use the automatic RNAV routing function of your Flightmaster!

Don't forget Route→Quick!

Route→Quick, the last function on the 'Route' menu, is often overlooked by Flightmaster users because it doesn't show up on the menu screen (unless you scroll down to it with the cursor keys). But it's a useful function and worth knowing about.

Route→Quick works just like the normal Quick function except that, instead of prompting you to enter the 'From fix:' and 'To fix:', it automatically

uses the first leg of your route. It takes just one second or so to display the course and distance.

The purpose of Route→Quick is to give you an initial course to fly quickly when you've entered a new or revised route. This gets you going in the right direction while the Flightmaster is calculating your full trip log. It is particularly useful when you get an unexpected routing amendment in-flight or just prior to takeoff. Try it!

When to start down

Several owners have asked if there's a way to have their Flightmaster tell them the appropriate time to start descending from cruise altitude to the destination airport. The answer is "yes" and the procedure is simple.

First, make note of the *time-to-descend* figure that Flightmaster computes for you in its trip summary. This can be found in the top row, column 'I', of the trip log spreadsheet.

Now, as you approach your destination, keep an eye on the *time-to-destination* figure in the last row, column 'L', of the trip log. (Pressing the 'L' and 'Z' keys takes you there in two key-strokes.) This figure will count down as you approach your destination. When time-to-destination equals time-to-descend, it's time to start down.

Of course, if you have a LORAN, DME or RNAV that gives you time-to-destination, you can use that figure instead. Just compare it with the time-to-descend that Flightmaster has computed for you, and start down when the two times are equal.

Ambiguous identifiers: to 'K' or not to 'K'

If you enter a three-letter identifier which ambiguously identifies both a navaid and an airport (such as 'ICT', the identifier for both the Wichita Mid-Continent Airport and the Wichita VORTAC), Flightmaster normally assumes that you mean the *navaid*. To specify that you mean the *airport* rather than the navaid, prefix the identifier with a 'K' (e.g., 'KICT').

This seems simple enough. However, there are a few fine points that seem to be giving some users difficulty. For one thing, you are only permitted to use the 'K' prefix in front of *three-letter* airport identifiers (ICT, LAX, JFK, BOS, etc.) Flightmaster already knows that any identifier that contains *digits* (such as '2G4' or 'O56' or 'NV11') must be an airport, and prefixing such an identifier with a 'K' will just confuse it.

Also, there is one significant exception to Flightmaster's rule about assuming that an ambiguous three-letter identifier refers to the navaid unless prefixed with a 'K'. The exception applies to the *first and last fixes* in a trip route. Since trips normally start and end at airports, Flightmaster assumes that an ambiguous three-letter identifier given as the first or last fix in a route refers to the airport, not the navaid. So, for example, the route 'ICT PER IRW ADM DFW' is exactly the

same as 'KICT PER IRW ADM KDFW'. The 'K's on the first and last fixes are superfluous (although they don't hurt).

But wait! Suppose you actually *want* to specify a route that starts or ends at a navaid? Aha! Flightmaster provides a way to do that, too. (Although it's not documented in the *User's Guide*.) Prefixing a three-letter identifier with a 'V' tells Flightmaster that you mean the navaid (VOR) rather than the airport. So the route 'VICT HUT' commences at the Wichita VORTAC, *not* the Wichita Mid-Continent Airport.

Routes that don't start or end at an airport

While we're on the subject, there's a subtle but important point that many users miss. If you give Flightmaster a route that starts at a fix that isn't an airport, Flightmaster assumes that you're already at cruise altitude when you depart that fix. It does its time and fuel calculations without any allowance for takeoff or climb. If you look at the top row, column 'H' of the trip log, you'll see that time-to-climb is '0:00'.

Likewise, if you give Flightmaster a route that ends at a fix that isn't an airport, Flightmaster calculates time and fuel without any allowance for descent, and shows a time-to-descent figure of 0:00 in the top row, column 'I'.

Magnetic variation vs. VOR declination

"There's something wrong with the database of my Flightmaster. It shows the magnetic variation of the Sea-Tac International Airport (KSEA) as E20, but the variation of the Seattle VORTAC (SEA) as E22. Since the VORTAC is right on the airport, it's obvious that one of these figures must be wrong!"

No, there's nothing wrong. Both figures are correct! The local magnetic variation in the Seattle area is 20° east, as you can confirm by looking at a chart. But the 360° radial of the Seattle VORTAC is actually aligned 22° east of true north!

If this surprises you, you're in very good company. Even experienced professional instructors who teach instrument groundschools for a living usually don't realize that, more often than not, the 360° radial of a VOR is misaligned from local magnetic north by a degree or two, sometimes more.

Technically, the true bearing of the 360° radial of a VOR is known as *declination*. The declination of a VOR is always within a few degrees of the local magnetic variation, but in general the two do not agree exactly.

Why? Well, the earth's magnetic poles are constantly drifting. As a result, local magnetic variation at a given location varies slowly over time. If VOR declination had to agree precisely with magnetic variation, every VOR would have to be physically realigned every few years.

But realigning a VOR is a very costly and complicated procedure. The radi-

als defining every airway based on the VOR have to be revised and flight-checked. Likewise with any instrument approaches that use the VOR. All the charts and approach plates have to be redrafted and reissued.

Consequently, the FAA isn't very enthusiastic about revising the declination (alignment) of its VORs. Instead, they accept small differences (a degree or two or three) between VOR declination and local magnetic variation, and only realign VORs when those differences become unacceptably large.

You can really impress your CFII with this stuff!

Updates when you record ATAs

When Flightmaster calculates your trip log initially, all of the trip and leg times and fuel burns are estimates, based upon the aircraft performance figures and forecast winds aloft that you entered. However, when you record your actual takeoff and fix-crossing times in-flight (see page 31 of the *User's Guide*), many of the trip log estimates are automatically recalculated to reflect your actual progress.

Naturally, recording an actual fix-crossing time that is earlier or later than what was estimated causes all subsequent ETAs (in column 'L') to be revised. In addition, the following trip log entries are also updated: total trip time (top row, column 'A'), total trip fuel burn (top row, column 'D'), total time-in-cruise (top row, column 'J'), total time to each fix (row 1...., column 'J'), total fuel to each enroute fix (row 1...., column 'K').

If ATC issues you a hold...

Here's a nifty technique to use next time you're flying IFR with your Flightmaster and ATC gives you holding instructions: "Wombat 24F, hold at the XYZ VORTAC as published, expect further clearance at 20:43, time now 20:02."

Enter your 'expect further clearance' (EFC) time into the Flightmaster trip log as a *fix-crossing time*. [In this example, enter 20:43 as the ATA at XYZ VORTAC.] Now look at the top row, column 'D', to see what your recalculated trip total fuel burn will be (assuming that you depart the hold at XYZ at the EFC time).

You can immediately assess the impact of the ATC-issued hold on your fuel status. If you see that the hold may cause you to have less-than-comfortable reserves, you should immediately inform ATC and negotiate an alternative clearance that is more acceptable.

If you accept the hold, don't forget to go back and record the *actual* time that you depart the hold (which will rarely be exactly the same as your EFC time) in your Flightmaster trip log.

By the way, this particular technique is illustrated in the new Flightmaster video.

Recalculation after Route→Change

It is often desirable to recalculate a trip log in-flight to reflect a routing amendment, altitude change, or winds aloft that differ from those originally assumed during pre-flight planning. To do this, you exit the trip log; execute the Route→Change function to revise the route, altitude, and/or winds aloft; then execute the View function to recalculate and display the revised trip log.

Changes to the route require that all trip navigation and time/fuel calculations be redone. Changes to winds aloft involve only time/fuel figures to be recalculated, which is much quicker. Changes to the cruising altitude involves only time/fuel figures, *unless* the route contains automatic routing specifiers (A, R or V), in which case all calculations must be redone.

If a route is revised in-flight using the Route→Change function, Flightmaster retains the takeoff and fix-crossing times *up to the point of first routing change*. On the other hand, if the route is re-entered using the Route→New or Route→Load function, all ATAs are reinitialized as '—:—'.

Using Route→Xpand before Route→Save

Suppose you enter a route that contains the automatic routing specifiers A, R or V, and then save it with Route→Save. Then Flightmaster will have to perform its automatic routing analysis whenever you subsequently retrieve that route with Route→Load. This can take time.

On the other hand, if you *first* do Route→Xpand to convert the route to a fully explicit one (with no automatic routing specifiers), and *then* save it with Route→Save, the route will require no automatic routing analysis when you subsequently retrieve it.

If you use this technique for routes containing AutoR or AutoV segments, it's a good idea to specify the lowest cruising altitude that you normally use for the route before expanding it. This will help ensure that the Flightmaster's automatic routing algorithm will generate short-enough legs to be navigable at lower altitudes.

Auto-airways routing between airports

The Flightmaster's automatic routing-by-airways specifier 'A' is intended to be used between a pair of nav aids or intersections in the airway structure. You should avoid using 'A' between airports *unless* those airports happen to have an associated nav aid that uses the same identifier as the airport.

For example, the route "LAX A LAS" is okay because both LAX and LAS airports have associated VORTACs with the same identifiers. Flightmaster is smart enough to convert the route from "LAX A LAS" to "KLAX LAX A LAS KLAS" before performing its automatic routing analysis.

On the other hand, the route "SAN A PHX" is no good because neither SAN nor PHX airports have an associated nav aid with the same identifiers. Flightmaster will quickly determine that no airways pass through either SAN or PHX, and will revert to AutoV routing. If you want airway routing, you should specify something like "SAN MZB A SRP PHX". (MZB and SRP are the VORTACs closest to KSAN and KPHX, respectively.)

If you use 'A' between two airports when one of them has a same-identifier nav aid and the other doesn't (such as "LAX A PHX"), Flightmaster will attempt to find a suitable airways route for as much of the trip as possible, but will revert to AutoV routing near the no-nav aid airport.

Checklist positioning

When using checklists on the Flightmaster, if you leave the checklist function and then subsequently re-enter it, Flightmaster will position you to the same list and item that you were looking at when you left. This is true whether the intervening time happened to be a minute, an hour, or a month.

When preparing for a new flight, be sure to press the DEL key when you first enter the checklist function. This causes you to be repositioned to the first item of the first checklist.

Some users have found it useful to prefix the first entry of each checklist with a particular symbol such as '*' to make it very obvious whether they are positioned to the beginning or middle of a checklist.

»BEFORE START
preflight
door
belts, harnesses
controls
park brake set
fuel selectors
gear sw down
mixtures rich
props forward
throttles set
all switches off
ckt breakers in
flight timer off
batt&alt sws on
lights as reqd
rot beacon on
nav lights
gear pos lights
warn lights test
cowl flaps open]
alt air off
fuel gauges chk
totalizer set

Arm vs. moment in W&B templates

When setting up a Flightmaster W&B template for an aircraft, it is very important to note that *all 'CG' entries in the template must be expressed in terms of "distance aft of datum plane" (also referred to as 'arm')*. This applies to the 'MaxCG', 'MinCG' and 'MidCG' values for various loading stations, as well as to the 'MinCG' and 'MaxCG' values for envelope entries.

Pilot Operating Handbooks that conform to the GAMA-standard format (which came into wide acceptance starting in the mid-1970s) always give the 'arm' values for all loading stations, and graphically depict the allowable CG envelope in terms of weight vs. CG arm. This is precisely the information needed by the Flightmaster. Consequently, setting up a W&B template from such a POH is straightforward.

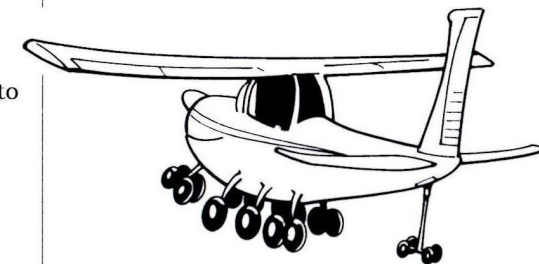
However, many older POHs that predate the GAMA standard provide W&B data in terms of 'moment' instead of 'arm', and graphically depict a moment envelope in terms of weight vs. moment. *'Moment' and 'arm' are not the same!* Moment data cannot be entered directly into a Flightmaster W&B template. It must be converted to arm data. *Arm data is calculated by dividing moment data by weight.*

To help make this clear, the next section illustrates how to prepare a W&B template for a 1972 model Cessna 172 (which has an old pre-GAMA format POH that presents moment rather than arm data).

Dual-category W&B templates

Certain airplanes are certificated in two categories (such as Normal and Utility) with different W&B envelopes for each category. Examples include some Beech Bonanzas and small single-engine Cessnas. If the airplane is loaded within the more-restrictive Utility Category envelope, certain maneuvers (such as spins) may be permitted that are prohibited when the airplane is operated in the Normal Category.

The Flightmaster's W&B function can easily accommodate such aircraft if you set up the W&B template correctly. Simply define two different CG-checked calc entries (one for Normal, the other for Utility) and define different envelopes following each one. The next section illustrates this technique in connection with a W&B template for a 1972 Cessna 172.



Weight-and-Balance

Quite a few Flightmaster owners have encountered difficulty setting up the W&B templates for their aircraft. In most cases, this has occurred with older aircraft that have pre-GAMA-format POHs that give moment rather than arm data. Since the Flightmaster requires arm data (not moment), this can be very confusing, and requires some extra steps to convert the moment data to arm data.

To illustrate exactly what's involved, let's go through the process of creating a Flightmaster W&B template for a 1972 model Cessna 172 Skyhawk, step by step. This aircraft has one of the older-style POHs.

Basic Empty Weight

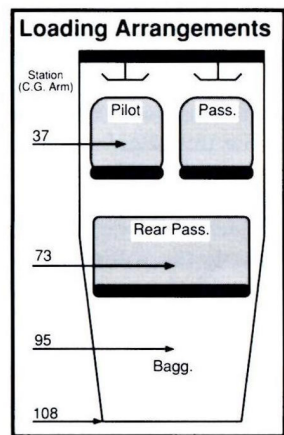
The basic empty weight for our aircraft comes from either the manufacturer's "Weight and Balance Data Sheet", or from changes noted on FAA Form 337 if equipment has been added, changed or removed since manufacture. In either case, the aircraft W&B documents give us three figures:

Licensed Empty Weight: 1,382 pounds
C.G. Arm: 37.9 inches (aft of datum)
Moment: 52,377.8 pound-inches

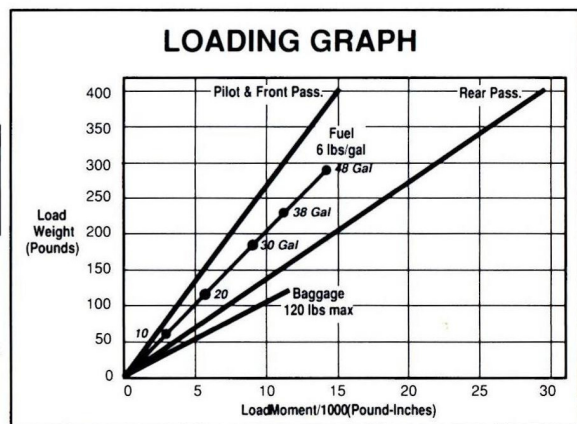
We can ignore the moment figure, and enter the weight and CG arm figures (1,382 lbs. and 37.9 in.) into the top line of our Flightmaster W&B Template Worksheet.

Load Stations

Now we need min/mid/max weights and CG arms for each aircraft load station (fuel, seats, baggage, etc.) The load station data must be obtained from the W&B section of the POH. Unfortunately, this information is a bit obscure in our old-style POH. We find one diagram that looks like this:



and a load graph that looks like this:



Now let's see...do we have the weight and CG information that we need? Well, for the front seats, the loading diagram shows an arm of 37 inches, and the loading graph shows min and max weights of zero and 400 pounds. Fine. We'll use 200 pounds for the mid weight.

Similarly, the rear seats have an arm of 73 inches, and min/mid/max weights of 0/200/400 pounds. And the baggage area has an arm of 95 inches and min/mid/max weights of 0/60/120 pounds. So far, so good.

Fuel & Oil CG

But what about the fuel tanks? Its CG arm does not show up anywhere in the POH, so we have to calculate it. If we pick a point on the "fuel" line on the loading graph...let's pick full long-range tanks at 48 gallons, for example...we can see that this point corresponds to a weight of 288 pounds, and a moment of about 13,750 pound-inches.

We can calculate the CG arm of the fuel by dividing the moment by the weight. 13,775 pound-inches divided by 288 pounds gives us a CG arm of 47.8 inches.

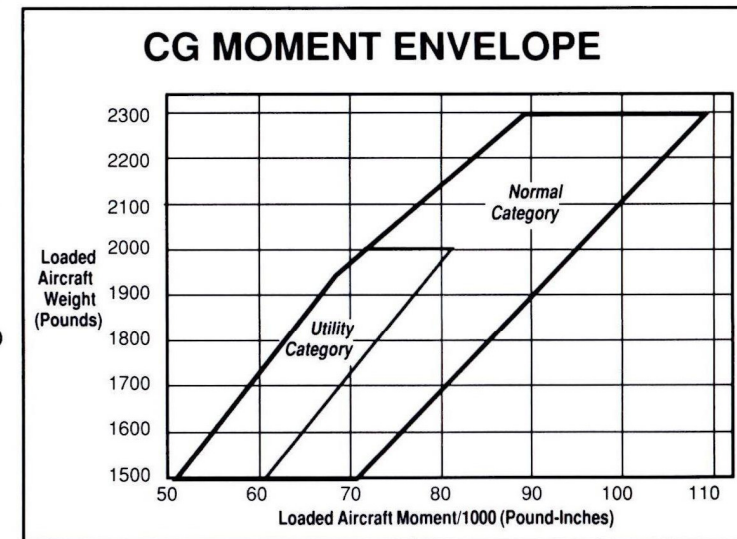
Just to double-check our work, let's pick another point on the loading graph "fuel" line...38 gallons (full standard tanks) this time. The graph shows 228 pounds and 10,900 pound-inches. Calculating, 10,900 divided by 228 gives us a CG arm of 47.8 inches once

again. Good! That's the CG figure we'll use in our W&B template.

How about engine oil? Well, there's a little footnote to the loading graph which says: "Engine Oil: 8 qts = 15 lbs. at -0.2 moment/1000, may be assumed for all flights." Okay, let's see: -0.2 times 1,000 is -200 pound-inches (moment). -200 pound-inches divided by 15 pounds gives a CG arm of -13.33 inches. (The minus signifies a CG forward of the datum plane.) So that's the arm we'll use for the oil item on our W&B template.

Normal Category CG Envelope

Now let's look at the CG envelope:



Unfortunately, Cessna's old POH format provides only a "CG moment envelope" so we have to calculate the "CG arm envelope" for ourselves. To do this, we locate each "corner" of the moment envelope and calculate the CG arm by dividing the moment by the weight (just as before).

The upper righthand corner of the Normal Category moment envelope, for example, is at 2300 pounds and 109,000 pound-inches. Dividing 109,000 by 2300 gives a CG arm of 47.4 inches.

Likewise, the upper lefthand corner of the Normal Category moment envelope is at 2300 pounds and 88,500 pound-inches. Dividing 88,500 by 2300 gives a CG arm of 38.5 inches. We must do this same calculation for each "corner" point of the moment envelope in order to derive the complete arm envelope that we need for the Flightmaster W&B template.

Utility Category CG Envelope

The Cessna 172 is also certificated for operation in the Utility Category as long as gross weight does not exceed 2,000 pounds and CG remains within a more-restrictive Utility Category envelope.

The airplane is approved for spins when operated in Utility Category, but not in Normal Category.

We can set up a special Utility Category calc entry with a max weight of 2,000 pounds. This must be followed by a special Utility Category envelope description, derived from the moment envelope just as we did for the Normal Category envelope.

W&B Template

Finally(!) we have all the data we need to complete the W&B Template Worksheet and set up the W&B template in the Flightmaster.

As you can see, setting up a W&B template using an older-style moment-oriented POH can be quite a bit of work. There's one bit of good news, though...you only have to go through this agony once. From then on, the Flightmaster makes W&B a snap.

Entry Type	Title	Item Entries Only						Calc Entries Only			Envelope Entries Only			
		Multiplier	MaxVal	MaxCG	MinVal	MinCG	MidVal	MidCG	MaxWt	MinWt	Check CG?	@Wt	MinCG	MaxCG
Item	BASIC EMPTY WT.	1	1382	37.9	1382									
Item	fuel (gal)	6	48	47.8	10	47.8	38	47.8						
Item	eng oil (qt)	1.875	8	-13.33	6	-13.33	7	-13.33						
Item	pilot+front pass	1	400	37	0	37	200	37						
Item	rear pass	1	400	73	0	73	200	73						
Item	baggage	1	120	95	0	95	60	95						
CALC	NORMAL (2300)								2300	0	Y			
Envelope												1500	34.7	47.4
Envelope												1950	34.7	47.4
Envelope												2300	38.5	47.4
CALC	UTILITY (2000)								2000	0	Y			
Envelope												1500	34.7	40.5
Envelope												1950	34.7	40.5
Envelope												2000	35.5	40.5

Software Revisions

The following summarizes the various versions of Flightmaster software, and the bug-fixes, enhancements, and database revisions that have been made in each subsequent update. Watch future issues of FwF to keep apprised of software and database changes as they become available. (Update subscription customers automatically receive a reminder card whenever a new update is available.)

v1.00 30-Jun-89

First commercial release.
Database based on FAA 01-Jun-89 revision cycle.

v1.01 07-Jul-89

Fixed bug in AutoRNAV affecting N-S courses.

v1.02 19-Jul-89

Re-fixed bug in AutoRNAV affecting N-S courses.
Fixed trip log lat/lon display to show waypoint loc.
Enhanced Route→Load to reset fix-crossing times.
W&B setup, changed prompts from "Wt" to "Val".
Enhanced W&B to add CG display for Part 135 ops.
Backup to pak switches machine off to change paks.
Editing checklist rewinds saved position.

v1.03 30-Jul-89

Database updated to FAA 27-Jul-89 revision cycle.
Fixed AutoA bug affecting "fix A airport" routings.
Fixed AutoA bug affecting "fix A userdef" routings.
Fixed bug in Search involving roundoff of distance.
Fixed bug in Search affecting battery longevity.
Enhanced Route→Revs to reset fix-crossing times.

v1.04 29-Sep-89

Database updated to FAA 21-Sep-89 revision cycle.
Deleted duplicate VORs: CDR, CRO, LIB, SYA, TAL.
AVIATION does a device-boot at startup.
AVIATION does an escape-off on way out.
Warbling "beep" deleted...annoyed some users.
Print changed to 60 chars/line (from 80).
Fixed bug: divide-by-zero error on zero-length leg.
Fixed bug in retrieval of NDBs with 2-letter ids.
Fixed minor bug in checklist editor.
Fixed minor bug in Database→Def.
Fixed minor bug in route parsing.
Fixed minor bug in Quick display.
Enhanced FltPln error recovery.

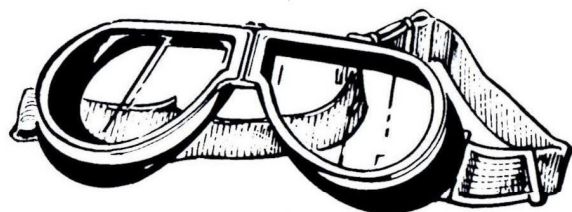
Now it's your turn!

This is almost the end of the premier issue of *Flying with Flightmaster*. We hope you've found it interesting and enjoyable reading, and that it will help you to get the most from your Flightmaster. Look for the next issue in about three months.

To steal a line from Barbara Walters, "We're in touch, so you be in touch."

If you love your Flightmaster, please let us know...preferably in writing (by letter, FAX, or electronic mail). You'll notice that our video and print ads for the Flightmaster feature user testimonials prominently. We'd really like to receive a testimonial from *you!* (But only if you think we deserve it, of course.)

If you have some ideas about how we might improve the Flightmaster, tell us! You can see from the revision history above that we're constantly working to improve the machine, and to pass those improvements on to you whenever you order a database update.



(What *other* aviation company does that?) Almost all of our enhancement ideas came from customers. We really enjoy hearing your ideas, and although we can't promise to implement all of them, you might be surprised just how often we do.

Above all, if you have problems or questions, contact us. We're here to help you, and we want you to get the most from your Flightmaster. If you call evenings or weekends, you might get our voicemail system...leave a detailed message and we'll get back to you ASAP.

If you have bug reports or product enhancement ideas, or just want to tell us how you're using your Flightmaster, it works best to communicate in writing. You can send us a FAX or electronic mail or a letter. The telephone is fine when you need help or want to place an order.

You can call us at (800) 462-6669, or in Maryland (301) 387-7997. The FAX number is (301) 387-7322. Or reach us by Compuserve Easyplex electronic mail (PPN 74020,10).

We genuinely look forward to hearing from you.

Ordering Information

Flightmaster

- Flightmaster\$595
The complete handheld flight management system with battery, 75-page User's Guide, and laminated quick-reference card.

Flightmaster is sold on a 30-day no-risk satisfaction-guaranteed basis. Fly with your new Flightmaster for 30 days, and if you are not convinced that it is the greatest advance in cross-country flying since the VOR, return it undamaged within 30 days of purchase for a full refund...no questions asked.

Updates

- Annual (6x) update subscription via 2nd-day air\$150
The Flightmaster database is updated every 8 weeks with revised airport, airway and navaid data from the FAA flight data center. This subscription covers your next six updates. We send you a reminder card when each update is available. You ship us your two datapaks, we reprogram them with the latest updated database and software revision, and ship them back to you via 2nd-day air. (You need not get every consecutive revision, as long as you take at least two per year.)
- Annual (6x) update subscription via next-day air\$180
Same as above, except we ship your updates by next-day air. This provides one less day of downtime.
- Zero-downtime update option\$200
We provide a pair of extra datapaks for you so that you can receive database updates without any downtime whatsoever. This one-time-only price covers only the two extra datapaks... you must also purchase an update subscription.
- One-time update via 2nd-day air\$50
Ship us your two datapaks at any time, we reprogram them with the latest updated database and software revision, and ship them back to you via 2nd-day air. Add \$5 more for shipment by next-day air.

Accessories

- RS232 comms link\$100
Enables your Flightmaster to communicate with a PC, modem, or serial printer, or any other device with a serial port. Includes software: specify MS-DOS or Macintosh version.
- RS232 adapters\$20
Used with Comms Link to change its DB25F connector to whatever is necessary. Specify which of the following adapters you need: IBM AT, Mac+, Mac SE or II, serial printer, modem.
- Fitted leather case\$30
With Velcroed flap to keep your Flightmaster looking new.
- Nylon case\$20
With zippered pouch for Comms Link, spare battery, etc.
- 32K RAMPACK\$90
The most convenient way to back up your Flightmaster data.
- AC adapter\$20
Lets you power your Flightmaster from an electrical outlet.
- Printer II\$350
Compact "docking" thermal printer for your Flightmaster.
- Thermal paper for Printer II (4 rolls) ..\$20

Video Information Package

- Video information package with manual\$15
Detailed 30-minute VHS videocassette which demonstrates the many features of the Flightmaster, explains how it is used in a wide variety of pre-flight and in-flight situations, and shows the various accessories available. Also includes the complete 75-page Flightmaster User's Guide. The \$15 cost for this package is credited toward your purchase of a Flightmaster.

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